PAINTSQUARE.COM
JPCL
CELEBRATING 1984 35 2019 YEARS
VOLUME 36, NUMBER 9 THE VOICE OF SSPC SEPTEMBER 2019

Cover photo: Pamela Simmons

SSPC The Society for Protective Coatings

FEATURES

This section previews the technical program scheduled for Coatings+ 2020, SSPC's annual conference and exhibition, which will take place at the Long Beach Convention Center in Long Beach, California, Feb. 3–6, 2020.

PAINTSQUARE.COM
JPCL
THE VOICE OF SSPC

DEPARTMENTS

ALSO THIS ISSUE

STAFF

Periodical class postage at Pittsburgh, PA and additional mailing offices. The Journal of Protective Coatings & Linings (ISSN 8755-1985) is published monthly by Technology Publishing Company in cooperation with the SSPC (877-281-7772).

PAINT SQUARE
Printed in the USA / www.paintsquare.com

SSPC CONTRACTOR CERTIFICATION:
A BRIEF HISTORY

BY MICHAEL KLINE, DIRECTOR OF TECHNOLOGY AND COMMUNICATIONS, SSPC

In a year of key milestones that includes the 35th anniversary of JPCL, SSPC's innovative QP painting contractor certification program also celebrates 30 years of being a strong, trusted and truly industry-driven contractor accreditation tool.

The QP program started from an idea shared between industry colleagues in the mid-1980s. Initiated by John C. Hauck of Mobay Chemical Corporation, who was looking for a standards-based method to streamline contractor selection based on qualification, the concept was popular among SSPC members including contractors, facility owners and consultants. At the SSPC Annual Meeting in February of 1986, it was a featured discussion of the SSPC Advisory Committee on Application Methods. Like other innovations, in order to move from theory to practice, having a passionate supporter, such as Hauck, to champion the cause made all the difference.

By the spring of 1986, the issue had gained enough momentum that SSPC scheduled a meeting of contractors in Pittsburgh in June, where the main topic of discussion was how to move this idea from concept to reality. Present at that meeting, and captured on the cover of the July 1986 JPCL, were key influencers from major painting contractors.

In that same July 1986 issue, Hauck and Eric S. Kline of KTA-Tator, Inc., published a paper entitled, "Prequalification of Contractors: One Giant Step Toward Increasing the Service Life of Coatings." The paper suggested to the industry that tremendous benefits in the quality and longevity of coatings projects could be gained by having painting contractors' capabilities evaluated according to an objective set of criteria—similar to how engineering firms are evaluated prior to being invited to bid on projects.

The July 1986 JPCL cover featured participants at a meeting of contractors held at SSPC's Pittsburgh office in June of 1986. Pictured, front row, from left: Dale Atkinson of Brock Enterprises, Steve Kett of I.H. Whitehouse & Sons, David Boyd of Vulcan Painters, Albert Kay of Akron Sandblasting & Metallizing, Allen DeLange of J.L. Manta and Ralph Tralio of O.B. Cannon & Son; second row, from left: John Conomos of John B. Conomos, Inc., George Paterakis of W.W. Paterakis Sons, Larry Natale of DuPont MPS and Dick Nordstrom of Arbonite; third row, from left: Paul Thomarios of Thomarios Painting, Jim Hamlos of MP Industries, Jerry Brock of Service Painting and Tom Lambert of Tom Lambert Painting; fourth row, from left: Web Chandler of Metalweld, Charles Heist of C.H. Heist, Jack Mobley of Mobley Industrial Painters and Bob Maley of Steel Maintenance Corp.

The thought, while not new, had never been tried before in our industry. Up to that point, it was up to each individual facility owner to conduct its own evaluation. There was no standard, no common set of measures or benchmarks that had been vetted and debated and agreed upon through a consensus process. And, to that point in time, there was no accrediting body that took up the mantle to pursue the idea.

In stepped key members of SSPC (known then as the Steel Structures Painting Council). The contractors' meeting in Pittsburgh, the paper by Hauck and Kline and the discussions by the Advisory Committee on application methods were all part of the larger movement afoot. Some of the historic names in paint contracting were on board with the idea. Facility owners also jumped into the mix, spurred by the belief that pursuing this path could lead to lower life-cycle costs on their projects while delivering a high-quality project.

From the beginning, the contractors understood that in order for the program to gain acceptance, there needed to be broad agreement and accountability regarding program rules and governance. The concept of having a program developed by industry and for industry was a guiding principle. The participants had the vision to understand that they were putting their names and company reputations on the line. Any program that resulted from this creation needed to have

the acceptance of industry peers.

Over the next three years, the foundation of the program was laid. Modeled after the AISC Steel Fabrication Certification Program, SSPC issued the first version of the SSPC-QP 1 standard in September of 1989, after consensus on its content was reached by SSPC's C.3.5 Technical Committee for Applicator Prequalification. The QP 1 standard contains benchmarks by which facility owners can assess contractors. Contractors also use these benchmarks to evaluate and improve their processes and procedures so they can provide a high-quality product to their customers. Like all SSPC consensus standards, QP 1 is reviewed periodically to provide a baseline primary technical qualification program for contractors. Since 1989, QP 1 has been reviewed and reissued in August 1998, February 2008, September 2013 and most recently in January 2019.

The QP 1 standard is the basis for SSPC's Painting Contractor Certification Program, also established in 1989. The PCCP is an administrative program set up by SSPC to independently evaluate industrial painting contractors against the requirements of QP 1 and other QP standards. The rules of the PCCP program are maintained by the PCCP Advisory Committee, established in 1992 and primarily made up of contractors, with representation from facility owners, consultants and suppliers. The audit program requires SSPC to assess a contractor's technical knowledge and operational capability annually by visiting active jobsites. In addition, the program has a very strong corrective action program to provide feedback and help contractors continually improve operations.

Other highlights include establishment of the Disciplinary Action Criteria in 1998, allowing SSPC to discipline contracting firms that are unable or unwilling to meet the program's high standards. SSPC QP programs also achieved ISO 17020 accreditation in 2015, and SSPC is currently pursuing accreditation to ISO 17065.

The first contractor certified to SSPC-QP 1 was R.J. Wildner from Johnstown, Pennsylvania. Today, there are 422 QP-certified contractors worldwide that hold 499 certifications, and QP programs are a key part of the tool kit used by specifiers everywhere as part of their plans to protect assets and infrastructure.

The QP 1 standard is still maintained by the C.3.5 committee, which has a membership as diverse as SSPC's overall membership. The committee's work has been the linchpin to making SSPC programs among the most trusted and recognized contractor certification programs in the coatings industry.

For more information about SSPC's QP programs, visit sspc.org/qp-programs-info.

aluxum / Getty Images

SSPC, NACE Name Talks Facilitator

On Aug. 6, SSPC and NACE International announced the mutual decision to bring McKinley Advisors on board as a guiding entity for the two organizations' merger discussions.

Serving as an independent third party, McKinley was chosen for its established success in advising other organizations through similar talks. McKinley will also advise through considerations related to strategic, financial and cultural barriers, among others.

"McKinley is a respected, proven entity and they bring a neutral point of view along with their expert insight," said incoming SSPC President Joe Walker. "It's already helping us make effective decisions more quickly. We're impressed with what we've seen so far and optimistic that this will help us make the best, most informed decisions we can on behalf of our members."

McKinley is also known for aiding clients with strategic guidance, research, insights, assistance with business transformation and marketing services.

"Bringing together associations that share meaningful missions like NACE and SSPC is one of the many rewarding aspects about our work," said Jay Younger, FASAE, President & CEO, McKinley Advisors. "The recognition of their members' best interests demonstrates strong leadership and a dedication to living their values. Our team is experienced in this area and looks forward to uniting the goals of two great associations and advancing their efforts."

SSPC and NACE announced the beginning of merger talks in March. Last month, leaders from both organizations reported making headway on combining the organizations into one venture. Both SSPC President Garry Manous and NACE International President Terry Greenfield saw the meeting as a success.

Moving forward, both organizations will continue to communicate about progress.

New SSPC Steel City Chapter to Meet

SSPC announced via an emailed press release the reestablishment of its Pittsburgh chapter, to be known as The SSPC Steel City Chapter.

With the launch of the endeavor, SSPC hopes to attract members from Pennsylvania, Ohio and West Virginia, as well as western Maryland.

The Chapter's first meeting is scheduled for Oct. 3, at Olivia's restaurant in Coraopolis, Pennsylvania.

Featured speakers at the event will include SSPC Executive Director Bill Worms and a member of the SSPC Board of Governors. There will also be discussion

and an update regarding the merger of SSPC and NACE International. Questions will also be accepted.

According to SSPC, the meeting will also feature an introduction to the Chapter Steering Committee, as well as subcommittee chairs detailing their focus in the Chapter.

The meeting will begin with a social running from 5:30–6:15 p.m., followed by dinner, which costs $35 a person. The address is 318 Forest Grove Road, Coraopolis, PA, 15108.

For those interested in attending, contact Heather Stiner, Steel City Chapter Chair, at heather.r.stiner@sherwin.com to reserve your seat. Information on Chapter sponsorship is also available.

SSPC WOMEN IN COATINGS AWARD NOMINATIONS OPEN

SSPC is currently accepting nominations for the 2020 Women in Coatings Impact Award, which will be presented at the annual awards luncheon during Coatings+ 2020, Feb. 3–6, 2020 in Long Beach, California.

This award is presented each year to recognize women in the coatings industry who contribute to creating a positive impact on the industry culture. These women are leaders in their profession and demonstrate commitment to the advancement of the field of coatings.

Download the nomination form at sspc.org/awards and submit a completed form to lajzo@sspc.org. Please note that self-nominations will not be accepted.

Nominations must be submitted by October 8, 2019.

CORRECTION

Table 1 in the August JPCL article, "Are You a QC Inspector? By Whose Definition?" was mislabeled. The correct Table 1 is reprinted below. JPCL apologizes for this error.

Table 1: SSPC QCS Experience and Training Requirements.

Certification	Experience	Training
QP 1	3 years	BCI Level 2 or PCI Level 2, NACE CIP Level 2, FROSIO Level II, ICorr Level 2, BGAS-CSWIP Grade 2
QP 8	3 years	CCI Level 2
QP 9	2 years	MPI Level One Online

OBITUARY

STEPHEN G. PINNEY, 1936–2019

Former corrosion engineer, coatings consultant, SSPC contributor and JPCL reader and writer Stephen G. Pinney passed away on August 23, 2019. He was the CEO and President of the engineering and inspection firm S. G. Pinney & Associates (dba Underwater Engineering Services).

Born on July 21, 1936 in Waterbury, Connecticut, Pinney graduated with Bachelor of Science degrees in Agriculture Engineering and Civil Engineering from the University of Connecticut and later earned his Master of Science degree in Business Management from Florida State University.

According to his obituary, he first worked as a project engineer for the NASA Apollo 11 program, where he established the original panel test site for exterior modifications and field inspections. Later, he began his own engineering firm and in 1977 became the largest employer in Port St. Lucie, Florida, with more than 100 employees.

Pinney served as chairman and a director for SSPC and NACE, headed ASTM paint and coatings committees, served as a technical editor and performed expert testimony for multimillion-dollar corporate cases regarding coatings. He was a registered Professional Engineer licensed in 14 states and held SSPC and NACE certifications.

Pinney was instrumental in the development of *The Inspection of Coatings and Linings: A Handbook of Basic Practice for Inspectors, Owners and Specifiers*, SSPC's first paint inspection manual, released in 1997. He served as a technical reviewer, was main author of the fourth chapter (Basic Inspection Practice) and his firm provided many of the photos throughout the book. He also taught SSPC's C-2, "Planning and Specifying Industrial Coatings Projects," for some time.

"Steve was a well-known and respected member of SSPC. He was a familiar face at SSPC conferences, writing papers and giving presentations and working on technical committees. He was always willing to stop and answer a question or share a story," said Terry Sowers, Senior Member Services Advisor, SSPC.

Pinney is survived by his wife, Teri, their six children, 11 grandchildren, 10 great-grandchildren and other family.

PAINTSQUARE COMMENTS

In Response to "Firm Refusing to Settle in FIU Case"

(PaintSquare News, Aug. 16)

While 23 companies being sued in light of the bridge collapse at Florida International University, which occurred roughly a year and a half ago, have decided to settle, one last holdout could delay the disbursement of funds to the victims. The remaining company that is currently not opting to settle is independent consultant Louis Berger, hired by FIGG to verify the bridge's design.

Mark Taylor:
"I don't care what techniques they come up with—the human factor will always make building bridges over active roadways a fool's ploy. People are lazy, corrupt and complacent. Until we can invent a perfect human, no bridge-building over active roads should take place."

Tony Rangus:
"Mr. Berger, did you perform a design review at Stage 3?' 'Yes, I did, but my wife washed my overalls where I had stored the report.'"

John Ducote:
"This is unbelievable that '26 threaded steel rods—the kind being tightened on the bridge at the time of the collapse—were melted down after being removed from the site.' This sure sounds like criminal obstruction of justice to me. It is one thing for them to be inadvertently disposed of, but to be melted down? That sounds like a deliberate act, like intentional destruction of evidence."

