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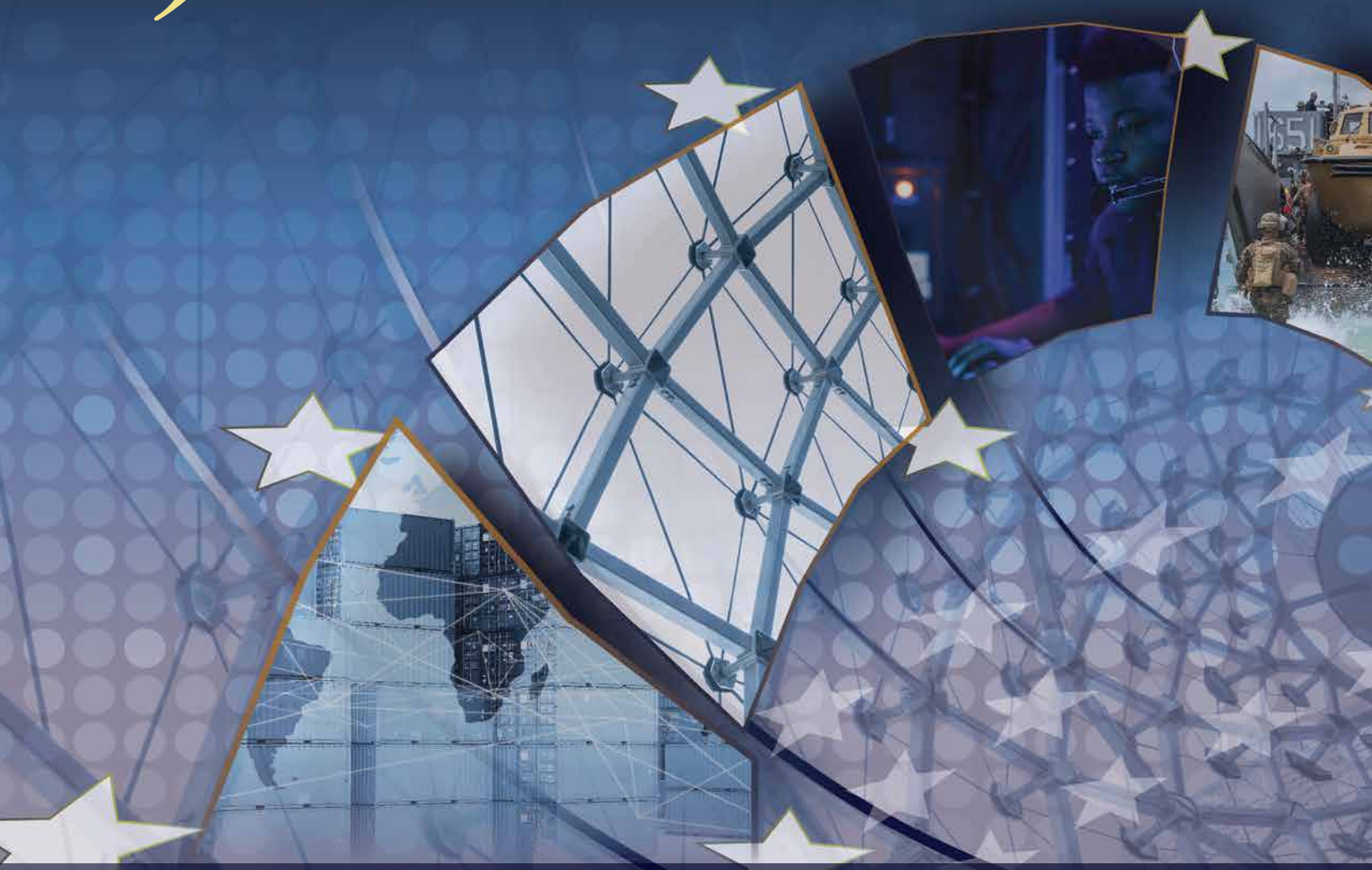
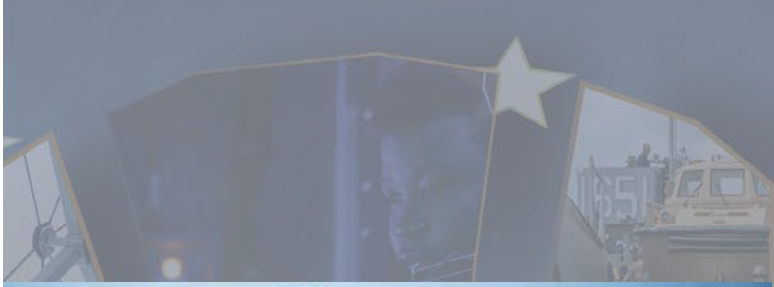


Standardization Stars

- Radio Frequency Connector and Cable Specifications and International Adoption Efforts
- Military Specifications for Elimination of Hazardous Hexavalent Chrome (Cr6+)
- Standard Practice for Systems Human Integration
- Landing Aircraft, Utility 1700

Contents

Departments



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Director's Forum

Standardization Stars

On January 1, 2019, I assumed the role and responsibilities of Director of the Defense Standardization Program Office (DSPO) and, along with it, the pleasure of working with the broad, diverse group of professionals of the Defense Standardization Program (DSP). The DSP has a 67-year history of working with government, industry partners, and our nation's allies to promote standardization for the warfighter—to improve operational readiness, reduce total ownership costs, and reduce cycle time through the development and use of standards. Standardization continues to play a necessary and critical role in supporting our nation's defense.

The priorities of the Department of Defense (DoD), as detailed in the *National Defense Strategy*, are rebuilding military readiness as we build a more lethal joint force, strengthening alliances as we attract new partners, and reforming DoD's business practices for greater performance and affordability. Standardization is key to engineering, fielding, and sustaining systems and supplies for the warfighter that are reliable, technologically superior, interoperable, and affordable. The *National Defense Strategy* also reminds us that we have returned to a state where interstate strategic competition, not terrorism, is now the primary concern in U.S. national security. This momentous time of strategic competition in our nation's history reminds us of the lessons of the past—some quite literally paid for in blood, sweat, and tears—as we adapt to our present and prepare for the future.

On June 6, 1944, more than 150,000 Allied troops landed along a 50-mile stretch of heavily fortified French coastline to fight Nazis on the beaches of Normandy. More than 5,000 ships and landing craft and 11,000 aircraft supported the D-Day invasion and, within 5 days, more than 326,000 troops, 54,000 vehicles, and 100,000 tons of supplies crossed the English Channel, making Operation Overlord the largest amphibious invasion in history. This force was only successful through mass production made possible by standardization and the industrial revolution.

America had learned much during the Revolutionary and Civil Wars about the value of standardization—enabling commonality, reliability, affordability, and interchangeability of parts. However, standardization between the Allies in the Second World War was still lacking. For example, the standardized engines and airframes of the German Luftwaffe supplied

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an advantage over the varied Allied aircraft. Lack of standardization between Allies also left British tanks and trucks broken down despite the vast quantities of replacement fasteners delivered by the U.S. because of different screw thread standards. The effectiveness of coalition warfare depends on interoperability, and standardization is essential to enabling interoperability.

Our network of alliances and partnerships remains the backbone of global security, and the *National Defense Strategy* charges us with deepening interoperability with our allies and partners. For 70 years, the bond between Europe and North America has made NATO the strongest alliance in history. Since 1952, DoD has worked with NATO, via the DSP, to standardize equipment for the warfighter and make that equipment interoperable with our allies. Today, standards ensure that allied aircraft are capable of aerial refueling; shelters and supplies are transportable by ship, rail, or road; and our warfighters and weapons systems are able to communicate.

Operational readiness and lethality also depends on our ability to modernize capabilities to maintain a competitive advantage. Our strategic competitors, China and Russia, have aggressively invested in advanced technologies, such as artificial intelligence, hypersonics, and 5G. The *National Defense Strategy* warns, "Success no longer goes to the country that develops a new technology first, but rather to the one that better integrates and adapts its way of fighting." Technical standards are the fundamental building blocks that enable innovation and modernization of defense capabilities, and they are key to modernizing our engineering and acquisition practices. Standards are an essential element of modular and open systems approaches and a vital enabler of the data and model exchange required to realize digital transformation—the leap from paper-based to digital products in engineering and acquisition. Standardization is critical to meeting our operational readiness and lethality goals.

