Logistics Directions

Newsletter of
The Council of Logistics Engineering Professionals
March 2020

In This issue:

From the President

At CLEP, we are always striving to bring you very the best opportunities for education in the field of Logistics Engineering. Recently, and because of the COVID-19 Pandemic, many of the conferences and symposia that we promote have been cancelled. We all appreciate these moves to help prevent the spread of this virus, but also understand that we all need to keep sharp with our training and education. So, after some planning and coordination, CLEP has decided to bring back our **Lunch and Learn** series. We've begun lining up speakers and presentations that we feel will be superb topics that you will enjoy, learn from while having your lunch. Please watch for announcements in the next few weeks for these events.

We've all had a laugh or two with regard to the toilet paper hording that's been going on, so I thought I'd share this true account of the USS Skipjack (SSN-585) from June 11, 1942.
LCDR James Wiggin Coe was CO of the USS Skipjack when he wrote his famous "toilet paper" letter to the Mare Island Supply Office:

USS SKIPJACK

June 11, 1942

From: Commanding Officer

To: Supply Officer, Navy Yard, Mare Island, California

Via: Commander Submarines, Southwest Pacific

Subject: Toilet Paper

Reference: (a) USS HOLLAND (5148) USS SKIPJACK req. 70-42 of 30 July 1941.
(b) SO NYMI Canceled invoice No. 272836

Enclosure: (1) Copy of cancelled Invoice
(2) Sample of material requested.

1. This vessel submitted a requisition for 150 rolls of toilet paper on July 30, 1941, to USS HOLLAND. The material was ordered by HOLLAND from the Supply Officer, Navy Yard, Mare Island, for delivery to USS SKIPJACK.

2. The Supply Officer, Navy Yard, Mare Island, on November 26, 1941, cancelled Mare Island Invoice No. 272836 with the stamped notation "Cancelled---cannot identify." This cancelled invoice was received by SKIPJACK on June 10, 1942.

3. During the 11 ¾ months elapsing from the time of ordering the toilet paper and the present date, the SKIPJACK personnel, despite their best efforts to await delivery of subject material, have been unable to wait on numerous occasions, and the situation is now quite acute, especially during depth charge attack by the "back-stabbers."

4. Enclosure (2) is a sample of the desired material provided for the information of the Supply Officer, Navy Yard, Mare Island. The Commanding Officer, USS SKIPJACK cannot help but wonder what is being used in Mare Island in place of this unidentifiable material, once well known to this command.

5. SKIPJACK personnel during this period have become accustomed to use of "ersatz," i.e., the vast amount of incoming non-essential paper work, and in so doing feel that the wish of the Bureau of Ships for the reduction of paper work is being complied with, thus effectively killing two birds with one stone.

6. It is believed by this command that the stamped notation "cannot identify" was possible error, and that this is simply a case of shortage of strategic war material, the SKIPJACK probably being low on the priority list.

7. In order to cooperate in our war effort at a small local sacrifice, the SKIPJACK desires no further action be taken until the end of the current war, which has created a situation aptly described as "war is hell."

J.W. Coe

Here is the rest of the story:

The letter was given to the Yeoman, telling him to type it up. Once typed and upon reflection, the Yeoman went looking for help in the form of the XO. The XO shared it with the OD and they proceeded to the CO's cabin and asked if he really wanted it sent. His reply, "I wrote it, didn't I?"

As a side note, twelve days later, on June 22, 1942 J.W. Coe was awarded the Navy Cross for his actions on the S-39.

The "toilet paper" letter reached Mare Island Supply Depot. A member of that office remembers that all officers in the Supply Department "had to stand at attention for three days because of that letter." By then, the letter had been copied and was spreading throughout the fleet and even to the President's son who was aboard the USS Wasp.

Continued on page 2

Calendar of Events

AUSA - 2020 Global Force Symposium and Exposition, March 17-19 2020, Von Braun Center, Huntsville AL; https://meetings.ausa.org/global/why_exhibit.cfm

Manufacturing in America 2020, March 25th and 26th, Ford Field - Detroit, MI, https://www.attendmia.com/

Model-Based Enterprise Summit 2020, March 30 - April 3, 2020, NIST Campus, Gaithersburg MD; https://www.nist.gov/news-events/events/2020/03/model-based-enterprise-summit-2020

Advanced Machinery Technology Symposium 2020, April 1-2, 2020, **Philadelphia 201 Hotel**, 201 N. 17th Street, Philadelphia, PA 19103; http://www.navalengineers.org/Events/Event-Info/sessionaltcd/AMTS2020

2020 Office of the Secretary of Defense, Product Support Manager (PSM) Workshop, April 14 – 16, 2020, General Jacob E. Smart Conference Center, Joint Base Andrews, Maryland; https://www.acq.osd.mil/log/MR/PSM_workshop.html

Navy League - Sea-Air-Space Exposition, April 6-8, 2020, Gaylord National Resort & Convention Center, National Harbor, MD; https://seaairspace.org/

AIA-Product Support & Technical Data Workshop, May 4-7 2020, **Jacksonville, FL;** https://www.aia-aerospace.org/event/2020-product-support/