Thomas Van Hooser:
"What a tangled web we weave, when we practice [first] to deceive."

PAINT POLL

paintsquare.com/poll

In the beginning of July, U.S. Customs and Border Protection and the Army Corps of Engineers awarded a $33 million contract for four miles of border wall work in Texas. Environmental regulations including the National Environmental Policy Act, the Endangered Species Act, the Federal Water Pollution Control Act and the Archaeological Resources Protection Act, among others, for this section of work, were waived. Do you think this is the best policy to speed up the construction?

Yes. **48%**

No. **42%**

Other. **10%**

ElFlacodelNorte / Getty Images

Michael Beitzel:
"The regulators for these various concerns should have a limited time to make the case for potential adverse impact to their areas of responsibility and let courts decide if additional consideration is warranted that outweigh the benefits of the proposed work."

Martin Rose:
"Regulations were put in place after a great deal of study and consideration, not arbitrarily. They should not be suspended indiscriminately without at least some limited time for review as Michael stated. They—the regulations—do have a public purpose."

Donald Flynn:
"The question assumes the wall should be built. This is another volley by this president's administration to roll back or roll over regulations [that] were developed and implemented, in response [to] protecting resources recognized by both Congress and the public. The moves are clearly an abrogation of the public trust. We should reach out to assist our neighbors, not build a wall."

Peter Kenimer:
"The border has been under consideration since the Bush administration. I'm sure that there's more than enough data in place. No need to hold it up indefinitely [because] our government can't get along with itself. Build the fence!"

Michael Halliwell:
"Setting aside the need for the wall, environmental reviews (and the associated Acts) are typically there to preserve environmental, historical, archaeological or similar resources from harm. Waiving such reviews is typically only done as a matter of national emergency or crisis (i.e., dealing with flooding, a dam breach or other critical/emergency measure). I personally don't think it was warranted in this case. However, if pipelines are any indicator, this would have been in the courts for 15–20-plus years if they hadn't been waived, so I can see why they were."

Problem Solving Forum

paintsquare.com/psf

What is the best way to remove thick-film elastomers from floors and ship decks?

Lydia Frenzel, Advisory Council:
"Use ultra-high-pressure waterjetting, preferably with [a] vacuum attachment."

Zenith Czora, Parex Davco:
"Depending on the degree of adhesion of the elastomers to the substrates, environment-friendly chemical stripping might be needed, or using a heat gun to soften the elastomers and scraping off the softened coating and waterjetting the remnants of the elastomers."

Jon Cavallo, Sponge-Jet Inc.:
"Many contractors have had good results by removing thick-film elastomeric coatings using encapsulated blast media (SSPC-AB 4)."

Jim Gooden, Blastmaster:
"This is a really good question and one that we are often asked. Thick coatings are often difficult to remove as the thicker the coating, the slower it is to blast using conventional blasting systems. ... The conventional thinking has been to use a coarse abrasive, and depending on the thickness of the coating to be removed, this approach can still be effective. There are many technologies available, but I will mention four we have seen used successfully.

1. The addition of a technology [such as] induction coating removal to remove the coating can significantly increase the removal rates, so long as there is no problem in heating the top 1/32-inch of the steel to almost red hot. This releases the coating and it can be scraped off.

2. UHP waterjetting [with] vacuum attachments can be used. The ability of a 40,000-psi waterjet to cut through and remove coating is often several times faster than abrasive blasting on coatings over ¼-inch thick. UHP speeds do not vary much as the coating is thicker, where abrasive blasting will rapidly decrease in production for thicker coatings.

3. Using a scraper to remove some coatings will also achieve good results. In areas where a coating is partially delaminating, this can be very fast. Ride-on scrapers that are commonly used to remove floor tiles and linoleum can be fitted with a narrow blade

and extra weights to help cut through the coating and remove it. Residual coating can then be cleaned up with another method.

4. There are some abrasives now available with blended grading specifically engineered for thicker coating removal. They have a coarse particle range to cut through the coating and a finer particle range to clean the surface quickly. These have made abrasive blasting more effective than it was in the past.

I'll include a fifth technique we have seen employed very effectively. Elastomeric coatings, when blasted, will often heat up and become 'gummy' with the abrasive impact. By working a larger area with the blast nozzle and coming back three-to-four times so that the coating stays cool and harder, we have found improvement in blasting productivity by 80–100%, instead of blasting the coating off all in one pass. On both ship decks and tank floors we have seen that once the coating is removed, shot-blast machines or abrasive blasting can then be used to quickly create a surface that is clean with a consistent profile that can be coated."

PAINTSQUARE NEWS TOP 10

paintsquare.com/news, Aug. 5–Sept. 1

1. **Explosion Reported at AL Coatings Plant**
2. **Natural Gas Pipeline Explodes in KY**
3. **Firm Refusing to Settle in FIU Case**
4. **Report: Russia Nuclear Reactor Explosion Likely**

al_la / Getty Images

5. **Chernobyl Safe Confinement Completed**
6. **Contractor Uses Cast-in-Place System for Border Wall**
7. **Floating Nuclear Plant Draws Concern**
8. **WV Pipeline Coating Reported Safe After Concerns**
9. **SSPC, NACE Name Talks Facilitator**
10. **Fired Contractor Claims $1B Needed for CO Airport**

The Effect of Additional Waterjet Cleaning on Surface Cleanliness & Coating Performance

BY HEEBAEK LEE AND EUN-HA SONG, KOREA SHIPBUILDING & OFFSHORE ENGINEERING (KSOE) CO., LTD.

Solvent cleaning (SSPC-SP 1) is a method for removing all visible oil, grease, soil and other soluble contaminants from steel surfaces. The solvent degreasing procedure in the authors' company yard is to use some commercial mixtures that contain a strong solvent, such as xylene or high-flash naphtha. This mixture is wiped over the surface to be cleaned and the grease or oil is picked up by the solvent. Because the solvents are neutral and evaporate from the surfaces, there is no residue left.

Near-white blasting (SSPC-SP10/NACE No. 2 or Sa 2.5 of ISO 8501-1) or white-metal blasting (SSPC-SP 5/NACE No. 1 or Sa 3), is considered to be a practical and reliable degree of surface preparation recognized by the industry before the application of a protective coating. These blasted surfaces combine a clean metal surface with sufficient roughness to provide a surface area that allows the maximum mechanical and chemical adhesion[2].

Prior to blasting work, an additional high-pressure freshwater cleaning (3,000 psi) process is specified by the authors' company after the solvent-cleaning process. (Waterjet cleaning is particularly effective in the removal of accumulated salts and dirt). Before the application of coatings, the surface should be checked for soluble-salt contamination. If the salt contamination exceeds the specified level, high-pressure freshwater cleaning should be carried out until the specification is met. Our level of water-soluble-salt contamination, before the application of paints for offshore construction, is 30 mg/m² NaCl (18 mg/m²Cl⁻).

To evaluate the effectiveness of additional waterjet cleaning for the removal of soluble salts, and the durability of protective coatings applied on the blasted surfaces, the degree of cleanliness and the soluble-salt level on the surface were re-checked, and coating performance and durability were tested with and without waterjet cleaning through an accelerated-aging test according to ISO 12944-6.

Photo courtesy of WITA.

METHODOLOGY

Test specimens were contaminated with lubricant to check the degree of surface cleanliness and the soluble-salt level with and without waterjet cleaning. The contaminated specimens were cleaned and wiped with solvent-soaked cloths. Two types of solvents were selected to determine the neutrality of the solvent-cleaned surfaces. The solvents were neutral and made up of volatile chemicals that do not to leave any residual substance on the surface. One group of the specimens was then subjected to waterjetting followed by blasting. The other group was blasted without waterjet cleaning.

Before waterjet cleaning, the pH of the solvents and solvent-cleaned surfaces were measured using pH test strips. Dust-grade and soluble-salt levels for the specimens after blasting were also measured according to the ISO 8502 standard.

After surface preparation, coatings were applied to the steel specimens as per the coating specification of a project, and then dried at room temperature for seven days.

Based on the ISO 12944 test procedure, samples were exposed in a water-condensation chamber for 720 hours and a salt-spray chamber for 1,440 hours to assess coating performance in the C5-M high-corrosivity environment[3].

RESULTS AND DISCUSSION

pH Measurement

Both solvents were identified as neutral with a pH of 6.5–7 and surfaces cleaned with these solvents were also identified as neutral. Therefore, additional waterjet cleaning to neutralize the surface was not necessary.

Table 1: Results of Dust-Grade Assessment and Salt-Level Measurements With and Without Waterjet Cleaning.

	Before Blasting		After Blasting		Requirement
Test Items	With Waterjet Cleaning	Without Waterjet Cleaning	With Waterjet Cleaning	Without Waterjet Cleaning	
Dust Grade	-	-	Grade 0	Grade 0	Grade 0
Salt Level (mg/m²Cl⁻)	7.2	18	8.3	5.4	≤18

Fig. 1: Assessment of dust grade on test panels. All figures courtesy of the authors unless otherwise noted.

Measurement of Dust-Grade and Soluble-Salt Levels

Dust grade of the specimens with and without waterjet cleaning was analyzed using pressure-sensitive tape and a 10x-magnifying microscope, as shown in Figure 1[4]. Soluble-salt level on the surfaces was measured by the conductivity measurement of the water from the salt patch applied on each sample (Bresle Method)[5,6].

Based on test results, cleanliness of both blasted samples satisfied the surface condition of our specification (free of dust with a salt level of ≤18 mg/m²Cl⁻) (Table 1). There was no significant difference between the two specimens with or without waterjet cleaning. Even though one test surface was not cleaned by blasting and waterjetting, its salt level was only 18 mg/m²Cl⁻. After blasting, the salt level was dramatically decreased to 5.4 mg/m²Cl⁻. In the case of waterjet cleaning, the salt level of the blasted surface was 8.3 mg/m²Cl⁻.

The salt level of the blasted steel surfaces already satisfies the company's specification. Therefore, it is not necessary to perform additional waterjet cleaning to achieve a reliable surface-condition cleanliness level. From these test results, it can be inferred that coating performance and durability for surfaces with and without waterjet cleaning are similar.

Water-Condensation Test

The water-condensation test was conducted in accordance with ISO 6270[7]. After specimens were exposed to moisture condensation conditions at 40 C for 240, 480 and 720 hours, visual inspection was conducted to identify any coating defects. There was no blistering, corrosion, cracking or peeling found in any of the specimens during the 720 hours of exposure. To verify the adhesion, a pull-off strength adhesion test was performed on the specimens exposed for 720 hours. Adhesion on both specimens measured approximately 10 MPa, higher than the requirement of >5MPa.

Therefore, from the water-condenstion test results, it was determined that coating performance on blasted-steel surfaces without waterjet cleaning is equivalent to that of coating performance with waterjet cleaning.

Salt-Spray Test

A salt-spray test was conducted in accordance with ISO 7253[8]. After specimens were exposed for 480, 720 and 1,440 hours, rust creepage and adhesion strength of the coating films were evaluated to compare coating performance (Fig. 2). Rust creepage was calculated according to ISO 12944-6. Rust creepage from the scribe line of the accelerated-aged specimens should be below 1 mm to meet the criteria of coating performance corresponding to a C5-M corrosivity environment.

After the specimens were exposed to salt fog for 1,440 hours, rust creepage from the artificial scribe in both specimens was measured at <1 mm, showing good corrosion resistance. Adhesion strength of the coating films on the blasted-steel surfaces with and without waterjet cleaning was measured at about 10 MPa for both specimens, higher than the requirement criteria of >5MPa. From the 1,440 hours of salt-spray-test results, it was found that coating performance of the blasted-steel surface without waterjet cleaning was equal to the surface with waterjet cleaning.

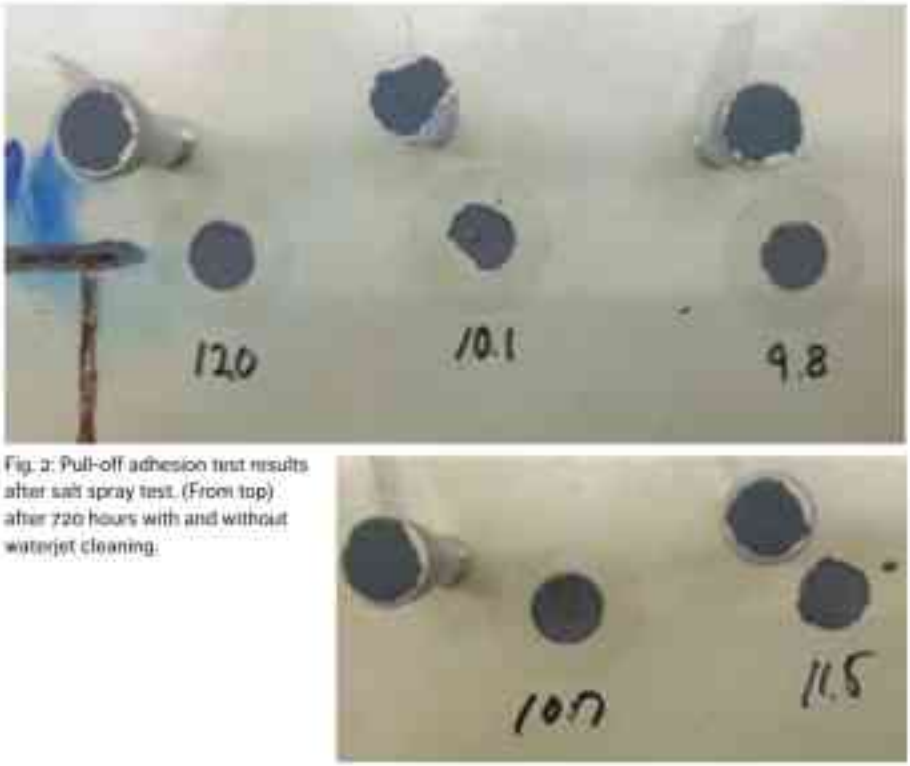

Fig. 2: Pull-off adhesion test results after salt spray test. (From top) after 720 hours with and without waterjet cleaning.