Since 1987, DSPO has presented awards honoring individuals and organizations of the military departments and defense agencies who have achieved significant improvements in interoperability, cost reduction, quality, reliability, and readiness through standardization. These Standardization Stars have made singular improvements in technical performance, greatly enhanced safety for DoD personnel, and avoided billions of dollars in costs. Two of this year's award winners worked diligently with industry and international standardization bodies to reduce the use of counterfeit parts and improve engineering practices for human system integration. An Army team consolidated and replaced several specifications after testing alternatives for improved corrosion prevention. The final award went to a Navy team that applied standardization, obsolescence management, and an innovative contracting approach to replace and improve on the Navy and Marine Corps' existing Landing Craft Utility class—the descendent of the landing crafts that proved so critical in the Normandy invasion.

Maintaining a credible, combat-ready force and strong alliances is essential to deter war and maintain a free and open international order. The DSP award winners serve as examples of excellence in standardization in support of the warfighter—supplying the warfighter with equipment that is interoperable, reliable, technologically superior, and affordable. Congratulations to this year's winners. I hope that reading about their successes will inspire other standardization stories and efforts, some of which just may be future award winners!

Radio Frequency Connector and Cable Specifications and International Adoption Efforts

Award Winner: Defense Logistics Agency (DLA), DLA Land and Maritime, Defense Supply Center Columbus (DSCC), Engineering and Technical Support Directorate, Document Standardization Division, Interconnection Branch

Counterfeit radio frequency (RF) connectors and cables are prevalent in the DLA supply chain and this effort reflects DLA's commitment to enforce purchases of qualified components. Implementing tighter tolerances and enhancing qualification requirements will cement DLA's RF specifications as the gold standard in international committees. The effort covers the following documents: MIL-STD-348, MIL-DTL-17, MIL-DTL-3643, MIL-DTL-3650, MIL-DTL-3655, MIL-DTL-25516, MIL-PRF-31031, MIL-PRF-39012, MIL-PRF-49142, MIL-PRF-55339, and MIL-DTL-83517. By leading the way in standardization, the United States can effectively fight counterfeit items on a global level and enforce our standards and quality requirements.

BACKGROUND

Increasingly, counterfeit connectors and cables were entering DLA supply chains. Many of these parts originated in foreign countries and contained significant errors in construction and quality documentation. DLA met with qualified suppliers to create a refined approach to enforce DLA standards and prevent counterfeit material from entering our supply chains.

PROBLEM/OPPORTUNITY

Some of the tolerances and quality requirements in the defense specifications required tighter controls to prevent entities with lesser manufacturing capabilities from creating counterfeit RF parts. Mr. Jeremy Funk, lead engineer for RF connectors and cables at DLA Land and Maritime, met with manufacturers, distributors, suppliers, quality personnel, test engineers, and government representatives to formulate an appropriate path forward. Through extensive collaboration with industry partners and other government entities, the proposed changes to the specifications were created to enhance and enforce rigorous requirements. Upon completion, these

specifications will represent a gold standard for international committees and government users, affecting adoption at a global level and preventing other entities from adopting their own less-restrictive specifications. By maintaining control of the international standards, the United States has positioned itself to retain quality and manufacturing control of parts that are easily counterfeited.

APPROACH

Mr. Funk formally started updating the requirements for the documents through monthly teleconferences and biannual coordination meetings. The first coordination meeting was held in May 2014 with participation from the National Aeronautics and Space Administration (NASA), the Aerospace Corporation, the Energy Information Administration (EIA) 2.2 Committee, the International Electrotechnical Commission (IEC) US-46F Committee, RF connector and cable manufacturers, and major original equipment manufacturers (OEMs). The teleconferences continued monthly until revisions to the documents were completed. Mr. Funk was a major participant and contributor to the document updates and is actively selecting details for additional specification sheets.

MIL-PRF-39012 "Connectors, Coaxial, Radio Frequency, General Specification for" and MIL-STD-348 "Radio Frequency Connector Interfaces" are the RF connector defense specification and standard with the highest incidences of counterfeit and subpar parts. The current trend in RF connector technology increases bandwidth by increasing frequencies on existing RF connectors, components, and cables. For example, a typical MIL-STD-348 TNC connector may function at 18 GHz and comfortably route 40 Mbit/s. Industry and military customers now require throughput greater than 100 Mbit/s in most systems, pushing the bandwidth requirements of existing connector designs well beyond their designed for 18 GHz and up to 70 GHz for certain connector families.

Increased bandwidths necessitate tightened tolerances on existing connection systems and complete redesigns of some connector families to prevent RF leakage and noise issues. Tolerances that do not reflect current manufacturing bandwidth requirements are the primary issue between intermateability (the ability of parts from different manufactures to be interchangeable) and performance.

Quality control and conformance was another issue throughout RF specifications; therefore, MIL-STD-790 "Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic, and Fiber Optic Parts Specifications," the quality control standard for Department of Defense (DoD) specifications, was added and enforced throughout the RF connector ecosystem. This enabled DLA to introduce periodic manufacturing auditing to its toolbox and enhance manufacturing capability through the RF connector and cabling supply chains.

After these tighter tolerances and higher qualification requirements were in place, Mr. Funk approached the national and international standardization groups to acquire buy-in for the adjusted standards. The IEC was the first to adopt Mr. Funk's new specifications and promote them for use on an international level. By adopting the U.S. standards for RF connector technology, the IEC prevented other entities from using unique specifications that could lack tightened tolerances and good quality control. The U.S. standards also include built-in enforcement measures to prevent manufacturers from producing less-than-fit parts. These measures give DoD the authority to take steps to prevent counterfeit material from entering our supply chains.

The industry standards for RF connectors are now the modified and updated specifications Mr. Funk formulated. He is currently producing new slash sheets for MIL-PRF-39012 and MIL-PRF-55339 "Adapters, Connectors, Coaxial, Radio Frequency,

(Between Series and within Series), General Specification for" to reflect designs capable of throughput of up to 110 GHz. These connectors and their associated interconnect systems are used DoD-wide in a variety of weapon systems from drones and unmanned aerial vehicles to missiles, ships, and aircraft. By establishing the DoD standards as the international level of quality and workmanship, the United States is leading the way on RF interconnect systems.

OUTCOME

Military-grade connectors had not been able to meet interchangeability needs to facilitate their replacement and repair. The revised connector specifications will supply the military, NASA, and industry with high-quality, interchangeable connectors that are hardened against counterfeiting. During the last several years, OEMs submitted many non-standard parts for approval for use in their systems. The new specifications will furnish the needed connectors while avoiding the use of non-standard connectors. Non-standard parts are typically more expensive, harder to procure, not as reliable, and become obsolete and out of production sooner than standard military parts. The new specifications will support the long system life of current military and space programs without the connectors becoming obsolete and unavailable. These connectors are also protected by the trademarked J and JAN (Joint Army-Navy) branding to make them less susceptible to counterfeiting.

These efforts support the military department standardization by supplying reliable connectors that meet their performance needs. The result will be thousands of dependable connectors for demanding military systems. These efforts preclude the costly piecemeal introduction of non-standard parts to achieve a similar end and enforce U.S. specifications and standards at an international level. They have also helped curb counterfeit RF connectors from entering DoD supply chains.

CURRENT STATUS

MIL-PRF-39012 and MIL-STD-348 are currently being updated to reflect tighter tolerances and higher quality requirements. Mr. Funk is continuing to hold coordination meetings to further the effort of tighter tolerances and higher quality manufacturing while reducing counterfeit parts.

CHALLENGES

There were many challenges to this project. Industry representatives did not immediately agree on new designs and a great amount of time was required for technology research and collaboration. Mr. Funk encouraged connector manufacturers to support the new specification, work with the many manufacturers and users, come to a consensus on requirements, and resolve the hundreds of official comments from the draft documents. Mr. Funk also had to seek out and confront counterfeit material manufacturers, and work with the DSCC Qualifications division to ensure enforcement of QPL requirements.