Air Force Association – 2020 National Convention, September 12-13 2020, National Harbor, MD https://www.afa.org/events/calendar/2020-09-12/national-convention

2020 Society for Maintenance & Reliability Professionals (SMRP) 28th Annual Conference, October 19 – 22, Columbus, Ohio; https://smrp.org/Symposia/Denver-2020

Surface Force Projection Conference, National Defense Transportation Association (NDTA), May 12-14, 2020, Christopher Newport University, Newport News, VA; https://www.ndtahq.com/events/ports-conference/

NDIA 23rd Annual Systems and Mission Engineering Conference. Oct 19-22, 2020, Renaissance Orlando at SeaWorld; https://www.ndia.org/events/2020/10/19/23rd-sme-conference

American Society of Naval Engineers (ASNE) Fleet Maintenance & Modernization Symposium 2020, Sep 14-17 2020, Virginia Beach Convention Center, VA Beach, VA; http://www.navalengineers.org/Events/Event-Info/sessionaltcd/FMMS2020

Given current public health concerns stemming from the Novel Coronavirus outbreak (COVID-19), many of the events listed here may have been cancelled or postponed. Follow the URL to verify before signing up for these events.

From the President - Continued From Page 1

As the boat came in from her next patrol, the CO and crew saw toilet-paper streamers blowing from the lights along the pier and pyramids of toilet paper stacked seven feet high on the dock. Two men were carrying a long dowel with toilet paper rolls on it with yards of paper streaming behind them as a band played coming up after the roll holders. Band members wore toilet paper neckties in place of their Navy neckerchiefs. The wind-section had toilet paper pushed up inside their instruments and when they blew, white streamers unfurled from trumpets and horns.

As was the custom for returning boats to be greeted at the pier with cases of fresh fruit/veggies and ice cream, the Skipjack was first greeted thereafter with her own distinctive tribute-cartons and cartons of toilet paper.

This letter became famous in submarine history books and found its way to the movie ("Operation Petticoat"), and eventually coming to rest (copy) at the Navy Supply School at Pensacola, Florida. There, it still hangs on the wall under a banner that reads, "Don't let this happen to you!" Even John Roosevelt insured his father got a copy of the letter.

Upgrades to the CLEP Website

Over the past few weeks we've begun upgrading the CLEP website. Our plan is to perform a complete redesign over the next few months with several new features. Some new features will include a more effective newsletter system, and podcasts with podcast archives. So please stop by the CLEP website at http://logisticsengineers.org/ and see what's new.

Membership is undergoing a revision in the onboarding process for new members. We now mail the new member a membership certificate and include a member lapel pin at that time.

Once on board we now have improved digital features that allow members to log into our supplemental pages to the existing website available as Members Only features.

For example, once logged into the site the features allow members to search for other members with like interests or to simply make contact. At that point email addresses and phone numbers are available.

Also available after login are forums for use both a technical forum and an organizational forum. We expect this to be useful as the features become more familiar to the members.

The features we have with this login into a secure site is to be made part of a facelift to the current website. That effort is intended to bring more modern features to our digital needs and is being scoped now by the Board.

Where to Start Supportability Analysis for a Development Program

By Stephen Brunner, Senior Systems Analyst/Business Director, Acquisition Logistics Engineering (ALE);

We are exploring how to effectively accomplish SAE TA-STD-0017 Activities in a DoD development program environment; where source data is scarce and established logistics analysis tools lack widespread acceptance. In this article we will tackle Activity 9, Functional Requirements Analysis, which is the current manifestation of MIL-STD-1388-1A Logistics Support Analysis (LSA) Task 301, for us "old school" Logistics Engineers. The objective of this particular Product Support Analysis activity is to define early in a development program the "functions" that the system is intended to perform in the successful accomplishment of its mission. This encompasses operations, maintenance, and support functions, along with consideration of the intended operating environment.

Our analysis methodology will leverage the Systems Engineering approach in order to comprehensively understand and document all functional requirements associated with our system and comply with the guidance of Activity 9.1. Our initial analysis activity will be focused on gathering all program information that defines the system mission capability, having its roots in the needs of the User community. Typically, the desired capability is described in program documents such as the Initial Capabilities Document, Statement of Work, Product Performance Specification, Life Cycle Sustainment Plan, and Concept of Operations. It is through a review of these documents that the criteria for mission success can be derived and captured in terms of capabilities and functions.

The Systems Engineering activity has the primary responsibility of developing the system functional architecture that encompasses all operations, maintenance, and support functions. The example we will utilize for this article is a new propulsion diesel engine. In coordination with the Systems Engineering activity, the system functional architecture is defined in Figure 1.

You will notice that the functional architecture is both comprehensive and applicable to any aircraft powerplant. This correlates well with the application of corporate knowledge by the manufacturer and leverages numerous years of producing and supporting gas turbine engines. Translating the functional architecture into tangible, actionable tasks is the duty of the development program Logistics Engineer and will give us the first glimpses into the operating and support requirements for the fielded system.