CONCLUSIONS

To verify the effectiveness of additional waterjet cleaning on the coating performance and corrosion resistance of coatings on surfaces prepared with and without waterjet cleaning, specimens were evaluated using the accelerated-aging test according to ISO 12944. The results were as follows.

1. There was no difference in dust grade, salt contamination, salinity or pH value of the surface with or without waterjet cleaning. Blasted surfaces without waterjet cleaning had a dust grade of 0, a low salt level and a neutral pH, satisfying the company's specification.
2. Based on the water-condensation test results at 720 hours, coatings on blasted steel surfaces without waterjet cleaning complied with the specification requirement of a C5-M high-corrosivity condition according to ISO 12944.
3. From the salt-spray-test results at 1,440 hours, it was determined that coating performance of the blasted steel without waterjet cleaning was equal to that of a surface prepared with waterjet cleaning, satisfying the specification requirement of a C5-M high condition.

ABOUT THE AUTHORS

Heebaek Lee is a Senior Researcher in the Protective Coatings Research Department of Korea Shipbuilding & Offshore Engineering (KSOE) Co., Ltd.

He earned a Master of Science degree in polymer synthesis in Korea. Lee's specific focus is the optimization of painting processes related to ships and construction equipment.

Eun-Ha Song is a Senior Researcher in the Protective Coatings Research Department for Korea Shipbuilding & Offshore Engineering (KSOE) Co., Ltd.

She has 15 years of experience in the research and development of the protective coating materials used in the marine and oil and gas industries. Song has a master's degree in chemical engineering from POSTECH in Korea.

REFERENCES

1. SSPC-SP 1, "Solvent Cleaning."
2. ISO 8501-1, "Preparation of steel substrates before application of paints and related products—Visual assessment of surface cleanliness—Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings."
3. ISO 12944, "Paints and varnishes—Corrosion protection of steel structures by protective paint systems."
4. ISO 8502-3, "Preparation of steel substrates before application of paints and related products—Tests for the assessment of surface cleanliness—Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)."
5. ISO 8502-6, "Preparation Of Steel Substrates Before Application Of Paints And Related Products—Tests For The Assessment Of Surface Cleanliness—Part 6: Extraction Of Soluble Contaminants For Analysis—The Bresle Method."
6. ISO 8502-9, "Preparation Of Steel Substrates Before Application Of Paints And Related Products—Tests For The Assessment Of Surface Cleanliness—Part 9: Field Method For The Conductometric Determination Of Water-Soluble Salts."
7. ISO 6270, "Paints and varnishes—Determination of resistance to humidity—Part 2: Condensation (in-cabinet exposure with heated water reservoir)."
8. ISO 7253, "Paints and varnishes—Determination of resistance to neutral salt spray (fog)."

CELEBRATING 1984 35 2019 YEARS

THIS MONTH IN ...

1988

In his article, "Improving Bridge Painting Specifications," former SSPC Executive Director and JPCL Senior Editor Bernard Appleman reviewed a survey on state highway department painting specifications to discuss the important factors that go into preparing a bridge painting spec to ensure a satisfactory outcome.

1997

"Inspection Requirements Are Down the Tracks for Lined Tank Cars," by Lori Huffman of JPCL, outlined existing and upcoming qualification and maintenance regulations for the railcar industry, describing the specific requirements, offering responses from industry figures and advising on compliance criteria.

2007

After the deadly I-35W Bridge collapse in Minneapolis earlier that year, Bob Kogler of Rampart LLC was inspired to pen, "Bridge Safety and the Role of the Coatings Industry," which reflected on the root causes of bridge deterioration and failure, and offered tips on assessing the true conditions of structures and how coatings can play a role in protecting infrastructure and preventing future tragedies.

2013

"The Crude Truth About Lining Tanks for Oil Transport," written by Michael McGlamry of Hempel USA, explored emerging corrosion concerns for crude-oil-carrying tank cars and the new coating technologies available to protect both the tank car and the cargo within. The article was revisited and updated with new information in the January 2019 JPCL.

Visit paintsquare.com/archive to read more.

Dry Blast and Waterjetting Units for Vertical Surfaces: A Review

Brian Goldie

BY BRIAN GOLDIE, TECHNOLOGY PUBLISHING COMPANY

Editor's Note: *This year marks the 35th anniversary of the publication of JPCL, the definitive source of technology and information about protective and marine coatings. To celebrate, JPCL will be highlighting archived content, updating previously published technical articles throughout the year and looking back on past practices and technologies.*

This article initially ran in the May 2000 issue and has been updated by the author for publication in this issue.

The most recent developments in dry abrasive blasting and ultra-high-pressure (UHP) waterjetting equipment are remote-controlled, robotic blasting units for vertical surfaces. These units are designed to crawl along the surface of a ship hull, a storage tank or a cooling tower while being operated from the ground. They bring the advantages of enclosed, dust-free blasting operations out of the shop and into the field. Dry blasting units of this type are not new for horizontal surfaces. What is different about this technology for dry blasting is that these units work effectively on vertical surfaces, as do the UHP waterjetting units.

DRY BLAST UNITS

These units are equipped with either centrifugal-wheel or compressed-air blasting components, as well as vacuum recovery, filtration/separation and supply/waste storage systems.

The blasting and vacuum recovery systems can be operated from the unit's power source, which can be a diesel or gas engine or an electric motor, depending on the model. Specially designed shrouds around the blasting heads "seal" the units to the surface being cleaned to prevent dust from escaping into the atmosphere.

There are different methods of accessing the surface with the blasting head unit. Usually, the remote-control equipment for the robotic blasting unit is located on the ground. In fact, it is often packaged together and mounted on a trailer or skid for ease in transporting it around the jobsite or from one project to another.

One method of reaching vertical surfaces is to attach the robotic unit to the platform of a scissor lift or to the end of a telescopic or pneumatically controlled arm mounted to a vehicle, such as a cherry picker, allowing the unit to traverse the blasting surface. In some cases, the arm is permanently mounted to a dry-dock installation. The arm allows for horizontal and vertical movement of the unit within a given range.

Another method is to suspend the unit from rigging that is attached to a girder mounted at the top of the surface to be cleaned. The robotic unit can move horizontally along the girder as well as vertically in a fixed location.

Finally, magnetic force or a counterweight, aided by vacuum power, can be used to attach the blasting unit to the surface, thus allowing for relatively free movement of the unit. The vacuum is also used to capture debris removed from the surface, as well as spent abrasive. Recyclable grit or a mixture of grit and slag can be used by these blasting units, depending on the surface to be cleaned, the contaminant to be removed, and the desired degree of cleanliness.

A surface cleanliness of SSPC-SP 6/NACE No. 3, SP 5/NACE No. 1 or SP 10/NACE No. 2 (Sa 2, Sa 2½ or Sa 3) can be achieved with this equipment, depending on the abrasive used and the unit's travel rate, dwell time and so on.

Cleaning rates achieved with vertical dry-blasting equipment also depend on the nature of the surface to be cleaned, the standard of cleanliness required and the width of the blast pattern. In addition, the degree of flatness of the surface is a factor, because the blasting head must be kept against the surface to maintain a dust-free operation.

Advantages of remote-controlled vertical-blast-cleaning equipment include dust-free cleaning, speed of operation without the need for scaffolding and the resultant savings in scaffolding and labor costs. Disadvantages include more up-front expense for equipment compared to traditional blasting units, the possibility of cumbersome setup (such as rigging a support beam from the top of the surface), and, in some cases, the need to scaffold the surface for painting (for example, if it cannot be reached from a cherry picker or permanent staging in a dry dock).

ROBOTIC UHP UNITS FOR VERTICAL SURFACES

Like the robotic dry-blasting equipment for vertical surfaces described previously, robotic units equipped with UHP waterjetting nozzles that can clean vertical surfaces are designed to crawl along a ship hull, a storage tank or other large, flat surfaces. As with the dry-blast systems, an operator controls the work with a remote-control system on the ground.

Despite differences in individual products, robotic UHP waterjetting units for vertical surfaces share some features. They have one or more spray bars that hold the spray nozzles, and they feature vacuum recovery, filtration/separation and waste-storage systems. Ultra-high-pressure water is supplied to the nozzles by intensifier or conventional plunger pumps, which can be powered by a diesel or an electric motor. In some cases, the same motor powers the vacuum recovery and filtration units. The pumps and separation systems are located on the ground, where they may be mounted on a skid or a trailer for easy transport.

As with vertical dry-blasting machines, the UHP waterjetting units have shrouds that surround the blast nozzle heads and seal them to the surface being cleaned to prevent the escape of debris or used water.

Depending on the manufacturer, these units may be free-crawling machines, or they may be constructed to attach to the end of a telescopic arm mounted to a self-propelled vehicle or to a dry-dock installation. In either case, the units are operated by remote control from the ground and held against the surface by means of magnetic force or a vacuum.

The free-crawling machines have either twin tracks or wheels at each corner. A winch system is used to position the unit on the surface from the top. It also serves as a safety device to support the unit should it accidentally become separated from the surface.

Because waterjetting alone does not produce a surface profile, use of this technology is restricted to maintenance work. Joint standards from SSPC: The Society for Protective Coatings and NACE International covering steel preparation with UHP waterjetting are available (SSPC-SP WJ/NACE 1–4), as are standards from Schiffbautechnische Gesellschaft e.V. in Germany and several marine paint companies in Europe. A European standard on this topic, ISO 8501-4, was released in 2006.

As with any surface preparation method, the cleaning rate and level of cleaning depend on the nature of the surface (coating type and thickness, presence and degree of rust, and degree of flatness); the standard of cleanliness required; the width of the blast pattern; and the speed of the unit.

Advantages of remote-controlled UHP waterjetting units for vertical surfaces are the same as those for the dry-blasting units for vertical surfaces: dust-free cleaning; speed of operation without the need for scaffolding; savings in scaffolding and labor costs; and the usual advantages of waterjetting (such as no abrasive to purchase, collect and dispose of).

Disadvantages include more up-front expense for equipment compared to traditional waterjetting units (although several companies will rent these units to contractors for specific projects) and, in some cases, the need to scaffold the surface regardless if it cannot be accessed for painting from a cherry picker or from permanent staging in dry dock.

RECENT DEVELOPMENTS

Both centrifugal-grit-blasting and UHP waterjetting robotic equipment are still in use today. These remote-controlled machines are most suited for the surface preparation of large, flat surfaces such as the exterior (or interior) of steel storage tanks and the sides of a ship's hull, were they can offer faster, safer and cleaner removal of old coatings. They are typically used in maintenance operations, and they eliminate the need and cost of scaffolding, cherry pickers or aerial work platforms, except for the small areas that cannot be reached by the robotic blasting head.

The grit blasting machines are typically suspended by rigging or from a crane and held to the surface by strong magnets, and can be maneuvered easily in both vertical and horizontal directions by a single operator on the ground. A powerful vacuum removes the spent abrasive and old paint debris for safe disposal. SSPC-SP 5 and SP 10 can be achieved at a typical rate of 323 ft²/hr (30 m²/hr) with a 15.7-inch (400-mm) blast width. This blasting path width can be increased by the use of multi-blast nozzles or swivel heads on some units to give cleaning rates up to 1,615 ft²/hr (150 m²/hr).

However, robotic UHP waterjetting machines are arguably more popular today. These are typically held against the surface to be cleaned by a strong vacuum, which also allows the safe removal of the paint and rust debris to a central collection and separation unit on the ground, and are driven across the surface on pneumatic tyres. One unit from a major supplier, however, uses a set of eight high-performance magnets to hold it against the surface.

These UHP waterjetting units typically clean the surface at a rate of 753 ft²/hr (70 m²/hr) with a path width of 14.5 inches (370 mm). Although the use of UHP waterjetting cannot produce a profile on a steel surface, it ensures that the remaining chloride level on the cleaned surface is well below that which would have been achieved by dry blasting, and the existing surface profile remains, ensuring good adhesion of the subsequent coating. This type of technology is most at home in a dry dock during the maintenance painting of ships' hulls. One such system is attached at the end of a telescopic arm mounted on a self-propelled vehicle running on the dock floor is still popular. This has a cleaning width of 33 inches (850 mm) and removal rates of old coatings and rust of between 1,076 and 3,229 ft² /hr (100 and 300 m²/hr), depending on the quality of surface finish required.

Both types of machines are available from US and European manufacturers, and from partner companies around the world.