About the Award Winner

Mr. Jeremy Funk *demonstrated outstanding leadership and accomplishments in this significant engineering standardization effort. As DLA's RF connector and cable expert, he was a critical part of this effort from the inception of the initial concept. He was an integral member of the working group, guiding the group and keeping it on track.*

Mr. Funk's responsibilities as the preparing activity for the new and existing documents were many, including adding valuable input during teleconferences and meetings, requesting projects, generating and coordinating multiple drafts, chairing coordination meetings, consolidating comments and recommending their dispositions, resolving comments, obtaining final approval for documents, and answering the many questions along the way. His expertise in DoD 4120.24M "Defense Standardization Program Procedures" and MIL-STD-961 "Defense and Program-Unique Specifications Format and Content" was vital to the development and dating of the new specifications. Mr. Funk took the rough outline started during the teleconferences and created the full military specifications. He enhanced the qualification procedures and finalized the specifications.

Mr. Funk participated in the 2018 Fall IEC US-46F Radio Frequency Working Groups in Nuremberg, Germany. While there, he worked with participating country representatives from Japan, Germany, France, Italy, Finland, and the United States to find international sources of counterfeit material and initiated the processes to limit and stop the material from entering the DoD supply chain. Mr. Funk met with the international delegation about counterfeit MIL-DTL-17 cable and requested IEC remove the international specifications from its standard families. He also discovered international counterfeits of triaxial connectors originally manufactured and patented by Cinch Connectivity Solutions, a company in good standing on the QPL for MIL-PFR-49142. Mr. Funk notified Cinch of the intellectual property breach and is working with Cinch to prevent further theft of its patented qualified material.

Military Specifications for Elimination of Hazardous Hexavalent Chrome (Cr6+)

Award Winner: U.S. Army Research Laboratory (ARL), Weapons and Materials Research Directorate (WMRD), Materials Development and Transition Branch

The U.S. Army Research Laboratory (ARL) sought to develop and transition a series of new military specification–compliant hexavalent chromate (Cr6+) -free pretreatments for steel, aluminum, and multi-metal systems for surface preparation steps prior to the application of the primer and topcoats on ground, marine, and aviation weapon systems as well as associated support equipment. Proper surface preparation prior to coating is critical for ensuring maximum coating adhesion and minimizing vulnerability to system degradation of function, nonavailability, accumulation of corrosion damage, and the accompanying loss of productivity due to costly repairs. Three specifications were involved in this effort. Two specifications, MIL-DTL-13924D and TT-C-490F, were revised and amended, respectively, to fully enable the transition to new and effective surface pretreatment products free of Cr6+, replacing legacy products that use Cr6+ as a critical active component. Many existing specifications prohibit the use of new novel technologies to replace materials, such as DOD-P-15328D wash primer, that contain Cr6+ and are high in volatile organic compounds (VOCs). A review and revision of these specifications was necessary to introduce effective performance-driven options to the user and enable them to stay in compliance. These updated specifications fully define the replacement product pathways to enable the complete elimination of the current and acutely hazardous pretreatment known as wash primer via notice of cancellation (Notice 2) of its associated DOD-P-15328D specification and a revision to the specification for black oxide coatings to enable substitution of new products in place of current Cr6+ rinses.

BACKGROUND

The MIL-DTL-13924 "Coating, Oxide, Black, for Ferrous Metals" specification covers black oxide coatings applied to ferrous metals, such as carbon, low-alloy, and corrosion-resistant steels and wrought iron. Specific end-user applications for black oxide include munition cases and gun barrels. These coatings are particularly suited for moving parts that cannot tolerate the dimensional buildup of a more corrosion-resistant finish. Black oxide coatings, with or without a supplementary preservative treatment, may be used when a subdued black surface is required versus an otherwise lustrous and reflective metallic appearance. To promote better corrosion resistance, rinses containing Cr6+ have historically been applied to these coatings.

The product known as wash primer under DOD-P-15328D "Primer (Wash), Pretreatment (Formula No. 117 For Metals) (Metric)" has long been reluctantly retained as the sole effective means to surface pretreat systems with mixed-metal components to impart additional corrosion resistance prior to the final coating steps with primer and topcoat. Wash primer is applied via spray process and contains high levels of Cr6+ (a known carcinogen) as well as elevated levels of VOCs and hazardous air pollutants that pose high occupational hazards to workers at sites throughout all of the Department of Defense (DoD), including depots, logistics centers, fleet readiness centers; at the original equipment manufacturer (OEM) production facilities; and even to warfighters conducting unit-level repair operations. Efforts to produce effective alternatives to eliminate this product go back to the 1980s.

While a number of new chemistries functioned for some products, their effectiveness was limited to just one type of metal, such as being effective on steels but ineffective or even harmful to aluminum substrates or vice versa. Although significant funds were invested over many years, no solutions were found for multi-metal systems. Thus, Cr6+ wash primer lingered in use throughout DoD and was considered a necessary evil with no viable alternative.

The Cr6+ present in wash primer and within legacy rinse products for black oxide coatings is an ion of chromium with a +6-oxidation state. Cr6+ is highly regulated by the Occupational, Safety, and Health Administration (OSHA); Environmental Protection Agency (EPA); and European Union with regulations becoming more and more stringent. For example, in 2006, OSHA lowered the permissible exposure limit ten-fold from 52 to 5 micrograms-per-cubic-meter, making Cr6+ among the most stringently regulated materials used in manufacturing and maintenance operations. Hazardous exposure occurs mostly through inhalation of air containing Cr6+ particles or dust. On April 8, 2009, the Under Secretary of Defense (Acquisition, Technology, and Logistics) released policy memo "Minimizing the Use of Hexavalent Chromium" directing reduction of the use of Cr6+ on weapon systems. The policy required that Cr6+ use in any new systems be thoroughly justified and approved by both the program executive officer (PEO) and the component's corrosion control and prevention executive. Application of the policy to existing systems was limited to modifications where alternative coatings could be inserted.

As a secondary concern, DOD-P-15328 wash primer contains high amounts (about 5.8 lbs./gal.) of VOCs, such as isopropyl alcohol and butanol. VOCs contribute to poor air quality through the creation of ozone and smog, increasing the risk to human health by contributing to higher incidences of asthma attacks, cardiac arrest, and respiratory illnesses. EPA sets limits on the emissions of VOCs from coating processes through the promulgation of subparts to the Clean Air Act, depending on the item coated. To reach air quality targets, individual states can also set emission standards stricter than those of EPA. State regulators forced at least one Army depot to restrict wash primer usage due to high VOC emissions.

Wash primer is applied to many components, including the following weapon systems:

- MIM-104 Patriot
- Hellfire
- Longbow
- BGM-71 TOW
- M143 HIMARS
- Sentinel AN/MPQ-64A3
- AN/TWQ-1 Avenger
- M997 HMMWV
- FMTV
- Firefinder
- Generators
- Force Provider

Chemical agent resistant coating (CARC) is required on all Army tactical and related support equipment. Correct application of CARC dictates painters follow the TT-C-490 and DOD-P-15328 specifications for the surface preparation and pretreatment step. Both specifications govern the pretreatments for metal surfaces on tactical vehicles and aircraft to improve adhesion and corrosion resistance prior to coating with an epoxy primer and a camouflage topcoat. In depot operations and for touch-up in OEM processes, DOD-P-15328 wash primer is the primary surface treatment required for mixed-metal applications. DOD-P-15328 calls for a specific composition: 54 pounds of zinc chromate per 100 gallons of paint. The FY13 DSP award-winning TT-C-490F and its three amendments created Types III and IV to delineate new products verified as fully capable replacements for wash primer. Amendment 3 of TT-C-490 was issued as an interim amendment and, though excellent products were finally being designated as Types III and IV, a new full amendment was needed for a cancellation notice of DOD-P-15328 to be permitted.

PROBLEM/OPPORTUNITY

A number of Army and Office of the Secretary of Defense programs funded research and development at ARL to reduce and eliminate use of Cr6+ products to create a less hazardous work environment for depot workers and the warfighter.

Environmental Quality Technology Pollution Prevention Toxic Metal Reduction (TMR) is an Army U.S. Army Research, Development, and Engineering Command–funded program created to demonstrate and qualify Cr6+-free chemical pretreatments. The primary goal of the TMR program is to reduce or eliminate Cr6+ and cadmium use in surface finishing on nearly all types of weapon systems across multiple PEOs and program managers by demonstrating more environmentally sustainable processes at Army depots, installations, and repair facilities. The Pollution Prevention Technology Team (P2TT) voted to fund the TMR program as a high priority. The TMR integrated

process team (IPT) selects and prioritizes individual projects and leadership of the P2TT manages the projects through semi-annual in-process reviews. Project leads receive feedback from the IPT on test methods and coordination of demonstration sites. By creating Cr6+-free wash primer alternatives, this project specifically addresses the TMR requirement in the 2012 Army environmental requirements and technology assessments.

Complimentary to the TMR work, ARL successfully tested spray-applied pretreatments for armor steel as part of Environmental Security Technology Certification Program (ESTCP) project WP 200906. Key to this effort, ARL investigated the effectiveness of the technology on mixed-metal substrates to address the technology gap that was preventing the phase out and full cancellation of DOD-P-15328.

APPROACH

ARL compiled a test matrix of ten commercially available pretreatments and investigated their application procedures to decide if each alternative could work with existing Army maintenance facility infrastructure with the same ease of use. The commercial products were validated against the requirements for chemical pretreatments listed in TT-C-490, with most testing at ARL on mixed-metal coupon assemblies. The final validation plan included humidity testing, neutral salt fog, cyclic corrosion, outdoor exposure, adhesion, coating hardness, chip resistance, hydrogen embrittlement, and other tests as compiled by group and stakeholder requirements. In addition, these alternatives were demonstrated on Army assets in their operational environments to prove they produce as good or better results for ease of application, coating adhesion, corrosion protection, and durability as baseline wash primers. In addition to laboratory testing, alternatives were subjected to outdoor exposure testing at Cape Canaveral Air Force Base using mixed-metal (galvanic) test coupons and subsequently demonstrated on Army weapon systems.

Three products met all initial test requirements and application standard operating procedures: Henkel's Bonderite 7400 (manganese and fluoride-based), Chemetall's Oxsilan 9810/2 (zirconium silane-based), and PPG's PPG 11-TGL-07-Z (zirconium-based). Full-scale trial demonstrations began in FY15 on ground support equipment in operational environments. For the first phase of the demonstration, ARL had painters at Letterkenny Army Depot (LEAD) apply Bonderite, Oxsilan, and PPG on surplus parts to gauge ease of use and approval from users and to verify that the products could be applied using the same painting lines. The phase 1 demonstration included application of PPG on one Tricon type shipping container and one generator trailer, Bonderite on one Tricon and one generator trailer, and Oxsilan on one Tricon and one generator trailer. Lastly, one generator trailer had Bonderite applied to half the trailer and DOD-P-15328 wash primer applied to the other half. All assets were subsequently primered and topcoated. Once cured, ARL then tested adhesion and hardness to confirm that initial test findings carried over for actual weapon system substrates. All assets remained stored outdoors at LEAD for follow-up evaluations with the exception of the half-and-half generator trailer, which was transported to the ARL corrosion site at Cape Canaveral Air Force Base for exposure in an aggressive tropical environment.

For phase 2, ARL selected Bonderite, the product most preferred by the users during phase 1. The Bonderite product was applied to a Patriot support 373 trailer at LEAD, while the DOD-P-15328 wash primer baseline was applied to another 373 trailer. ARL tested adhesion and hardness again to evaluate application quality. These trailers were deployed and remain in service. Bonderite was recommended for implementation at LEAD because it most complemented LEAD's existing processes. ARL has plans to repeat this process at Anniston Army Depot (ANAD) with Bonderite on Strykers. Previous demonstrations on Strykers in support of the ESTCP WP 200906 project yielded excellent results with Oxsilan.

ARL thoroughly coordinated with the users and receiving installations during the revision of the TT-C-490 to ensure a clear pathway for implementation of alternatives. ARL gathered test requirements from customer organizations, such as the Aviation and Missile Command and U.S. Army Tank-automotive and Armaments Command, to ensure that alternatives met their performance requirements and sustainment needs. LEAD, ANAD, and Red River Army Depot were chosen as the optimal locations to conduct demonstrations due to the high volumes of wash primer these depots use and their willingness to implement sustainable alternatives.

After rigorous testing and multiple demonstrations, ARL confidently listed Bonderite 7400, PPG 11-TGL-07-Z, and Oxsilan 9810/2 on the TT-C-490 Qualified Products Database (QPD) for Type III, organic pretreatments, which enabled Type III and Type IV to interchangeably replace DOD-P-15328 wash primer and promoted the use of non-Cr6+ pretreatments. With this step, ARL published an initial memorandum in October 2016 announcing the upcoming cancellation of DOD-P-15328 for distribution to all CARC users. The original goal date was September 30, 2017; however, additional time was needed to adequately ensure approved products were readily available so the cancellation would not negatively affect readiness. In July 2018, when sufficient products became available for the QPD, the interim Amendment 3 to TT-C-490F was superseded by Amendment 4, thus enabling the coordination and publication of DOD-P-15328 Notice 2, "Notice of Cancellation," with the following instructions:

Users are instructed to use the Type III (greater than 50% organic compounds by weight in the dried film) and Type IV (greater than 50% inorganic compounds by weight in the dried film) products listed under QPL-TT-C-490.

In parallel to the wash primer replacement, the TMR also investigated additional surface finishing processes that used Cr+6 and found that MIL-DTL-13924 "Coating, Oxide, Black, for Ferrous Metals" was a viable candidate for Cr6+-free rinse processes based on the successful product chemistries qualified under the wash primer TT-C-490 effort. Laboratory and outdoor validations were performed on black oxide–coated surrogate panels in validations similar to the TT-C-490 effort and, as under TT-C-490, products that met or exceeded the acceptance criteria for the Cr6+ were found. These viable products enabled the full revision of MIL-DTL-13924 to permit the use of non-Cr6+ rinses, thus furthering reductions of Cr6+ on DoD materiel.

OUTCOME

According to a Government Accountability Office report issued in 2003, DoD spends between $10–$20 billion annually on corrosion prevention and mitigation. Technologies that improve corrosion resistance or reduce the amount of maintenance required by military and contract personnel have a great value to DoD. A recent study commissioned by the National Association of Corrosion Engineers suggests that the national corrosion bill has an annual value exceeding $270 billion, thereby furthering the value of improvements in technology to the commercial sector. The TMR program qualified three Cr6+-free pretreatments for mixed-metal substrates to TT-C-490 as alternatives to DOD-P-15328 wash primer. The new guidance enables and encourages the use of Cr6+-free technologies and economical green methods for pretreating metals. These two successes of qualifying the new chrome-free processes and revising the specifications to permit their addition enable the Army to implement Cr6+-free pretreatments for metal surfaces rapidly. These technologies facilitated Amendment 4 of TT-C-490F, enabling the complete cancellation of DOD-P-15328 wash primer, eliminating the emission of 2.3 million lbs. per year of VOCs from depot operations, and reducing Cr6+ use in Army operations by 24,000 lbs. per year. The revisions to these specifications were pivotal to fulfilling the Army's goal of Cr6+ reduction and decreasing impediments to readiness from environmental, safety, and occupational health risks.

CURRENT STATUS

TT-C-490F Amendment 4 was published on July 20, 2018, and is currently available from the ASSIST online database at http://assist.dla.mil/. By rule, an existing specification may not be cancelled or replaced by another specification if it is under an interim amendment. Therefore, Amendment 4 enabled the cancellation of DOD-P-15328. Paralleling these efforts, additional Cr6+ eliminations were enabled through revision of MIL-DTL-13924 "Coating, Oxide, Black, for Ferrous Metals" on September 12, 2018 (available via ASSIST). Upcoming plans include completing ongoing laboratory and outdoor exposure validations on Cr6+-free rinses for MIL-DTL-16232G "Phosphate Coating, Heavy, Manganese or Zinc Base" to further reduce Cr6+ use. If proven successful, a full revision to this specification is planned.