REDUCING RAILCAR OWNERSHIP COSTS:

WISE SELECTION OF COATINGS AND LININGS

Pamela Simmons.

BY MIKE MANETTA, SHERWIN-WILLIAMS PROTECTIVE & MARINE COATINGS

While the freight-rail business is potentially very profitable, it's capital-intensive and full of risk. About 40 cents of every revenue dollar goes back into the business for infrastructure, equipment and maintenance. Closely tied to the commodity markets, demand for different types of railcars—tanks, hoppers, gondolas, flats, covered hoppers and boxcars—can change year to year or monthly, leaving owners and operators without the right mix of cars. Unfortunately, railcars prepared for one type of commodity cannot always carry another. A tank car prepared with a food-grade epoxy may not, without an interior recoating, transition to another commodity such as hydrocarbons. For this and many other reasons, railcar interior and exterior coatings play a significant role in the industry's complex profit equation. They affect the life of the car and what it can haul, as well as how often and how long it is out of service for maintenance.

Decisions around railcar coatings concern all the major players in the industry including owners, investors, operators and application shops. Each has a stake in efficiencies that are lost or gained as the railcar is coated during the original manufacture, maintained during service or completely refurbished at some point in its life cycle. Everyone should be educated in new and recent coating options that enable lower total cost of ownership (TCO) and greater uptime for railcars.

MANUFACTURING SPECIFICATIONS: EXTERIORS

In the freight business, the main role of exterior coatings is corrosion prevention and, only secondarily, appearance. However, the

market is beginning to demand economical coating solutions that address both considerations. Unlike passenger cars and locomotives, which typically feature high-gloss formulations for aesthetic appeal, freight cars are most often given a one-coat, direct-to-metal (DTM) epoxy that does not require a primer. The most effective epoxies are ultra-high-solids, as they provide a smoother appearance and superior edge retention, as well as superior corrosion resistance (Fig. 1).

Durability varies among epoxies and other exterior coating types, including waterbased enamel and DTM urethanes. Greater durability may demand a price premium. Therefore, the specifier will need to consider the cost/benefit ratio of a coating that lasts longer (for example, five versus 10 years) based on whether the car will be leased or owned and for what periods of time.

Many owners and specifiers choose epoxy exterior coatings for their proven durability and corrosion resistance. However, when exposed to ultraviolet (UV) rays, epoxies will chalk and change color within a year or two—red coatings will turn pink and black coatings will turn gray (Fig. 2, p. 28). These color changes do not affect the coating's corrosion resistance in the short term, but some companies will recoat cars well before required simply to improve their appearance. Leasing companies, for example, may be motivated to recoat a car to obtain better leasing terms or to maintain their reputation for high-quality cars.

To improve the appearance of epoxies after UV exposure, coating companies have been researching new formulations. An example is a black epoxy coating that chalks to a black, rather than gray. The darker chalking provides a more pleasing finish over a longer time period, potentially enabling railcar owners to forgo early maintenance and therefore reduce railcar ownership costs. If a car is coated once in 10 years as opposed to twice, that's a significant savings.

Fig. 1. Most freight cars, such as the tank and pressure-differential covered hopper cars shown here, feature one-coat, direct-to-metal (DTM) epoxy coatings.
Photos courtesy of The Sherwin-Williams Company unless otherwise noted.

MANUFACTURING SPECIFICATIONS: INTERIORS

The interior coating or lining in a railcar determines what commodities it can carry. While more durable coatings accommodate a larger range of uses, they're more costly. Therefore, it rarely makes sense to imagine the worst-case scenario and coat to that level of protection. Some railcars do cycle between commodities—these are known as swing cars—but in that case, the coating should be chosen specifically for the limited set of commodities the car will carry.

Another consideration is the cleaning protocol. The lining may need to be abrasion-resistant to withstand high-pressure water, be temperature-tolerant (from 120–150 F) and tolerant of harsh cleaning chemicals, especially for oil-and-gas commodities.

Interior coatings should be selected carefully based on a realistic and well-planned projection of how the car will be used. In some cases, it may be possible to overengineer the coating specification, with the idea that the car would be used first for a variety of aggressive contents, and then later, as the lining begins to wear down, for less aggressive contents. A coating manufacturer can help

recommend the most cost-effective coatings for a given railcar plan.

SHOP EFFICIENCY AND THROUGHPUT FOR NEW RAILCARS

Making proper coating selections for new railcars can yield many efficiencies and greater throughput for application shops (Fig. 3). Considerations include surface prep, coverage, cure times, heat applications, number of coats, time between coats, permitting and inventory costs. The objective is to move the car through the application process as quickly as possible, from the time the car comes off the welding process, gets blasted and then masked off for the coating application, through interior lining and exterior coating applications, and decaling.

Linings are usually applied first. They can be applied in a single coat or multiple coats, with the latest coating technology enabling one less coat compared to legacy products. Exterior coatings are usually applied in one coat, DTM.

The cure rate for both exterior and interior coatings is an important variable affecting efficiency. Ideally, shops should work with coatings that will dry and cure quickly at ambient temperature, within a few hours or a day. A faster cure time for interior linings enables inspectors to enter a car and perform holiday testing sooner, expediting the next stage in the process. To expedite the curing process, some shops employ heat, but heat adds another step to the process, requiring additional space and resulting in additional expense.

Typically, high-solids formulations are preferred for interior and exterior coatings, not only because they are lower in solvents and volatile organic compounds (VOCs), but also because they are applied at higher film thicknesses, which means fewer coats. Ease of application should also be considered when selecting coatings. Coatings should go on evenly, not clog spray guns and only require minimal touch-ups. High-solids coatings with high edge retentiveness allow the applicator to effectively spray corners, welds and edges. Because most shops will experience labor challenges at some point, it's generally a good idea to use coatings that are forgiving.

Whenever any new coating is being applied, the shop should consult with the manufacturer to ensure the equipment is set up properly. This is an important step that ensures a quality application and efficient throughput. However, even with the best coatings and application processes, it's still possible for spots to be missed. Touch-up locations are usually identified after a car has been moved to the yard, far from the application booth. Therefore, applicators must mix just the right amount of parts A and B of the coating in a bucket and run the quick-setting material to the yard—a process referred to as "mix and dash." The drill is hard on the applicator and introduces an opportunity for waste, as the product may set in the bucket before the repair is complete. Plus, applicators may mix more product than necessary to ensure they have enough. A way around this cumbersome process is to use cartridge technology for spot repairs. This portable technology, which looks somewhat like a caulk gun, dispenses parts A and B, catalyzing just the right amount of the product. The approach is efficient and ergonomic for the applicator, while ensuring coating quality and performance.

Fig. 3: While epoxy coatings will chalk and change color over time—as shown on these freight railcars—such changes do not affect the coating's corrosion resistance.

SHOP OVERHEAD AND EXPENSES

VOC permitting is a significant overhead cost for application shops. Not just the volume, but also the type of coating affects how much the shop pays to abate VOCs and secure permitting. By selecting 100%-solids or waterborne coatings, as opposed to solvent-based coatings, owners and operators can help application shops reduce VOCs and permitting costs, even when shops spray a large overall volume of coatings.

Another area where overhead can be reduced is coatings inventory, which not only ties up cash flow, but drives up insurance costs, which are based on volume. Close tracking is required to ensure the total storage volume does not exceed OSHA regulations and insurance requirements for hazardous flammable material. Because larger volumes require more insurance, keeping inventories low is a common goal among shops. A sensible strategy is to work with coating suppliers who can provide just-in-time (JIT) delivery, which holds inventory to a minimum, while ensuring the required coating supply is always on hand, with no cause for interrupting throughput.

RAILCAR MAINTENANCE AND REFURBISHMENT

Railcar surface maintenance can take many forms, from cleaning to overcoating and complete refurbishment. When a car is taken out of service, it cannot money for the operator. It's critical for that car to get back on the track as soon as a quality repair can be performed. As with new railcars, choices concerning coatings and linings, as well as application approaches, will have a profound effect on the speed and efficiency of the process.

Fig. 3: Applicators inspect the final finish of a tank car before moving the car out of the paint shop for stenciling.

Cleaning, which is the most frequent maintenance process, occurs when a car transitions between different commodities, ensuring the previous contents do not contaminate the new contents. During this process, cars are inspected. If corrosion or other damage such as soluble salt contamination or structural damage is discovered, the owner, operator and/or the shop will determine whether the car will be touched up or refurbished.

Overcoating and touch-up are options when corrosion is minimal and the coating's aesthetics are still sound. In this case, one way to achieve efficiencies is to select DTM coatings that can be applied over marginally prepared surfaces, cutting down on prep time. In addition, as with new railcar coatings, choosing high-solids coatings that provide fast cure times and are relatively easy to apply can be advantageous. When making a coating selection, it's best to avoid Band-Aid repairs with maintenance-type coatings that are not of the same quality as the original coating.

A complete refurbishment is required when corrosion is severe or when the car's overall appearance has significantly deteriorated. In such cases, the application shop will prepare the steel surfaces using a commercial blast. If there is pitting corrosion, they may apply filler. However, when interior pitting is extensive, another solution is a lining that bridges the pitting, creating a relatively even surface. Ultra-high-solids epoxies hold great promise in this regard. They may eliminate steps in the refurbishment process, while granting new life to older cars that might otherwise be limited in the commodities they can carry. When the new coating process is complete, the refurbished railcar should appear like new. Moreover, the new coating should last as long as the first one, provided its environmental exposures and contents are the same.

MANAGE TOTAL OWNERSHIP COSTS

Owners, operators and application shops share a common set of goals relative to coatings and linings for new and existing railcars: to increase throughput, contain costs and get railcars into service as soon as possible. The latest technology in high-performance coatings and linings can aid in these goals by:

- Reducing the number of coats required to provide durable, long-lasting coverage; fewer coats yields lower material and labor costs;
- Accelerating dry-to-service times; faster throughput translates to lower production costs; and
- Providing superior coatings that last longer, extending maintenance intervals and reducing the need for recoats; fewer recoats throughout the life of a railcar translate to significant savings.

If the freight-rail business is subject to unforeseeable economic cycles and other uncertainties that make the profit equation challenging at times, coating technology is one reliable source of cost savings. Consulting with a coating supplier will give owners, operators and applicators a solid means of lowering the cost of railcar ownership.

ABOUT THE AUTHOR

Michael Manetta is Global Market Director of Rail, Marine and Power Generation for Sherwin-Williams Protective & Marine Coatings. He has 15 years of experience in the coating industry including several sales and marketing roles within multiple end-use segments. ***JPCL***

CORROSION PROTECTION OF A HALIFAX HARBOUR BRIDGE:

CHALLENGES, ISSUES AND OPPORTUNITIES

BY AHSAN CHOWDHURY, HALIFAX HARBOUR BRIDGES; AND KENNETH A. TRIMBER, KTA-TATOR, INC.

The Angus L. Macdonald Bridge is a 1.3-kilometer-long (4,265-foot-long) cable suspension bridge that carries automotive traffic over the Halifax Harbour between Dartmouth and Halifax. There are four approach spans to the west cable bent on the Halifax end and 12 approach spans to the east cable bent on the Dartmouth end. The bridge was opened April 2, 1955.

The Macdonald Bridge was originally painted with a lead-based oil alkyd, three-coat paint system. In 1993, because of environmental concerns and availability, Halifax Harbour Bridges (HHB), the organization responsible for operating and maintaining bridges in the Halifax Harbour, transitioned to a zinc-hydroxy-phosphite (Fig. 1). Spot repairs are conducted by a seasonal crew of 30 painters who join HHB for the painting season.

Generally, HHB's painting team performs touch-up painting only, except for the main towers where a single finish coat is applied for color uniformity and aesthetic floodlighting. Although spot repairs to the existing coating system have successfully prevented the spread of corrosion for the most part, corrosion in difficult-to-clean-and-recoat areas is expanding due to the limitations of a maintenance strategy that is based on power-tool cleaning rather than on blast-cleaning. Furthermore, the number of coating layers present and high total thickness on many of the existing steel surfaces places further spot repair and overcoating at risk of catastrophic delamination failure, because the existing alkyd system becomes more brittle with age and seasonal temperature cycling (Fig. 2, p. 32). As a result, two independent consultants have recommended that the existing coating system on the approach spans, cable bents, towers and main cable of the Macdonald Bridge be completely removed and replaced. Full removal and replacement of the existing coating system will initiate a design life with a new maintenance cycle that will include spot repairs, overcoating and zone repairs, and eventually removal and replacement. HHB wants a durable corrosion-protection

Fig. 1: Localized touch-up on the Macdonald Bridge. Photos courtesy of Halifax Harbour Bridges unless otherwise noted.

system that will provide 25–30 years of service life.

HHB recognized that the implementation of the new corrosion-protection program for the Macdonald Bridge approach spans and towers is a significant capital investment estimated at $40 million in 2015. Due to many unknowns, HHB decided to implement the program in multiple phases over six years:

- Research and development in 2016;
- Detailed inspection in 2017;
- Trial/pilot project in 2018;
- Halifax approach and cable bents in 2019;
- Dartmouth approach spans in 2020; and
- Towers in 2021.