CHALLENGES

The biggest obstacle associated with the elimination of Cr6+ was the time needed for completion of the TT-C-490 Types III and IV products for the QPD, resulting in almost a half-year delay in the cancellation of DOD-

P-15328. In addition to elimination of Cr6+, a key performance parameter was the assurance that the replacement products would fully satisfy the established in-service performance-level expectations of the legacy Cr6+ products. The delay, while frustrating, was justified and vital to ensuring that no standards were compromised. These revised and amended specifications, created and published by the ARL-WMRD Specifications and Standards Office, enabled the cancellation of DOD-P-15328 and will reduce Cr6+ exposure in perpetuity. The TT-C-490F Amendment 4 Type III and Type IV products, with their appropriate descriptions, will be assigned new national stock numbers and be managed and procured against this specification.

About the Award Winner

The key to success for any specification effort includes not only the creation of its requirements and characteristics but the continuation of the document's review and maintenance to keep it relevant and up to date so its implementation can continue for years. This is why ARL's team consisted of four specifically talented individuals, each with their own expertise. The following team members contributed to the success of this highly visible and critical standardization effort.

John Kelley II*: Mr. Kelley served as the lead PI for the Toxic Metal Reduction (TMR 12-01) program's investigation of spray-applied, non-hexavalent chromium, low-VOC conversion coatings for multi-metal applications as replacements for DOD-P-15328 wash primer. A major technology gap would have existed if the specification was cancelled with no qualified alternatives. He created a comprehensive test plan with a rigorous test matrix for accurate assessment of the performance and application processes of the alternative pretreatments versus the baseline chrome-containing wash primer. The success of this project was critical to enabling the cancellation of DOD-P-15328 by proving the viability of non-hexavalent chrome alternatives that have since been qualified to TT-C-490 QPD. The number of alternatives pretreatments that are qualified for use as replacements for DOD-P-15328 wash primer has doubled since the initial acceptance with additional vendors working with the team toward approval. Mr. Kelley has also been active in scheduling and conducting full-scale demonstrations at Letterkenny Army Depot, Fort Benning, and Anniston Army Depot to ease transition and expedite implementation. The final closeout report for these actions was published as ARL-TR-8169.*

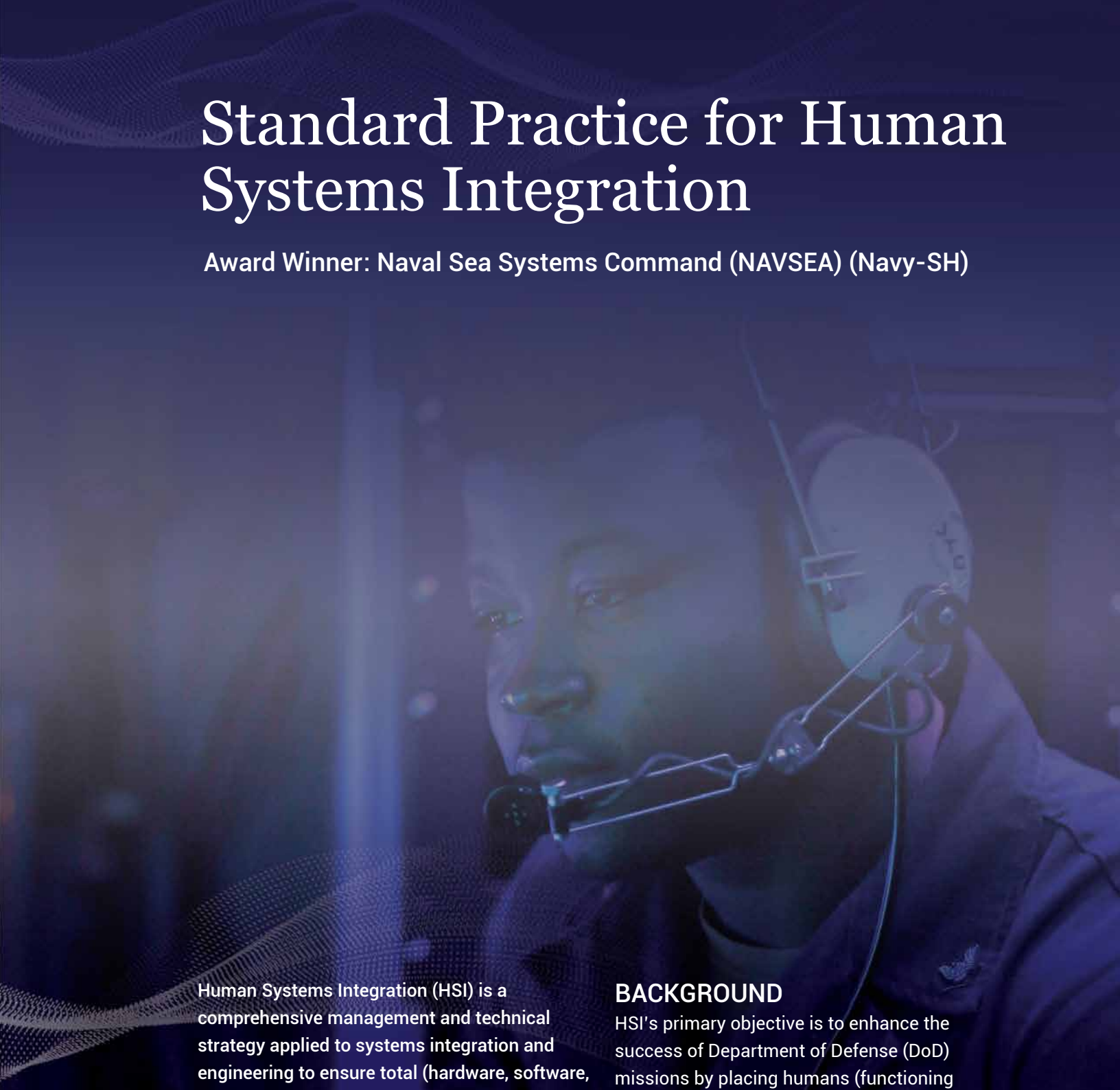
Thomas Braswell*: Mr. Braswell led the ARL team through the initial process of compiling the updates to TT-C-490 through two coordination efforts and eventual publication. Mr. Braswell assembled the ARL team, collected ideas from fellow stakeholders in the field and government, and assembled the first draft of TT-C-490F, which became the foundation for all of the amendments that followed, including the critical Amendment 4. He collated, organized, and maintained more than 300 comments and concepts from the field. Mr. Braswell edited and contributed, especially to the corrosion and surface preparation-related sections in the specification, while assuring the team maintained or improved on the integrity of the legacy systems. Mr. Braswell also served as a coatings subject matter expert during the execution of TMR 12-01. He completed an exhaustive literature survey of all potential non-hexavalent chrome candidate pretreatments and made recommendations. He also planned, set up, and carried out experiments as part of the program.*

William Lum*: Mr. Lum led the revision and amendment efforts for the TT-C-490F specification, namely the critical Amendment 4 that permitted the long-awaited cancellation of DOD-P-15328. Mr. Lum held several meetings with Messrs. Kelley and Braswell and additional surface finishing subject matter experts to draft and edit the sections for finalizing the specification and coordinating multiple drafts. He responded to all of the comments received.*

Brian Placzankis*: Mr. Placzankis led the overall standardization effort, which included gathering the initial technical drafts (outlines) from Messrs. Kelley and Braswell to finalize the specification and the coordination of multiple drafts and responding to all the comments received from the various coordinations, leading to the final review and publication of the document. Mr. Placzankis prepared the MIL-DTL-13924E "Coating, Oxide, Black, for Ferrous Metals" specification. He assembled all the documentation required to satisfy the conditions of the Army Material Command's funding to the ARL Specifications and Standards Office and to keep the standardization effort on track. Mr. Placzankis also led the effort to issue Notice 2, Notice of Cancellation, for DOD-P-15328D "Primer (Wash), Pretreatment (Formula No. 117 for Metals) (Metric)" where he coordinated with Mr. Lum to ensure that the alternative products were fully defined in TT-C-490F under Type III requirements and listed for immediate availability and acquisition via TT-C-490, thus fulfilling all actions needed for the wash primer cancellation.*

Standard Practice for Human Systems Integration

Award Winner: Naval Sea Systems Command (NAVSEA) (Navy-SH)



Human Systems Integration (HSI) is a comprehensive management and technical strategy applied to systems integration and engineering to ensure total (hardware, software, and human) system performance is optimized, increasing efficiencies and minimizing systems ownership cost. Focused on integrating human considerations into the systems engineering process, HSI enhances design and warfighting capabilities while ensuring people are fully and continuously considered during the design development and acquisition of all systems.