The main objectives of the pilot project were as follows:

- To select and use the most cost-effective coating system that would best protect the bridge and minimize maintenance works;
- To obtain practical knowledge on challenges, issues and opportunities prior to implementation of major contracts;
- To refine the estimate of steel repairs—estimated versus actual;
- To ensure that there is minimal impact on the natural environment;
- To ensure that there are no safety incidents throughout the project;
- To minimize negative impact on the neighbors; and
- To ensure public safety.

RESEARCH AND DEVELOPMENT

In order to gain practical knowledge and information about the application of different protective coating systems on similar bridges, HHB engineers conducted site visits to five bridges on the east coast that have environmental exposures similar to HHB's bridges and have recently completed or are presently undertaking major paint rehabilitation or replacement projects. From these bridge-site visits, HHB compiled key observations to be considered in planning a complete repainting program.

1. Some bridges use rock salt for effective snow and ice control, while others use sand (rather than salt). The sand reduces corrosion issues by eliminating the detrimental effect of the chlorides.
2. A notable amount of rivets and bolts might need to be replaced during the paint job.
3. During the paint contracts, 10–15% of the painted areas were found to require steel repairs that makes the construction sequence difficult and significantly increases the project's cost.
4. Access platforms and enclosures can catch fire and cause structural damage.
5. Swing stage for underdeck painting was found to be inefficient and caused extra cost for QA inspections. The tendered specs should include a provision stating that the contractor is to provide a safe access system and an efficient work-platform system that is quick to install.
6. Careful consideration should be afforded to limit the enclosure/containment lengths for aerodynamic stability of the structure.
7. An on-site abrasive/waste-collection unit and robust system is required for lead abatement with air-monitoring equipment near the jobsite.
8. Surface preparation:
   a. Adequate surface preparation is key for the durability of any coating system.
   b. Various surface preparation requirements for specific areas such as cable bands, steel plates, sharp edges, slip-critical faying surfaces and galvanized steel should be included in the tendered specs to avoid confusion.
9. Trial blasts for selected areas can be conducted to verify inspection findings and estimate the steel-repair area to minimize contingency.
10. Other bridge sites were applying an epoxy zinc primer (full coat and stripe), an epoxy intermediate (full coat and stripe) and a urethane finish. Caulking was used in select areas, prior to application of the finish.
11. Some coatings fade quickly and should be researched before specifying.

Fig. 2: Pre-blast condition.

Fig. 3: The existing steel was pressure-washed and blast-cleaned to SSPC-SP 10/NACE No. 2.

12. A full-time QA inspector/consultant is critical to ensure a long service life of the new coating system.
13. A QA team (consisting of the owner's engineer, a full-time resident engineer and coating inspectors) costing 10–15% of the total contract value is considered to be a best-value approach in a coating project.
14. The QA consultant should conduct daily inspections and submit daily and monthly reports.
15. Conducting annual paint inspections and producing an inspection manual to standardize inspection results are beneficial practices.
16. The contract should include provisions stating that the contractor is to provide uninterrupted inspection access for the owner's representatives or other contractors.
17. Prior to the acceptance of a repainting program, detailed inspections are beneficial to identify common steel defect types, estimate quantities and prepare typical repair detail to include in tendered specs.
18. The contractor should provide a detailed cost breakdown in a sealed envelope with the bid for dispute resolution if required.
19. Non-Conformance Reports (NCRs) are required to identify deficiencies that need to be addressed (for example, excessive paint thickness, inadequate surface preparation prior to the first coat being applied, inadequate or excessive curing between coats, paint overspray and drips contaminating the surrounding property).
20. Detailed coating specifications and typical steel-repair details should be included in the tendered package. This approach can minimize interruptions to coating work, uncertainties and extras.
21. Worker and public safety are paramount. Contract specs should include detailed safety requirements and strict clauses. Drug and alcohol policies and routine testing of painters is recommended.
22. Large bridges should consider implementing multi-phase, multi-year coating contracts.

THE PILOT PROJECT

Design and Specification

The tendered scope focused on 65,000 square feet of paint replacement as a pilot project on the Halifax truss spans and at a selected location on the girder spans. The project involved the shop painting of new steel and galvanized members, and the removal and replacement of the existing coating on the steel. The overall approach for cleaning and painting follows.

For the shop-coated steel, the specification required abrasive blast-cleaning to SSPC-SP 10/NACE No. 2, "Near-White Metal Blast Cleaning," and the application of a organic zinc-rich epoxy/epoxy/polyurethane (Z/EP/PU) system. The approved coating materials were from NEPCOAT, List B. All coats were applied in the shop with damages and connections touched-up in the field.

Existing galvanized steel that had been painted was prepared according to SSPC-SP 16, "Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals." The same epoxy intermediate coat and polyurethane finish coat were applied to the galvanized surfaces. If patches of corrosion were present, a spot coat of organic zinc-rich epoxy primer was applied.

The existing steel was pressure-washed and blast-cleaned to SSPC-SP 10/NACE No. 2 (Fig. 3). Soluble salts and pack rust were removed and the same Z/EP/PU system was applied, but with stripe coats of both the organic zinc-rich epoxy primer and the epoxy intermediate coat (Fig. 4, p. 35). Caulking was installed in areas where pack rust was found.

For control of the existing lead paint during removal, the specification required a Class 1A containment and ventilation system according to SSPC-Guide 6, "Guide for Containing

Surface Preparation Debris Generated During Paint Removal Operations." Work had to be conducted in compliance with Nova Scotia's "Occupational Health and Safety Act," "Lead in the Workplace: A Guide to Working with Lead," "Environment Act" and "Transportation of Dangerous Goods Act and Regulations," as well as the Canadian General Standards Board (CGSB) Provisional Standard No. 164-GP-IMP, "Guidelines For Disposal of Contaminated Solids in Landfills," and OSHA 29 CFR 1926.62 lead and other worker-protection regulations in 29 CFR 1926. Monitoring of the work was required according to applicable sections of SSPC- TU 7, "Conducting Ambient Air, Soil and Water Sampling."

Tendering

It is difficult for an owner to prepare a tender document without being familiar with the role of a general contractor and their subcontractors for the contract. A corrosion-protection project contract may have coating contractor as the GC and a steel contractor as a sub or vice versa, which depends on local market conditions, as well as the percentage of steel repair and coating work for the project. To assemble the best team for the project, HHB prepared tender documents that sought a coating contractor and a steel contractor as part of the same team, thereby eliminating concerns about each causing each other delays—with one acting as the GC and the other as a sub, they would be contractually tied and incentivized to work together.

Challenges and Opportunities

The pilot project identified the following challenges and opportunities for improvement when undertaking the painting of the remainder of the bridge.

Unpredictable Weather: Paint must be applied within the manufacturer's parameters for air and surface temperature, as well as relative humidity. According to the manufacturer's instructions for the selected product, the surface temperature must be at least 3 degrees C (or 5 degrees F) above the dew point temperature and the condition must be maintained until the coatings have adequately cured prior to exposure to weather. Although containment can prevent surface contamination, the continuous high humidity and low temperature can affect the speed of curing and application of the next layer of coating, slowing down the project.

Load Restriction on the Bridge: Due to structural constraints, maximum factored design load (dead plus live) of temporary structures is 8 kN/m per truss, which increased the difficulty of erecting scaffolding and limited the available manpower on the bridge.

Because the existing coating system contained lead (as much as 8.8% by weight) and chromium (up to 1.4%), containment to control releases was required. Wind load on the structure was also restricted, so containment

could not be installed continuously from Pier H1 to the Halifax cable bent. Therefore, the project was conducted in several phases, which slowed down production.

Restricted Working Hours: Due to spatial restrictions at the end of the truss, it was not possible to install temporary batten plates before the removal of end batten plates. Therefore, based on the consultant's specification, temporary steel bracings were installed immediately after the removal of the end batten plate under calm traffic. This project had no lane closures or bridge closure, requiring the contractor to work from 9:30 am to 3:00 pm, or 7:00 pm to 5:30 am, limiting the window for replacing end batten plates.

Uncertain Amount of Steel Repair Without Blasting: Since the Macdonald Bridge underwent an annual paint touch-up program, multiple layers of coating made it difficult to determine the condition of the steel and therefore, made it challenging to develop repair/replacement criteria for each structural element during tendering preparation. Although consultants provided repair/replacement criteria for components such as batten plates, measurements could not be taken before the contractor erected the scaffolding and actually blast-cleaned. After blasting to bare steel, additional deterioration and section loss were observed, requiring additional repairs. This increased quantities of steel repair relative to the tender estimates as well as additional time on-site.

Inaccessible Blasting Areas: Some areas, such as deck splice joints and rivet heads inside of troughs, were inaccessible due to the bridge design and configuration, and could not be brought to the required level of surface cleanliness (by reasonably practical methods) that was specified in the tender document.

Difficulties of Measuring Dry-Film Thickness on Corroded Faying Surfaces: The corrosion on some faying surfaces made it difficult to obtain accurate readings. For these pitted areas, a QA inspector would need to work closely with the contractor to adopt an acceptable solution.

Dry-Film Thickness Repair Procedure: During surface preparation of faying surfaces, it was necessary to blast the coated surface to ensure the final primer thickness was within in the manufacturer's tolerance. However, it took a long time to receive the paint manufacturer's response for the repair procedure. Therefore, in future tender documents, the contractor should be asked to submit a repair procedure and obtain approval from the paint manufacturer before commencing the work.

Galvanized Deck Splatter Removal: Deck panels were galvanized during fabrication and the galvanized splatter was not removed at that time. Sweep-blasting prior to priming did not remove the larger galvanized splatter, and its deterioration can be harmful to new coating systems. Removal of galvanized splatter

Fig. 4: Zinc primer and stripe coats applied.

should be considered for future projects.

Steel-Repair Procedure: A good deal of welding, cutting and removal are involved in steel repair and therefore, a detailed repair-work procedure should be requested in future tender documents.

Paint Manufacturer's Representative: Because surface preparation and the application of primer and intermediate coats are critical steps, the paint manufacturer's representative should be present at the early stages of coating work to approve of the surface condition and the methods being used by the contractor.

Quality Assurance: HHB selected a QA consultant to provide full-time, on-site inspection and testing services that included monitoring, recording and reporting on blast removal of the existing paint system, steel repairs, cleaning, surface preparation, environmental control and application of the new paint system, which consists of the complete section of the Halifax truss spans and a selected area on the adjacent girder spans.

PILOT PROJECT

Lessons Learned

HHB gathered a significant amount of valuable information from the pilot project, including the following.

Materials

Curing Time of Coating: Compatibility between caulking and the coating system is necessary. The contractor must confirm with the paint manufacturer that the caulking is compatible with the coating, and must also pay attention to the curing time of the primer and caulking materials, making sure to select fast-curing products.

Fire-Retardant Materials for Scaffolding: Fire-retardant materials must be used. Some typical fire-retardant materials used in containment construction are ASTM E-84 Class A/Class 1 flame-retardant plywood and 20-mil tarps that meet the NFPA 701, "Standard Methods of Fire Tests for Flame Propagation of Textiles and Films."

Salt Contamination: Although salt is effective for melting snow, in order to avoid chloride contamination, sand was used during this project with chloride tests conducted daily in certain spots.

Specification

Clarification of Scope Change and Quantity Change: Because an accurate quantity estimate of steelwork is not possible, the tender document should specify the difference between scope change and quantity change, and address how to deal with any delay induced by an increased quantity of work.

Painter Certificate: There should be a specific clause in the tender to clarify the qualifications of the painters and QC personnel in order to ensure the competency of workers.

Use of Language: Careful use of formal contractual language is important to ensure

that the owner's expectations are met by the contractor.

Annotated Photos: One must use caution when including photos in tender documents to explain locations because photos may lead a contractor to think that they represent the full scope of work. A clause should clearly state that the pictures are for illustrative purposes only and do not represent the locations of the entire scope of work.

Schedule

Critical Path and Benchmarks: Although the contractor submitted progress reports to HHB prior to biweekly meetings, comparing the work actually completed to work scheduled, HHB was not given a notice of the severity of the work delay at early stages. Therefore, it is critical to have up-to-date project schedules with key benchmarks and a critical path analysis to demonstrate the impact of changes on the schedule prior to the change being approved and the work beginning.

Construction Sequence

Pre-Blast Site Visit: Because the quantity of steelwork in the tender document is a rough estimate, it is hard for a contractor to decide how many steel-repair items to order beforehand. In this case, construction work may be delayed by the delivery of materials. Therefore, it is necessary to have a pre-blast site visit after scaffolding is set up to give the contractor a sense of how many steel-repair items may be required so that the fabrication process can begin. Therefore, when the blasting is finished, the contractor can start doing the steelwork while conducting more detailed observations and ordering materials as needed.

Conflict Between Cure Time and Steelwork: Based on the coating manufacturer's Class B certification, it took more than three days for the chosen primer to cure before making connections, so the installation of new batten plates was put on hold. Because only one batten plate can be replaced at a time in one truss member, the process of batten-plate replacement became very time-consuming. The contractor should be aware of the time required for each plate and organize the steelwork accordingly. Design of future repairs should also recognize the difficulties in quickly making assemblies when a Class B connection is required, and limit their use where possible.

Caulking and Coating Procedure: Caulking was originally intended to be applied before the final coat on designated crevice areas; however, due to the long curing time required and an effort to maximize productivity, caulking was permitted to be applied after the final coat, followed by a stripe coat of finish after the caulking cured, in some selected areas. Both methods are acceptable practices, but the advantage of the way it was ultimately done, is that if the caulking cracks, there is an extra coat under it to protect the steel.

CONCLUSION

There are many unique challenges related to bridge corrosion-protection projects and therefore, adequate research, investigation and planning is important to implement a successful coating program. HHB found it very useful to visit other bridges and similar projects to learn and adopt best practices. Implementing a pilot project provided a significant amount of valuable information on project specs and scope, construction means and methods, erection sequence, productivity, QC and QA, schedule and contract performance, and a reduction of financial risk.

This article will be presented at SSPC Coatings® 2020.

ABOUT THE AUTHORS

Ahsan Chowdhury came to Canada as a professional engineer and immigrant in 2007, after 10 years of engineering experience in planning, designing and maintaining of high-profile infrastructures in Bangladesh. He received a Master of Engineering degree from Concordia University in Montreal and began his bridge engineering career with HHB in 2010.

Chowdhury is a member of the TRB Standing Committee on Testing and Evaluation of Transportation Structures AFF40 and many other technical committees throughout Canada and the U.S.

Kenneth A. Trimber is the president of KTA-Tator, Inc. He has over 45 years of experience in the industrial painting field. Trimber is a NACE-certified Coating Inspector, an SSPC Protective Coatings Specialist, an SSPC C-3 Supervisor/ Competent Person for the Deleading of Industrial Structures and is certified at a Level III nuclear coating inspection capability in accordance with ANSI N45.2.6. He is a past president of SSPC, a member of the Standards Review Committee and is chairman of the SSPC Commercial Coatings Committee, SSPC Surface Preparation Committee and the SSPC Containment Task Group. Trimber is also past chairman of ASTM D1 on Paints and Related Coatings, Materials and Applications, and authored *The Industrial Lead Paint Removal Handbook*. ***JPCL***

Photos courtesy of U.S. Navy unless otherwise noted.

RIGHTING THE SHIPS

COATINGS COME THROUGH FOR U.S. NAVY VESSELS

BY JPCL STAFF

Editor's Note:
SSPC's annual Structure Awards recognize the work of teams of contractors, designers, end users and coating manufacturers for excellence on protective coatings projects. The 2019 Structure Awards were presented at SSPC Coatings+ 2019 in Orlando, Feb. 11.

SSPC presented awards for recent coating work performed on two U.S. Navy ships, recognizing the important role protective coatings teams play in maintaining and protecting these valuable assets.

For the recoating of the USS *Essex* (LHD 2), a *Wasp*-class Loading Helicopter Dock amphibious assault ship commissioned in 1992, the U.S. Navy turned to a new state-of-the-art coating developed specifically for Naval structures. The unique efforts undertaken on the *Essex* project earned the parties involved the E. Crone Knoy Award for outstanding achievement in industrial or commercial coatings work that demonstrates innovation, durability or utility.

Sailors (known as Ship's Force) on the *Essex* reached out to representatives from coating manufacturer NCP Coatings Inc., Dr. Erick Iezzi of the U.S. Naval Research Laboratory, and consultant Gordon Kuljian of GK Consulting LLC, to provide a new, single-component (1K) polysiloxane coating. This coating product was developed jointly by Iezzi and NCP Coatings under the direction of Mark Lattner of the Naval Sea Systems Command (NAVSEA) and the sponsorship of NAVSEA's Painting Center of Excellence program.

The Navy was interested in utilizing this new formulation for coating the freeboard of the 843-foot-long *Essex*, as it was developed to improve the overall durability and color retention of the Navy's topside coatings.

Adding to the uniqueness and complexity of this opportunity, the parties involved further decided that this project would serve as a test to determine if the newly developed

USS ESSEX PROJECT AT A GLANCE

Start Date: April 2017
Completion Date: May 2017
Facility Owner: U.S. Navy
Coating Formulator: U.S. Naval Research Laboratory / NAVSEA Painting Center of Excellence
Coating Manufacturer: NCP Coatings Inc.
Consultant: GK Consulting LLC

SSPC President Garry Manous; Jennifer Moore and Glenn Arent, NCP Coatings Inc.; and Gordon Kuljian, GK Consulting, LLC. Photo courtesy of SSPC.

and approved 1K polysiloxane could be applied to the entire freeboard by the *Essex*'s own Ship's Force while at its home port in San Diego, instead of having to be dry-docked at another location, as is typical for such an operation.

The challenge was accepted, and the training and application of this unique new coating product was overseen by Kuljian while the *Essex* was in port. The results were so well received that about three-quarters of the way through the application of the freeboard, NCP Coatings was contacted by the Ship's Force to provide the new coating product for the repainting of the LHD 2 island, as well. All in all, it is estimated that the Navy achieved a cost avoidance of over $35,000 in coating materials and over $1 million in dry docking fees.

According to Glenn Arent of NCP Coatings, "This cradle-to-grave project is an example of product development transforming into real-life field performance. The single-component polysiloxane coating was first conceptualized by Iezzi at the NRL. The NRL then approached NCP Coatings to take Iezzi's formulation from his notebook to a viable, in-the-can product. This coating was delivered and successfully applied in the field by Ship's Force with the help of individuals like Kuljian, and ultimately resulted in outstanding results and cost savings for the Navy. This is an example of a need being met through creative thinking, industry know-how and teamwork."

Arent also said that the new single-component polysiloxane coating is now being purchased and applied on a regular basis by the Navy's own Ship's Forces.

USS GEORGE WASHINGTON PROJECT AT A GLANCE

Start Date: Feb. 2017
Completion Date: June 2018
Facility Owner: U.S. Navy
Contractor: Mid-Atlantic Coatings
Coating Supplier: Sherwin-Williams Protective & Marine Coatings
Abrasive Supplier: Barton International
Surface Prep Equipment Supplier: Greener Blast Technologies
Cartridge Supplier: V.O. Baker
Project Site: Huntington Ingalls Industries-Newport News Shipbuilding

SSPC's Military Coatings Project Award of Excellence was given for the exceptional coatings work and collaboration completed on the USS *George Washington* (CVN 73), a *Nimitz*-class nuclear-powered aircraft carrier. The ship is 1,092 feet long, 257 feet wide and 244 feet high; it was christened in 1990 and commissioned in July 1992.

As part of the vessel's multi-year midlife refueling and complex overhaul, the coating project took place at the Huntington Ingalls Industries-Newport News Shipbuilding yard in Newport News, Virginia. Work on the project began in August 2017, with development plans already in the works two years prior.

Specifications for the *George Washington* included preserving and coating the freeboard, main deck, topside and more than 100 interior tanks. The work also involved the preparation and maintenance of the underwater hull surfaces.

"From the beginning, we knew this project would require looking beyond the usual horizons—not just in terms of engineering a strategy, but in effectively communicating

our innovations and ideas, and collaborating with the right teams," said Vinny D'Auge, President of Mid-Atlantic Coatings, the coating contractor on the project.

"Since several aspects of the project were groundbreaking, not only were we challenged to assemble this complex arrangement of features and benefits, we also had to demonstrate how these technologies and teams would come together to deliver on our promise."

For surface preparation, Mid-Atlantic Coatings and Sherwin-Williams joined forces with Greener Blast Technologies and Barton International in order to introduce Naval contractors to vapor blasting. This form of preparation was chosen by the team for its water-like medium properties and known reduction in dust levels.

After witnessing the technique remove miscellaneous exterior built-up materials and the outermost coatings prior to applying secondary direct-to-steel blasting, the Navy adopted the SSPC/NACE wet abrasive blasting standard, which incorporates vapor blasting.

Remaining materials and paints slated to be removed were done so with the use of garnet in dry-blasting techniques. Barton and MAC representatives worked together to ensure that the garnet would meet the project's requirements.

Barton supplied more than 6,000 tons of garnet for the project, including a new 30/60 garnet abrasive, engineered specifically for this project in January 2018.

"We are honored to have this opportunity to support MAC and the U.S. Navy by supplying our American garnet for the refurbishment of the USS *George Washington*," said Randy Rapple, President of Barton.

In taking steps to "improve sustainability and reduce environmental impact," several key initiatives were employed. Vapor blasting uses less abrasive media, thus lowering the overall amount of garnet requiring disposal. Emissions were also reduced by the use of air-powered pressure washers (unlike standard pressure washers requiring the use of fuel). Recycled steel grit was used on the internal tanks, which again lowers the overall waste stream.

Large areas of the freeboard were coated with an edge-retentive, ultra-high-solids, single-coat, rapid-cure epoxy. Through this product selection, MAC was able to achieve a four-hour primer cure time, allowing for faster recoat, overall accelerated coating schedules and expected long-term performance.

The freeboard topcoat is a state-of-the-art, two-component epoxy polysiloxane, which includes a new and improved Naval Research Lab low-solar-absorption pigment package. This technology enhances the U.S. Navy's signature "Haze Gray" color while achieving a reduced solar temperature load on the vessel.

Manous; Mike Vollman, Sherwin-Williams Protective & Marine Coatings; Vincent D'Auge, Mid-Atlantic Coatings; Orlando Nichols, Mid-Atlantic Coatings; and Mark Schultz, Sherwin-Williams Protective & Marine Coatings. Photo courtesy of SSPC.

Within the ship, the tanks designed to hold various fuels, ballast water and wastewater were also coated with an edge-retentive, ultra-high-solids, single-coat, rapid-cure epoxy. This system has a predicted service life of 15–20 years (and potentially beyond).

The coatings were applied using plural-component sprayers and utilized cartridge technology from V.O. Baker Company, developed for plural-component materials. During the project, more than 95% of touch-ups and repairs following initial spray applications were completed entirely with cartridges.

COATINGS+
February 3–6, 2020 | Long Beach, CA

Coatings+ 2020, SSPC's annual conference and exhibition and the only industry conference 100% dedicated to protective and marine coatings, heads west to the Long Beach Convention Center in Long Beach, California, Feb. 3–6, 2020.

SSPC will kick-off its 70th anniversary celebration during the show. The Coatings+ 2020 exhibit hall will also feature a new demonstration stage, among other highlights.

Additionally, the Coatings+ 2020 schedule includes a four-day-long technical program, packed with sessions covering new coating types, specific structures, surface-prep techniques, novel application methods, best health and safety practices and a long list of other topics of interest to coating professionals.

The following is a list of scheduled technical presentations; the list is current as of press time and is subject to change. The full technical program schedule will be published in the Coatings+ 2020 Advance Program in the December issue of JPCL.

For more information about the technical program, contact Christine Lajzo (lajzo@sspc.org) or Donald Molinari (molinari@sspc.org).

MONDAY, FEB. 3

Morning Session 1: INDUSTRY ESSENTIALS

- "5 Essential Benefits of the Pre-Project Hazardous Materials Inspection and Survey," by Julie Zak, Forensic Analytical Consulting Services, Inc.
- "Polychlorinated Biphenyls: PCBs: Updated Regulations and Implications in the Coatings Industry," by Michelle Rosales, Forensic Analytical Consulting Services, Inc.

Morning Session 2: PROJECT EXPECTATIONS

- "Coating Condition Assessments: What is It, What Value Does It Bring?" by David Hunter, Pond & Company.
- "UHP Waterjetting: The Oldest New Method for Surface Preparation," by Brady DeRoche, Innovative Surface Prep Smart Blasting & Robotics.
- "Mind the Gap: Increasing Coating Life Cycles Through Quality Program Implementation," by David Hunter, Pond & Company.

Morning Session 3: GOING ABOVE AND BEYOND INSPECTION

- "Using Laboratory Testing Requirements to Close a Specification: Are You Looking After Your Customer's Best Interest?" by Yanick Croteau, The Sherwin-Williams Company.
- "Fiber-Reinforced Polymer Applications, Process and Inspection," by Ramon Pelaez, Greenman-Pedersen, Inc.
- "Variability in Accelerated Corrosion Testing," by Nicole Rakers, PPG Industries.
- "New Coating Methodology for the Electrochemical Deposition of Aluminum-Based Layers from Aqueous Systems," by John Watkins, LumiShield Technologies.

Morning Session 4: FAILURES IN COATINGS

- "Analysis of Coating Blister Failures and Associated Coating and Substrate Risks," by Michael Kibler, Elzly Technology Corp.
- "Mechanical Testing of Epoxy Free-Films to Assess Cure Behavior and Integrated System Performance," by Gregory Smith, Naval Research Laboratory.

- "Evaluation of Polysiloxanes as Green Alternatives to Solution Vinyl Coatings," by Bobbi Jo Merten, Naval Research Lab.