BACKGROUND

HSI's primary objective is to enhance the success of Department of Defense (DoD) missions by placing humans (functioning as individuals, crews and teams, units, and organizations) on equal footing with design elements, such as hardware and software, during systems integration. Affordable human competence is a key factor in total system performance, which is affected by the design of the hardware and software. In many cases, human performance enhancements

directly correlate to enhanced mission and operational readiness. The major value of HSI is the integration of the seven individual HSI domains (manpower; personnel; training; human factors engineering; personnel survivability; habitability; and environment, safety, and occupational health) to reduce or limit total ownership cost. HSI integrates and facilitates trade-offs among the seven HSI domains without replacing individual domain activities and responsibilities outlined in the solicitation package and HSI domain specifications and standards. However, HSI cannot function outside the context of systems engineering and must be executed as an integral part of that process.

PROBLEM/OPPORTUNITY

While a number of standards exist in the military and commercial inventory that are relevant to HSI, they apply to particular types of systems (e.g., ASTM F1337-10 maritime systems), are intended for specific HSI domains only (e.g., MIL-STD-46855A for human engineering and MIL-STD-882E for safety), or do not cover HSI in its entirety (e.g., ISO 6385:2004, "Ergonomic Principles in the Design of Work Systems" and Federal Aviation Administration (FAA) HF-STD-004, "Requirements for a Human Factors Program"). Furthermore, mixing and matching from a disparate set of commercial and military standards and guidebooks is inefficient for HSI requirements and can lead to omissions of important considerations for the warfighter. A comprehensive standard was needed, which could be invoked on contracts, requiring DoD contractors to integrate the seven HSI domains.

APPROACH

Naval Sea Systems Command (NAVSEA) Engineering Directorate began the effort by creating a charter for the HSI Standards Working Group (HSISWG), a DoD-level working group approved by the Defense Standardization Council and the Joint HSI Working Group. The group started with a study and gap analysis of existing HSI standards and guidance, confirming the need for a new standard. The HSISWG initially recommended a new MIL-STD; however, before proceeding with a MIL-STD, the group sent a request for information (RFI) to four standards development organizations: American National Standards Institute/Human Factors and Ergonomics Society , ASTM, Institute of Electrical and Electronics Engineers, and SAE to gauge the viability of creating an industry standard. The HSISWG evaluated the RFI responses and selected SAE to prepare the new standard. In May 2016, the SAE HSI

Committee kicked off the creation of the HSI Standard Practice SAE 6906. This effort included HSI practitioners from numerous commercial companies, all service branches of DoD, and other U.S. and UK government agencies. An outline of the standard was prepared with sections of the outline divided and assigned to authoring teams. By April 2017, a first draft was assembled. Overall, the creation and final approval of this document incorporated assistance and feedback from personnel across DoD, commercial industry, the SAE HSI Committee, and liaisons. The actions taken by the award winners resulted in the creation and finalization of requirements and guidance, coordinating between DoD, the Joint HSI Working Group, and SAE. These actions had a significant influence on the success of the HSI standard practice, supporting comprehensive requirements to be contracted throughout DoD.

OUTCOME

The completion of this standard in February 2019 has supplied DoD with requirements for HSI management (planning, execution, coordination [internal and external] documentation, administration, and quality control), including collaboration among HSI domains, coordination between HSI and other disciplines to optimize total system and performance, and minimization of personnel-driven risks and customer ownership costs. Studies have shown that implementation of a successful HSI program can furnish lifecycle savings of up to 40 times the amount invested in HSI early in a program's lifecycle.

CURRENT STATUS

SAE 6906 "HSI Standard Practice" was approved and published in February 2019. SAE estimates that DoD adoption will be complete by September 2019. In addition, from gap analyses performed by the HSISWG, SAE is creating HSI domain standard practices for manpower, personnel, habitability, and force protection because there are no DoD-wide standard practices for these domains.

CHALLENGES

The obstacles to creating and finalizing the guidance were as follows:

1. Transitioning from the development of a MIL-STD to a non-government standard. This required a different perspective for the government team and the engagement and coordination of government and commercial industry participants in the development effort.

2. Coordinating parallel efforts of creating the SAE standard with the preparation of a new HSI military handbook and HSI data item descriptions. A government-lead team is creating the latter two items in parallel with the SAE committee that is a combined government and commercial industry team.

3. Creating standard tasking for four of the seven domains (manpower, personnel, habitability, and force protection) to facilitate HSI integrated tasks due to a lack of contractually invocable HSI domain requirements. These tasks will be the foundation for the four new domain standard practices.

About the Award Winner

Mr. Jeffrey Markiewicz, *NAVSEA Engineering Directorate technical warrant holder (TWH) for HSI, has represented NAVSEA and the Navy as technical lead for HSI for the past 5 years. As a charter member of the HSISWG, he collaborates with the other service branches of DoD and U.S. Coast Guard HSI subject matter experts (SMEs). He led the Navy HSISWG team through the gap analysis and became a voting member of the SAE HSI Committee during the SAE HSI standard practice kickoff meeting. Mr. Markiewicz supplied a U.S. Navy perspective for this effort, including reviews as a senior SME group member and as a committee member on first balloting review.*

Mr. Owen Seely, *Naval Surface Warfare Center Dahlgren Division, principal human systems engineer, has championed and developed this standard since 2012. He was the chairman of the HSISWG from the formation and charting of the group through the selection of SAE as the developer of the standard. During that time, Mr. Seely also represented the Marine Corp Material System Command as the service branch representative to the HSISWG. Following the SAE HSI standard practice kickoff meeting, he became the SAE HSI Committee DoD vice chair and worked with the committee's leadership. In addition, Mr. Seely solicited input from SMEs at DoD, the Department of Homeland Security, NASA, and the FAA to create and review the content of the standard. In February 2018, he transitioned the leadership of the government effort to support SAE to Ms. Lawson. Since that time, Mr. Seely has continued to advise and guide.*

Ms. Chelsey Lawson, *Naval Surface Warfare Center Dahlgren Division, principal human systems engineer, assumed leadership of the government effort in support of SAE's creation of the new standard in February 2018. Since then, SAE 6906 "HSI Standard Practice" completed senior SME group review and comment adjudication. The standard was then submitted to the first balloting review by the full committee. After the committee comments from this review, the standard was submitted for a second ballot on November 1, 2018. In February 2019, the standard was approved and published. Ms. Lawson's efforts have been critical in keeping this effort on track to completion.*

Ms. Susan Orr, *711th Human Performance Wing, human systems integration, SAE HSI Committee member, as a SME and a long-standing member, was requested to participate in the development of SAE 6906 "HSI Standard Practice." She is an authoring team lead and a champion for the U.S. Air Force. She has been part of multiple reviews and comment adjudications. As a committee member, Ms. Orr participated in the first full committee balloting and supplied significant comments and adjudications for this review.*

Landing Craft, Utility 1700

Award Winner: United States Navy

The legacy Landing Craft, Utility (LCU) fleet suffers from a complete lack of standardization. Its gravely extended service life resulted in different shipbuilders producing the craft and numerous configuration changes to accommodate the evolving mission over the decades. The LCU 1700 program has executed numerous measures to ensure the issues of the past are not repeated. The Amphibious Warfare Program, LCU 1700 Acquisition Team formulated an innovative approach to acquiring and improving standardization for the Navy's replacement of LCU 1610 with LCU 1700. The portfolio of LCU 1610 is valued at $760 million, which is an acquisition category III multi-year program. The successful award of a ship detail design contract is projected to save $240 million over the planned 30-year lifecycle of the 32 craft. The team's goal to standardize this defense program supports the missions of the Department of Defense (DoD) and improves overall reliability and maintainability with this new craft.