Afternoon Session 1: CASE STUDIES

- "Application of ASME and ISO Qualified Composite Systems Internally as a Preventative Measure to Extend the Service Life of Internal Linings at High-Risk Failure Locations of Assets," by Mark Borsky, Repair Technology LLC; and Gary R. Banks, Industrial Group LLC.
- "'Should Have Done It Right the First Time': Life Cycle Cost of a Job Gone Wrong," by Sam Scaturro, Alpine Painting and Sandblasting Contractors.
- "A Unique and Challenging Mississippi DOT Rehabilitation and Painting Project of the US-84 Westbound Bridge Over the Mississippi River in Natchez, MS," by Greg Richards, KTA-Tator, Inc.
- "Corrosion Protection of the Halifax Harbour Suspension Bridges: Challenges, Issues and Opportunities," by Ahsan Chowdhury, Halifax Harbour Bridges.
- "Corrosion Maintenance on the Sydney Harbour Bridge: A 30-Year Case Study," by Charlie Gooden, BlastOne International.
- "Houston's Best Practices for Coating Rehabilitation of Large-Diameter Above-Grade Water Line Crossings," Christine Kirby, Lockwood, Andrews & Newnam, Inc.
- "Hard Conduit/Stuffing Tube Preservation," by Jeff O'Dell, Vision Point Systems, Inc.

Afternoon Session 2: CORROSION CONTROL

- "Structural Polyurethane and Rehabilitation of America's Infrastructure," by Chip

COATINGS+ Exhibitors

The following is a list of companies planning to showcase their products and services in the Coatings+ 2020 exhibit hall. For questions about exhibiting, please contact Nicole Lourette (lourette@sspc.org).

Abrasives Inc.
Air Systems International
And-Dry
ARMEX
ARS Recycling Systems, LLC
Atlantic Design Inc.
Axxiom Mfg./Schmidt Engineered Abrasive Systems
Barton International
Bellemare Abrasives & Minerals
BlastOne International
BrandSafway
Bullard
Burleigh Industries
BYK-Gardner USA
CanAm Minerals, Inc.
Carboline
CESCO
ChlorRid International Inc.
Clemco Industries Corp.
Cortec Corporation
Chemours
Cor-Ray Painting Co.
CSI Services
D.H. Charles Engineering, Inc.
Dampney
Daubner Advanced Coating Solutions
DeFelsko Corporation
Dehumidification Technologies, LP
DESCO Manufacturing Inc.
Detroit Tarpaulin, Inc.
Doosan Portable Power
Dupont Protection Solutions
Dustnet by EMI
Eagle Industries
Ecomaterials, Inc.
Elcometer
Element Materials Technology
EnTech Ind.
Ervin Industries
Fischer Technology, Inc.
Gannett Fleming
Forensic Analytical Consulting Services (FACS)
GMA Garnet USA
GNP Ceramics, LLC
Graco Inc.
Greener Blast
Greenman-Pedersen, Inc.
Harsco Minerals
Herc Rentals
Hippwrap Containment
HoldTight Solutions, Inc.
HRV Conformance Verification Associates Inc.
Induron Protective Coatings
Industrial Vaccuum Equipment Corp
International Paint/AkzoNobel
ITW Polymers Sealants North America
IUPAT/ Finishing Trades Institute
Jetstream of Houston/FS Solutions
Jollyflex USA
Julbert Inc.
Kennametal
KTA-Tator, Inc.
Langtry Blast Technologies
MES – Rentals & Supplies
Minerals Research, Inc.
Monarflex by Siplast
Montipower
National Equipment Corp. (NECO)
NCERCAMP @ The University of Akron
Nextec, Inc./PreTox
Novatek Corporation
Nu Way Industrial Waste Mgmt., LLC
Olimag Sand
Opti-Blast, Inc.
Pacific Dust Collectors & Equipment
P & L Metalcrafts
Polygon
PPG Protective & Marine Coatings
Pro-Tect Plastic & Supply
Rapid Prep
RD Coatings - Dothée S.A.
Rizhao Garnet Ltd.
Rust-Oleum
Saint-Gobain
SAFE Systems, Inc.
The Sherwin-Williams Company
Somay Q
Sponge-Jet
Spray Foam Systems
Sprayrog, Inc.
Sulzer Mixpac USA
Tarps Manufacturing
TDJ Group
Technofink, LLC
Technology Publishing Co.
Texan Stone LLC
Tinker & Rasor
Titan Tool
Thermec Company Inc.
Trelawny SPT Ltd.
TruQC
U.S. Minerals
Van Air Systems
Vector Technologies Ltd.
VersaFlex
W Abrasives
The Warehouse Rental & Supply
Wasser Coatings
WNA
ZIBO TAA Metal Technology Co., Ltd.

Johnson, SprayRoq, Inc.
- "Lifetime Corrosion Control Cost Minimization," by Douglas Mittlesteadt, Hempel A/S.
- "Evaluation of High-Ratio Co-Polymerized Calcium Sulfonate (HRCSA) Effectiveness Addressing Crevice Corrosion for Structural Steel," by Barry Marcks, Caltrans.
- "Down-the-Hole Without a Paddle: Corrosion of Wellhead Surface Casings Using IMM Coatings," by Mike O'Donoghue, AkzoNobel.
- "Corrosion Resistance Comparison of Direct-to-Metal, Weatherable Protective Coatings," by Mary Roley, Carboline.
- "Combatting Localized Galvanic Corrosion at Bolted Connections in Gravity Sludge Thickeners and Clarifiers in Wastewater Treatment Plants," by Robert Nixon, Corrosion Probe, Inc.
- "Combatting Corrosion of Nuts and Bolts (Support Rods and Fasteners)," by John Glass, Amcorr Products & Services, Inc.

Afternoon Session 3: TANKS
- "Criticality of Weld Details Under Ultra-High-Solids Tank Linings," by Sean Meracle, The Sherwin-Williams Company.
- "Hidden in Plain Sight: Automated vs. Air Blast Surface Profiles for Internal Tank Lining Performance," by Mike O'Donoghue, AkzoNobel.
- "Advantages and Disadvantages of Utilizing UHP Robotics in Carbon Steel Preparation in Existing Storage Tanks," by Jeb Rush, The Sherwin-Williams Company.
- "Advantages and Savings by Using Portable Wheel Blast Machines for Maintenance of Storage Tanks," by Mauricio Herrera, Blasting Experts, Ltda.
- "Throughput Optimization for Tank Fabricators," by Joseph Windover, The Sherwin-Williams Company.
- "Cal Water Tank Maintenance Program," by Bryan Wilfley, Cal Water.
- "OAP Coating Systems and Linings for Petroleum & Water Storage Tanks," by Deborah Simmons, The Sherwin-Williams Company.

Afternoon Session 4: PROJECT MANAGEMENT
- "How Specific is Your Coating Specification?" by Chuck Fite, The Sherwin-Williams Company.
- "'Herding the Cats'—An EPC's Perspective on Good Project Execution and Dealing with Failures," by Mark Maresko, Kiewit Engineering Group, Inc.
- "Truth or Marketing? Hocus Pocus or Real Information? How Are You Selecting Products for Your Projects?" by Murray Heywood, The Sherwin-Williams Company.
- "Coating System Test Patches and Mock-Ups: Value to the Specifier and Your Owner Client," by William Seavy, The Sherwin-Williams Company.
- "Complicated Siphon Rehab Challenges Pre-Job Planning Process," by Steven Davis, Coblaco Services, Inc.

TUESDAY, FEB. 4

Morning Session 1: SURFACE PREP
- "Wet Abrasive Blasting Standards: The Future of Surface Preparation and the Effects it Has on Steel," by Joshua Bell, Tnemec Company, Inc.
- Surface Roughness Profile and its Effect on Coating Adhesion and Corrosion Protection," by Stuart Croll, North Dakota State University.
- "Relevance of Surface Roughness," by Dinko Cudic, Monti Power.
- "The Time Has Come: Use of Robotics in Surface Preparation is Here," by Garron Ross, J.H. Fletcher & Co.
- "Numerical Simulation of Blast Nozzles," by Gavin Gooden, BlastOne International.

Morning Session 2: INSPECTION
- "The Emergence of Contact-Based Nondestructive Testing (NDT) at Height Utilizing Aerial Robotic (Drone) Systems," by Robert Dahlstrom, Apellix.
- "How the Development of Electronics and Methods Can Support Visual Assessment of Surface Preparation?" by Craig Wallbank, WINDA USA.
- "QA-ing the QC from a Distance," by Troy Fraebel, ABKaelin, LLC.
- "Dry-Film Thickness Measurement and Challenges to Achieve Accurate Readings," by Jay Kunick, Fischer Technology.

Morning Session 3: MILITARY
- "Coatings for the Future: Addressing the Challenges for Military Assets," by John Escarsega, CCDC Army Research Laboratory.
- "The NSRP Surface Preparation & Coatings (SP&C) Panel 2020 Update," by Arcino Quiero, Jr., Huntington Ingalls Industries-Newport News Shipbuilding.
- "State of Technology: Cleaning and Coating


alxdaick / Getty Images

UAV Systems," by Jeff McCutcheon, Apellix.
- "Next-Generation Ships' Force Maintenance Coatings," by Jeff O'Dell, Vision Point Systems, Inc.
- "Work Force Development," by Nancy Pescinski, Advanced Marine Preservation.

Afternoon Session 4: PIPELINE REFINERY
- "Pipeline Refinery - Saudi Arabia," by Mana Al-Mansour, Saudi Aramco.
- "Pipeline Refinery - Saudi Arabia," by Wasim Al-Kabour, Wiskots.
- "Pipeline Refinery - Saudi Arabia," by Adel Botros, Al Ghatani Pipe Coating.
- "Pipeline Refinery - Saudi Arabia," by Kris Kemper, SSPC.

Afternoon: WORKSHOPS
- "Master the Maze: Interactive Coating Failure Investigation," by Valerie Sherbondy, KTA-Tator, Inc.
- "Basic Coatings Inspection Instrument Use," by William Corbett, KTA-Tator, Inc.
- "Fundamentals of Waterborne Coatings," by Leo Procopio, Dow Chemical Company.
- "Ratios and Induction Times: Should We Really Sweat It?" by Andrew Croll, IUPAT-Finishing Trades Institute.
- "Coatings 101: An Overview," by Charles Brown, Greenman-Pedersen, Inc.

WEDNESDAY, FEB. 5

Morning Session 1: SOLUBLE SALTS
- "Surface Soluble Salts Impact on Protective Coating Performance," by Andrew Recker, Chlor Rid International Inc.
- "A Discussion of the Effect of Soluble Salts on Corrosion and Coatings," by Rudy Libel, Eric Brandhorst and Bob Wissinger, The Sherwin-Williams Company.
- "Salt Contamination Testing Method and Accuracy Improvement," by Dejin Feng, Rader Coating Technolgy, Shanghai.
- "Detection of Soluble Salts Prior to Painting," by J. Peter Ault, Elcty Technology Corp.

Morning Session 2: SEVERE ENVIRONMENTS
- "Why Epoxy Coatings are the Most Practical Lining Material for Manhole Rehabilitations," by Tim Bauman, The Sherwin-Williams Company.
- "Lessons Learned, The Search Continues: Impact and Abrasion Resistant Coatings and Overlays for Immersion Structures in Severe Environments," by Jeffrey Ryan, U.S. Army Corps of Engineers.
- "Permeability: An In-Depth Look at the ASTMs, When the Data Can Be Important and When the Information is Irrelevant," by John Sierzega, The Sherwin-Williams Company.
- "Novel Two-Coat Water Repellent System for Long-Life Offshore Maintenance," by David Morton, Hempel A/S.

Morning Session 3: COATING TYPES & CHARACTERISTICS
- "Very High-Solid Acrylic Polyol Technology for Low-VOC 2K Direct-to-Metal (DTM) Coatings," by Jeff Arendt, Arkema Coating Resins.
- "Smart and Multifunctional Coatings," by Jaime Baghdachi, Innovative Technical Systems Corporation.
- "The Evolution of Waterborne Acrylic Protective Coatings," by Leo Procopio, Dow Chemical Company.
- "Stress-Localized Durable Coatings," by Hadi Ghasemi, University of Houston.
- "Self-Healing Microcapsule-Thickened Oil Barrier Coatings," by Jiaxing Huang, Northwestern University.
- "Developments in Polyamide Rheology Modifiers for Very High Solids and 100% Solids Industrial, Protective and Marine Coatings," by Yannick Naïbil-Moreau, Arkema Coating Resins.
- "Why Do We Record the Attributes as a Coating Failure as a Result of an Adhesion Test?" by David Barnes, Elcometer Limited.

Morning Session 4: ENVIRONMENTAL HEALTH & SAFETY
- "Regulatory Update: New and Revised Regulations and Actions Affecting the Coatings Industry," by Alison Kaelin, ABKaelin, LLC.
- "Plasma Coating Removal: A Safety and Industrial Hygiene Analysis," by Peter Yancey, Atmospheric Plasma Solutions, Inc.
- "Understanding the Inhalation Hazards Associated With Abrasive Blasting," by Thomas Enger, Clemco Industries Corp.
- "Updates to the SSPC/NACE Joint Corrosion Prevention and Control Planning Standard," by Stephen Spadafora, DoD Corrosion Office (Leidos, Inc.).
- "Fall Protection Training for the Construction Industry," by Charles Brown, Greenman-Pedersen, Inc.
- "The Rebranding of a Safety Culture 2.0: Leadership and Accountability," by Chris Peightal, KTA-Tator, Inc.

Afternoon Session 1: SURFACE PREP
- "Foundation for Strong Performance," by Stephen Streich, SC Streich Enterprise.
- "The Development of Surface Preparation Technology," by Kenneth Rossy, Holdfight Solutions.
- "Effects of Surface Conditioning on Corrosion Resistance Using New vs. Traditional Abrasive Blasting Media Types," by Edward Reitz, Saint-Gobain Specialist Grains and Powders.
- "How the Right Pot Choice and System Setup Can Improve Blasting Efficiency," by David Barnes, Elcometer Limited.
- "The Morphology and Performance Effects of Under-blasted and Re-blasted Carbon Steel Substrates," by Kat Coronado, AkzoNobel.

Afternoon Session 2: GAS & OIL PIPELINE COATINGS
- "Study of a 100%-Solids Liquid Epoxy Pipeline Coating in Low-Temperature Application: Curing Reaction Versus Performance Characteristics," by Sherry Rao, A Plus Coating Solutions Inc.
- "Lifting of Multiple In-Service Lines for CUPS Inspections and Maintenance," by Kurt Gribnitz, Ovolifts.

Afternoon Session 3: CONCRETE
- "Optimization of High-Solids Self-Leveling Epoxy Floor Coatings," by Eric Ripplinger, Olin Corporation.
- "Determining When to Coat Concrete," by Manuel Najar, VtbA Consulting Engineers, Inc.


MattGush / Getty Images

- "Preparation and Coating of Concrete for Aggressive Service with Glass Flake Vinyl Esters," by Edward Cilli, Corrocoat USA, Inc.
- "Lining Concrete Ground Storage Tanks," by Cory Brown, Themec Company.
- "Lining Below-Grade Concrete," by Matt Apsley, The Sherwin-Williams Company.

Afternoon Session 4: COATING TYPES & CHARACTERISTICS

- "Field Testing of Coatings for Shielding of Cathodic Protection Currents," by Benjamin Bussard, Shell Pipeline.
- "Duplex Coatings for Bridge Structural Steel," by J. Peter Ault, Elzly Technology Corporation.
- "Insights into the Consideration and Selection of Viscoelastic Materials for Potential Use in Field Patch Application," by Sherry Rao, A Plus Coating Solutions Inc.
- "Glass Flake Epoxy vs. Fiber Filled Epoxy: A Comparison of Design, Performance and Benefits," by Eric Zimmerman, The Sherwin-Williams Company.
- "Improvements of Waterborne Acrylic Latex Finish Paint Properties by incorporating Fluoroethylene Vinyl Ether (FEVE) Emulsion Technology," by Barry Marcks, Caltrans.

THURSDAY, FEB. 6

Morning Session 1: EIS

- "Investigation of Antifouling Coating Degradation in Marine Environments by Electrochemical Impedance Spectroscopy," by Samanbar Pernieh, Florida International University.
- "EIS Evaluation of Single-Layer Coating Performance in Corrosive Environments," by Donald Lawson III, AGC Chemicals Americas, Inc.

Morning Session 2: BEST APPLICATION PRACTICES FOR HIGH-SOLIDS MATERIALS

- "Behavior of Thermally-Sprayed Electric Resistance Heating Systems Subjected to Thermal Cyclic Loadings," by Milad Rezvani-Rad, University of Alberta, Canada.
- "Seven Ways Spraying with Plural-Component Equipment Provides Savings and Improved Performance on the Job," by John Lihwa, Graco, Inc.

Morning Session 3: BRIDGE

- "What Constitutes a Square Foot?" by Sergio Flores, Cor-Ray Painting Co.
- "The Edgy Truth About Corrosion: How Carbon Nanotubes (CNTs) are Redefining Edge Protection," by Joe Davis, Tesla NanoCoatings.

Morning Session 4: GALVANIZING

- "Development of Polymeric Cold Galvanizing Compound (CGC) for Metallic Protection," by Muhammad Abid, University of the Punjab, Lahore, Pakistan/Marjan Polymer Industries Pakistan.

Late Morning Session 1: ZINC (COATING TYPES)

- "Can You Use a Zinc-Rich Primer When Painting Offshore?" by Raquel Morales, Hempel A/S.
- "Influence of Nanoparticles on the Bond Strength of a Zinc-Rich Coating," by Saiada Fuadi Fancy, Florida International University.
- "Challenging the Organic 'Zinc-Rich' Primer SSPC Standard," by David Morton, Hempel A/S.

Late Morning Session 2: FIREPROOFING

- "Passive Fire Protection Under Artic Conditions: Is It Going to Crack?" by J.P. Leon, PPG Industries.
- "Doing It Differently: The Impact of Off-Site Intumescent Coating Application," by Greg Hansen, The Sherwin-Williams Company.

Late Morning Session 3: WIND TOWER COATINGS

- "Going Beyond Standard Corrosion Prevention Efforts and Getting Improved Life Cycle of Wind Energy Equipment," by Michael McLampy, PPG.

Late Morning Session 4: VENTILATION IN SHIPYARD COATING OPERATIONS

- "How the DH Do I Get the DH I Need?" by Nicholas Kline, Polygon US Corp.

Courtesy of SSPC

MTU ON THE MOVE

By now, many SSPC members have seen SSPC's Mobile Training Unit in person, as it has made appearances at industry conferences and traveled across the country conducting on-site coatings training.

The idea for the MTU was formally conceived in 2017 after discussions between some SSPC board and staff members. Now a reality, the MTU affords SSPC the opportunity to come to companies, wherever they are, and train their blasters and applicators according to SSPC's C-7, C-12 and other certification programs.

According to SSPC Vice President Sam Scalurro, "The SSPC Mobile Training Unit is a one-of-a-kind training facility for industrial blasters and painters. It offers SSPC the ability to bring training almost anywhere in a self-contained and safe training environment. Its versatility and mobility are a unique combination that can supplement both applicator and inspector training classes. It shows SSPC's continued investment in better and more efficient training of our industry's workforce."

In addition to its training capabilities, the MTU also helps increase the visibility of SSPC, its membership and the coatings industry as a whole. "The MTU provides SSPC the opportunity to advertise and to attract attention to our industry, in the hope of generating the interest of those looking for career opportunities," said Jennifer Merck, SSPC Director of Training and Certification. "Our membership can also advertise their organizations via the display of sponsored logos on the MTU."

The only resources required from the contractor for MTU training are fuel for the compressor and generator, abrasive material and paint. When used efficiently, the MTU can train between 5 and 10 people at a time. Gary Duschl, SSPC's lead instructor for the MTU, stated, "I have found the MTU to be a well-designed, self-contained blasting and painting unit, properly equipped to provide individual and group training and certification. It is safe and easy to operate and is extremely efficient due to its recycling capabilities. The people that I have explained and demonstrated this unit to have been impressed, and I have received many favorable comments about the MTU concept and operation."

This past May, the MTU spent two weeks at Huntington Ingalls Industries–Newport News Shipbuilding for a workforce development event, offering a glimpse into the future of training for blasters at the shipyard.

"SSPC's MTU provided a way to engage our workforce and improve 'time to talent' with our blasting operations by increasing safety awareness, proficiency and techniques," said HII-NNS Trade Director Walter Williams.

Xavier Beale, HII-NNS Vice President of Trades, also had an opportunity to visit the trailer. "The energy and learning generated on-site during the event was infectious. It was a clear demonstration of shipbuilders helping shipbuilders learn and grow. We're marrying today's technology to old process training. Blasters' techniques have a lot of variables, but we want to see them act safely and in a way that allows them to accomplish the standards that are set in place."

The MTU was also a hit at the 2019 MegaRust Show. The Navy's Ship's Force (SURFLANT) personnel and Corrosion Control Technology program managers all took turns performing hand- and power-tool-cleaning demonstrations on ASTM D4228 panels that are installed on the unit. The MTU garnered a lot of traction with the younger generation in attendance.

SSPC will hold quarterly craft worker training in the MTU at the SSPC headquarters in Pittsburgh, as well as demonstrations for other local companies. SSPC also plans to work with its nationwide chapters to continue to utilize the MTU in different regions and to promote craft worker training in areas that may not have been reached before. The MTU will also potentially be used to introduce craft worker training to high schools, trade schools and vo-tech programs.

For more information about the MTU, please contact Jennifer Merck at merck@sspc.org or 412-288-6040.

SSPC PCS Certification Update

SSPC is pleased to congratulate the individuals who have recently been certified as Protective Coatings Specialists, the Society's highest level of certification for industrial coating professionals.

The PCS certification recognizes industrial coating professionals for their extensive knowledge in the principles and practices specific to industrial coatings technology. Each individual has been evaluated for his or her mastery of coating type, surface preparation, coating application and inspection, contract planning and management, development of specifications and the economics of protective coatings.

For more information on the PCS and other SSPC training and certification programs, visit www.sspc.org.

Dave Cornette,
Kelly Industrial Coatings
(Milwaukee, WI)

Yves Duschenes, Sablage au Jet 2000 Inc.
(Boisbriand, QC, Canada)

Dylan Goddard,
Seaspan ULC
(Victoria, BC, Canada)

Murray Heywood, The Sherwin-Williams Company
(Oshawa, ON, Canada)

Jeff Kim,
The Sherwin-Williams Company (Reno, NV)

Jamie Laird,
Rodda Paint
(Happy Valley, OR)

Felipe Naciuk,
The Sherwin-Williams Company
(Porto Alegre, Brazil)

Randy Nixon,
Corrosion Probe, Inc.
(Centerbrook, CT)

Boyet Pangan, Panco Resources & Engineering
(Manila, Philippines)

Gregory Richards,
KTA-Tator, Inc.
(St. Petersburg, FL)

Robert Souchuck,
Champion Painting Specialty Services Corp.
(Ft. Lauderdale, FL)

Not pictured:

Andrew Jeffrey, Greenman-Pedersen, Inc. (Denmark, ME); Dustin Kaatz, The Sherwin-Williams Company (Silverado, CA); and Jorge Sergio dos Santos, Jotun (Itaborai, Brazil).

Index to Advertisers

CALENDAR

OCTOBER 2019

SSPC COURSES

Course information available at sspc.org

Oct. 3–4	QCS Quality Cntrl Spvr, Commerce, CA
Oct. 7–12	BCI Bridge Ctgs Insp, Pittsburgh, PA
Oct. 7–19	PCI Prot Ctgs Insp, Batam, Indonesia
Oct. 12–13	C12 Spray App, Norfolk, VA
Oct. 14–17	C3 Lead Pt Removal, Daytona Beach, FL; Surrey, BC
Oct. 14–18	C1 Fundamentals, Commerce, CA
Oct. 14–20	PCI Prot Ctgs Insp, Houston, TX; Norfolk, VA
Oct. 15–16	C14 Marine Plural Comp App, Norfolk, VA
Oct. 15–17	Safety, National City, CA
Oct. 16	Thermal Insp, St. Petersburg, FL
Oct. 16–17	C6 Power Tool, Columbus, OH
Oct. 18	C5 Lead Pt Refresher, Daytona Beach, FL; Surrey, BC
Oct. 19	PCS Prot Ctgs Spclst, Grand Rapids, MI
Oct. 21–22	C7 Abrasive Blast, Zephyrhills, FL
Oct. 21–25	C1 Fundamentals, Winnipeg, MB
Oct. 21–25	NABI NAVSEA Basic Pt Insp, Newington, NH
Oct. 21–27	PCI Prot Ctgs Insp, Pittsburgh, PA
Oct. 23–24	C12 Spray App, Zephyrhills, FL
Oct. 28–Nov. 1	NBPI NAVSEA Basic Pt Insp, Jacksonville, FL

CONFERENCES & MEETINGS

Oct. 6–8	SWRI 2019 Fall Tech Mtg, Charleston, SC, swrionline.org
Oct. 7–9	CPI Polyurethanes Conf, Orlando, FL, polyurethane.americanchemistry.com
Oct. 7–9	NACE Eastern Area Conf, St. Augustine, FL, nace.org
Oct. 9–11	CONSTRUCT 2019, National Harbor, MD, constructshow.com
Oct. 9–12	ASCE 2019 Convention, Miami, FL, asce.org
Oct. 20–22	NACE Northern/Eastern Conf, Ottawa, ON, nace.org
Oct. 20–24	ACI Fall Conv, Cincinnati, OH, concrete.org

25–30 Years

The service life that Halifax Harbour Bridges expects to achieve from the corrosion-protection systems employed on its bridges.
See page 30.

ISO 12944-6

The aging test used to determine whether or not coating performance and durability are affected by additional waterjet cleaning on blasted-steel surfaces.
See page 16.

70 m²/hour

The estimated cleaning rates for typical, modern robotic ultra-high-pressure waterjetting equipment used on vertical surfaces.
See page 21.

1989

The year that SSPC published the SSPC-QP 1 standard and created its Painting Contractor Certification Program, the coating industry's first established set of criteria for evaluating paint contractor qualifications.
See page 4.

2

U.S. Navy ships—the USS *Essex* (LHD 2) and the USS *George Washington* (CVN 73)—that were cleaned and recoated in separate 2018 SSPC Structure Award-winning projects.
See page 38.

1 or 2 Years

The time it will take for exterior railcar epoxies to chalk and change color when exposed to UV rays—red coatings will turn pink, black coatings will turn gray.
See page 28.