BACKGROUND

The LCU is a key element in the Navy–Marine Corps fleet of amphibious craft. Still in regular use in peacetime and wartime, the LCU is valued for its large lift capacity, excellent operational availability, ability to operate in both independent and sustained environments, and operational flexibility. Originally designed for a service life of 25 years, the current fleet of 32 LCU 1610 class landing craft is now decades overdue for replacement. LCU 1617, the oldest of the remaining LCU craft, was built in 1959; the newest, LCU 1681, was built in 1987. With an average fleet age approaching 50 years, it was critical that the Navy create a strategy for

LCU 1700 acquisition that would fully recapitalize primary capabilities inherent in the LCU 1610 class in the most cost and time-effective manner possible.

Acquisition of LCU 1700 was particularly complex because of interface requirements driven by the need to transport the craft in and deployed from the well decks of all U.S. Navy amphibious warships. The craft had to be simple, rugged, and able to meet challenging operational requirements including beach landing. Relative to its predecessor, the new craft had to conform to current standards. The mandate was to increase payload, improve habitability, resolve maintenance issues, and reduce the total ownership costs wherever possible. These constraints created unique design and construction challenges for the designer and builder. The schedule is aggressive and recapitalizing this needed capability in a cost-conscious manner is essential. Because this craft is likely to be in fleet service as long as its predecessor, heavy emphasis was placed on standardization in all aspects of the program.

The construction program began with a Navy in-house preliminary design. The procurement was designated as a small business set-aside, and a contract was awarded to a shipbuilder to complete the detail design and construction (DD&C) of the new fleet of 32 craft.

PROBLEM/OPPORTUNITY

The LCU 1610 class has served with distinction across seven decades of service, but material supportability costs and maintenance issues have steadily increased, and operational requirements have changed in these aging vessels.

- **Multiple designs**: The fleet of 32 craft (commonly referred to, collectively, as the LCU 1610 class) has four different designs: the 1610, 1626, 1646, and 1680 class variants. Configuration variations between classes drive the need for additional training, maintenance, and configuration management support.
- **System obsolescence**: Most of the LCU 1610 class major systems are obsolete or contain obsolete components that can no longer be procured or repaired.
- **Parts obsolescence**: From the engines to the anchor retrieval winch and the halon system, many LCU 1610 class system repairs require the costly manufacture of unique parts that have not been supported in the Navy or commercial supply systems for many years.
- **Maintainability:** The design of LCU 1610 class craft includes inaccessible voids that cannot be easily or properly maintained. This results in chronic rust issues. Some components in the engineering spaces require removal of other equipment to access them for maintenance.
- **Habitability**: LCU 1610 class craft were modified to add the ability to accommodate 14 personnel for up to 10 days of independent operations. The space was carved out of areas that originally were allocated to other purposes, resulting in a less than optimal and problematic design.

LCU 1700 presents an opportunity to employ lessons learned and industry best practices to address the cost and technical risks arising from product obsolescence, incorporate open systems into the design of the new craft that will facilitate vendor substitution throughout craft life, and improve craft quality, reliability, readiness, and capability.

APPROACH

During the government's preliminary design phase, standardization and expanding the potential shipbuilder base were the primary focus.

- The LCU team communicated regularly with industry to achieve shipbuilder involvement in the early design phase. Industry days supplied opportunities for the government to hold face-to-face briefings with shipbuilders interested in participating in the LCU 1700 program. The award of eight industry design and studies contracts to small businesses furnished the opportunity for these non-traditional shipbuilders to improve the draft specification and consider cost-effective alternative solutions to various aspects of the design. Requests for information ensured that design and production challenges and anticipated design risk areas were communicated to potential bidders early in the process.
- The craft was designed to operate with all potential host amphibious ships without requiring any changes or associated costs to the existing or planned host ships. Likewise, the craft design conformed to existing pier configurations to preclude changes to infrastructure and their associated costs.
- Emphasis was placed on selecting major system components already supported in the DoD supply system. Parts commonality was designed in wherever feasible. Program of record command, control, communications, computers, and intelligence systems were incorporated to ensure commonality with other ships and craft, such as the Landing Craft Air Cushion and Ship-to-Shore Connector.
- The team selected highly reliable, logistically supported key components and specified them in the contract. The fleet reviewed their selections to ensure that they were selecting proven systems.
- Following contract award, all early government learning (design background, model test results, and calculations) and the government-developed preliminary design were shared with the shipbuilder to enable a running start on the design effort. Challenges the government had already encountered and resolved in the early design phases were shared to preclude repeated mistakes and avoid costly future rework costs.
- Commercial construction standards and products were employed wherever appropriate to reduce program cost while leveraging the high reliability standards demanded by the commercial marine industry and driven by competition in the marketplace.
- The contract strategy focused on maintainability and minimizing the logistics footprint. The LCU 1700 DD&C contract required system arrangements to supply adequate access for maintenance and the design includes planned removal routes for major equipment; supply chain monitoring with counterfeit products reported and avoided; and a standardization and commonality program implementation in accordance with the contractual

product support plan, wherein a modified performance specification permitted the shipbuilder to design systems that would further minimize the number of different types and sizes of parts throughout the craft.

- Cybersecurity drove careful consideration of system integration throughout design development and backups for critical functions were included to reduce risk in the design.
- To minimize risk and avoid the costly need for a small shipyard to address complex areas outside its normal areas of expertise, the government will supply, install, and test specialized military communication and navigation systems, employing a turnkey approach.
- The team created a Joint Quality Management Team of government and shipyard design personnel. They contractually required access (in a not-to-interfere manner) to all working documents with the goal of enhancing government visibility of shipbuilder data and design, construction, and product support efforts in a cost-effective, non-disruptive manner, without adding to the data reporting burden on a small shipyard and the associated cost. Maximized insight and communication will facilitate increased awareness of the design and furnish an opportunity to discover areas where the shipbuilder might be having difficulty meeting requirements. This will avoid costly and time-consuming design errors that might otherwise go unnoticed until the craft is constructed and ensure that standardization goals are met.

Ships and craft are complex systems of systems, designed and constructed to many standards: DoD (DoD-STD-1399 for defining the craft loading factors) and military standards (MIL-STD) (MIL-STD-1623 for fire performance of non-metallic materials, interior finishes, and furnishings; MIL-STD-1627 for bending, fabrication, and control of piping and tubing; MIL-STD-777 for piping; MIL-STD-1310 for electrical, topside non-electrical, and electronic equipment grounding and bonding requirements; MIL-STD-1605 for installation of electronic, electrical, and electromechanical equipment and subsystems; and MIL-STD-461 for electromagnetic interference), Institute of Electrical and Electronic Engineers (IEEE) standards (IEEE-45 for voltage drop of cable for alternating current circuits, IEEE STD-485 for capacity for craft service battery banks, and IEEE STD 45-2002 for electrical system testing), International Electrotechnical Commission (IEC) standards (IEC standard 60529 for electrical enclosures), American Society for Testing and Materials (ASTM) standards for mechanical systems (ASTM F998 for centrifugal pumps and ASTM F1718 for positive displacement pumps), standard NAVSEA drawings (NAVSEA Drawing 804-6397309 for diffusing terminals), etc. LCU 1700 is effectively using a layered standardization approach. The contract requires the appropriate standardization documents in design and construction of

the craft, and the craft will use standard communications and navigation (program of record) equipment common to other platforms.

OUTCOME

The LCU 1700 team's exceptional technical innovation, dedication, and hard work resulted in formulating, developing, assessing, and incorporating significant improvements into the contractual requirements for LCU 1700 without adversely affecting the ships that would host or the infrastructure that would support the new craft, thereby avoiding costs associated with modifications or upgrades. Standardization was employed proactively and consistently across the LCU 1700 program, not just from documents, but also across all aspects of program management. This includes measures to promote production of all 32 craft from the same shipbuilder under the same contract; a common design that improves configuration management, facilitates parts commonality, and eliminates the need for multiple training curricula; a strategic program profile and production schedule that affords time to refine the detail design and incorporate changes upfront, leading to standardization and less rework during the rapid serial production that follows; the use of commercial construction standards and products wherever possible; and government execution of procuring, installing, and testing a standard set of specialized military communications and navigation systems. Some examples of craft improvements over the current fleet of LCU 1610 class craft that will result from LCU 1700 team standardization efforts to include the following:

- **Maintainability:** Access for maintenance is designed into the craft and only proven, reliable, mature technologies will be part of the final craft design.
- **Performance**: LCU payload size will increase to 170 short tons and enable the craft to embark and transport two U.S. Marine Corps (USMC) M1A1 main battle tanks with track-width mine plows. Legacy craft are restricted to transporting one tank.
- **Survivability**: Flooding damage stability will substantially increase from one-compartment to two-compartments; switchboard, electrical, and fire pump redundancy will increase; and the potential for magazines overheating due to environmental effects in hot climates will be reduced.
- **Habitability**: Better compartment arrangements and berthing improvements will greatly improve sailor quality of life.
- **Operability**: A raised and enclosed pilothouse will improve the crew's ability to operate the craft.
- **Sustainment**: A common design across a fleet of 32 craft delivered by the same shipbuilder will reduce total ownership long-term costs by improving configuration management, facilitating parts commonality, and streamlining training curricula.
- **Risk**: Employing a turnkey approach to procuring, installing, and testing specialized military communications and navigation systems will minimize risk and avoid a costly requirement that is well outside its normal area of expertise for a small shipyard.

Collectively, these changes will improve safety, performance, reliability, maintainability, and operational readiness while reducing acquisition costs, enabling significant future lifecycle cost avoidance, and maintaining interoperability with fleet and Marine Corps units. It is estimated that the cost avoidance over the 30-year planned operational lives of the 32 craft could exceed $240 million. The completed detail design will become the final, overarching standard executed by a single shipyard, which will produce what we have never had with the legacy fleet of LCUs: 32 materially identical craft, leading to ownership cost reductions from enhanced commonality of components (and for some systems and platforms), one design configuration for maintenance, and one training curriculum for the crew.

CURRENT STATUS

The LCU 1700 team successfully awarded the LCU 1700 DD&C contract in March 2018 to a historically underutilized business zone (HUBZone) small business. The procurement employed a single contract and engaged a single shipbuilder to deliver all 32 craft over several years. Detail design is currently proceeding, with construction of the first craft to follow. Communication chains, processes, and procedures that will ensure a successful long-term relationship between the government and the contractor are in place. Quarterly program reviews have begun. Government onsite representatives are working with the shipbuilder, maintaining effective communications, facilitating resolution of issues, and spot-checking progress to ensure that design standardization goals are met from the start and throughout the contract's life.

Through its innovative acquisition strategy and contracting approach that opened this procurement opportunity to small businesses, the LCU team

- took advantage of the cost benefits of a robust competitive environment,
- harnessed the capabilities and efficiencies of a small shipyard,
- positioned the government to recapitalize a critical capability at the lowest possible procurement and sustainment cost,
- created the potential for continued substantial cost avoidance and cost savings, and
- ensured continued availability of LCU, a key element of Navy-USMC operations from the sea.

CHALLENGES

Acquisition of the LCU 1700 was particularly challenging because all the capabilities must be supplied in a dimensionally constrained craft (i.e., length, width, draft, trim, and weight) to enable transport in and deployment from the well decks of all U.S. Navy amphibious warships. The design had to emphasize simplicity and rugged construction while, at the same time, meet complex operational requirements that included beach landing capability and fording depth parameters. These constraints created unique design and construction challenges for system and equipment access for maintainability, since the space available is so limited. This problem was mitigated by supplying the shipbuilder with the government's preliminary design solution and associated calculations incorporating lessons learned from the LCU 1610 class.

Small shipyards typically have little to no experience with specialized military command and control, communications, and navigations systems. However, through a turnkey approach with the government supplying, installing, and testing the specialized military communication and navigation systems, the small shipyard avoided the costly creation of new expertise to address complex areas outside of its normal areas of proficiency.

About the Award Winner

Kimberly Bagford: *Directly accountable to the program manager, she developed, presented, and defended the proposed acquisition strategy and contracting approach that were ultimately approved. She picked her small team and led them to successfully execute the strategy and award a DD&C contract in March 2018.*

Kathleen Minnich: *Supplied day-to-day leadership and naval architecture expertise to the team, analyzing capability development document requirements and creating the acquisition strategy and contract approach. She defended the single design and single builder concept to ensure commonality and reduce training and configuration management costs across all 32 craft. She ensured that all functional area concerns were addressed during early design and contract development efforts. Upon contract award, she ensured that communications and oversight established with the shipyard would support program goals.*

Mike Russell: *Expertly led the preliminary design. He employed standardization concepts to ensure that the design addressed maintenance concerns and minimized projected operating and support costs. He coordinated the efforts of subject matter experts to minimize the logistics footprint while ensuring that all required capabilities would be furnished.*

Johnna Sachse: *Provided expert logistics input throughout development of the preliminary design, request for proposal, and specification development to ensure that standardization and commonality considerations were addressed from the start and were included in both the early design efforts as well as the final contract.*

Linda Squires: *Orchestrated all contracting activities, ensuring that final products accurately and completely reflected program standardization goals and ensured that contractor proposals met those goals. She oversaw successful execution of the source selection plan.*

Program News

Topical Information on Standardization Programs and People

ANSI ANNOUNCES WORLD STANDARDS WEEK 2019

The American National Standards Institute (ANSI) has announced the schedule of events for World Standards Week (WSW) 2019, which will be celebrated November 4–8, 2019, in Washington, DC. A premier annual gathering, WSW brings ANSI members and diverse private- and public-sector stakeholders together from across the standards and conformity assessment communities for topical discussions and special events in the spirit of cooperation and collaboration.

2019 U.S. CELEBRATION OF WORLD STANDARDS DAY

In conjunction with WSW, the 2019 U.S. Celebration of World Standards Day on Thursday, November 7, will commemorate the critical role of voluntary standards and conformity assessment in driving innovation across every sector. The event is co-chaired each year by ANSI and the National Institute of Standards and Technology (NIST), and the American Petroleum Institute (API) serves as the 2019 administrating organization in celebration of its "100 Years of American Energy Innovation." Separate registration and sponsorship opportunities for U.S. Celebration of World Standards Day are available at www.wsd-us.org.

Events

Upcoming Events and Information

THE DIMINISHING MANUFACTURING SOURCES AND MATERIAL SHORTAGES (DMSMS) 2019 CONFERENCE

DECEMBER 2–5, 2019, PHOENIX, ARIZONA

Attendees may also attend the concurrent Defense Manufacturing Conference (DMC) at no additional expense (by qualifying as active U.S. military or government, or through a current DD2354 on file). The exhibit hall will include all the leading organizations from both the DMSMS and DMC communities. To access the agenda, registration, and lodging information, as well as view links from past conferences, please visit http://www.dmsmsmeeting.com.

DSPO AND DAU

The Defense Standardization Program Office (DSPO) has launched a partnership with Defense Acquisition University (DAU) to offer quality education and training to the standardization community. DSPO has first tackled training on ASSIST and the DSP procedures it supports. Webinars are a great opportunity for new and seasoned standardization management activities to engage with subject matter experts to enhance their knowledge and skillset in a virtual environment at a location that is most convenient for them. Participants may also receive continuous learning points by attending these webinars. Please review DAU's website for additional guidance (https://www.dau.mil/training/clc/p/Point-Credit) concerning issuance of training points. For more information about ASSIST webinars, please contact the ASSIST Service Desk at 215-737-8000.

Defense Standardization Program
JOURNAL
MAY–SEPTEMBER 2019

Upcoming Issue

Call for Contributors

We are always seeking articles that relate to our themes or other standardization topics. We invite anyone involved in standardization—government employees, military personnel, industry leaders, members of academia, and others—to submit proposed articles for use in the DSP Journal. Please let us know if you would like to contribute.

The following is our theme for the upcoming issue:

Issue	Theme
September—December 2019	Modular Open Systems Approach (MOSA)


DEFENSE STANDARDIZATION PROGRAM
MAKING SYSTEMS WORK TOGETHER