The Logistics Engineer is challenged with the decomposition of these overarching engine functional requirements into the operating, maintenance, and support functions that are unique to the proposed design. The functional decomposition activity is performed starting with the major functions identified above, then decomposed to sub-functions and continually decomposed until discreet individual tasks can be identified that ensure the success of each function. This functional analysis effort includes a review of the operational mission scenarios and functional Failure Mode, Effects, and Criticality Analysis (FMECA) results to characterize the functions necessary to operate and maintain the engine in its intended operating and support (O&S) environment. The Figure 1 presents the results of this analysis effort as one major function (Provide Power) from the functional architecture which is decomposed to further define the functional requirements associated with the "Support" sub-function.

The functional analysis results will be further studied to recognize any hazards associated with performing the identified functions. This hazard analysis includes an assessment of exposure to hazardous materials or excessive noise; hot surfaces or sharp edges; environmental pollutants; and rotating machinery during accomplishment of the functions identified, considering both hazards inherent to propulsion engines and unique to the proposed engine design.

The Functional Requirements analysis results will be utilized to determine the first-order support resource requirements, cost, readiness and hazards associated with performing the identified

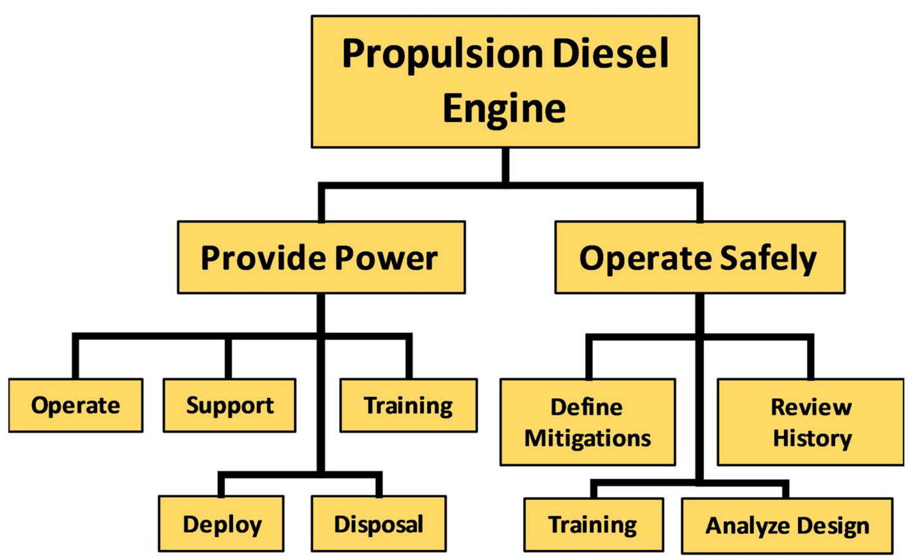


Figure 1

Continued on Page 4

New Members of the Council of Logistics Engineering Professionals

The first new CLEP member for the year is **John Newman**. John is the Transportability Engineering Chief of the Army's Surface Deployment and Distribution Command Transportation Engineering Agency.

The 2005 Base Realignment and Closure (BRAC) Commission recommended relocating TEA's Newport News, VA facility to Scott Air Force Base. In the summer of 2007, TEA moved to Scott AFB, IL. With this move, the Joint Distribution Process Analysis Center (JDPAC) was created in the winter of 2007 as a directorate under USTRANSCOM. JDPAC is comprised of TEA, AMC A9, and a portion of USTRANSCOM J5/4. Its mission is to provide analysis and engineering support to improve the nation's ability to move and sustain the Joint Force and operate the Joint Deployment and Distribution Enterprise (JDDE). This agency is located at Scott AFB, Illinois. Check out that command's TEA website here for details. >> https://www.sddc.army.mil/sites/TEA/Pages/default.aspx.

During the signup phase of new membership John has indicated an interest in Acquisition Logistics, Logistics Engineering, Life Cycle Management, Supportability and Program Management.

John resides in Highland, Illinois. Members may contact John via login to our Supplemental pages.

Welcome to CLEP, John!

Where to Start Supportability Analysis

functions. From this assessment, the Logistics Engineer will identify and document those functions that represent a driver to the developmental engine program from both a supportability and cost perspective. The identified driver functions are highlighted as a subset of the documented functions to be further addressed in the preliminary Product Support analyses and design influence.

Program risk associated with the identified operations and support functions (see Figure 2) will be evaluated and tracked consistent with the process defined as part of the Systems Engineering process. Program risks identified during Product Support analysis, including identification of system functions, initial human system integration analysis, and hazard analysis will be documented and communicated to the Product Support Manager (PSM) to be further evaluated for cost, schedule and performance impacts, and mitigation actions developed by the Supportability Integrated Product Team (SIPT).

Later, we will take each function and define the human performance requirements necessary to complete each function. This aspect of the functional analysis will lead to the development of a listing of the tasks required by the human operator or maintainer to accomplish each function. The resultant tasks will become the Task Inventory of Activity 9.8.

Stay tuned for more on Task Inventory!

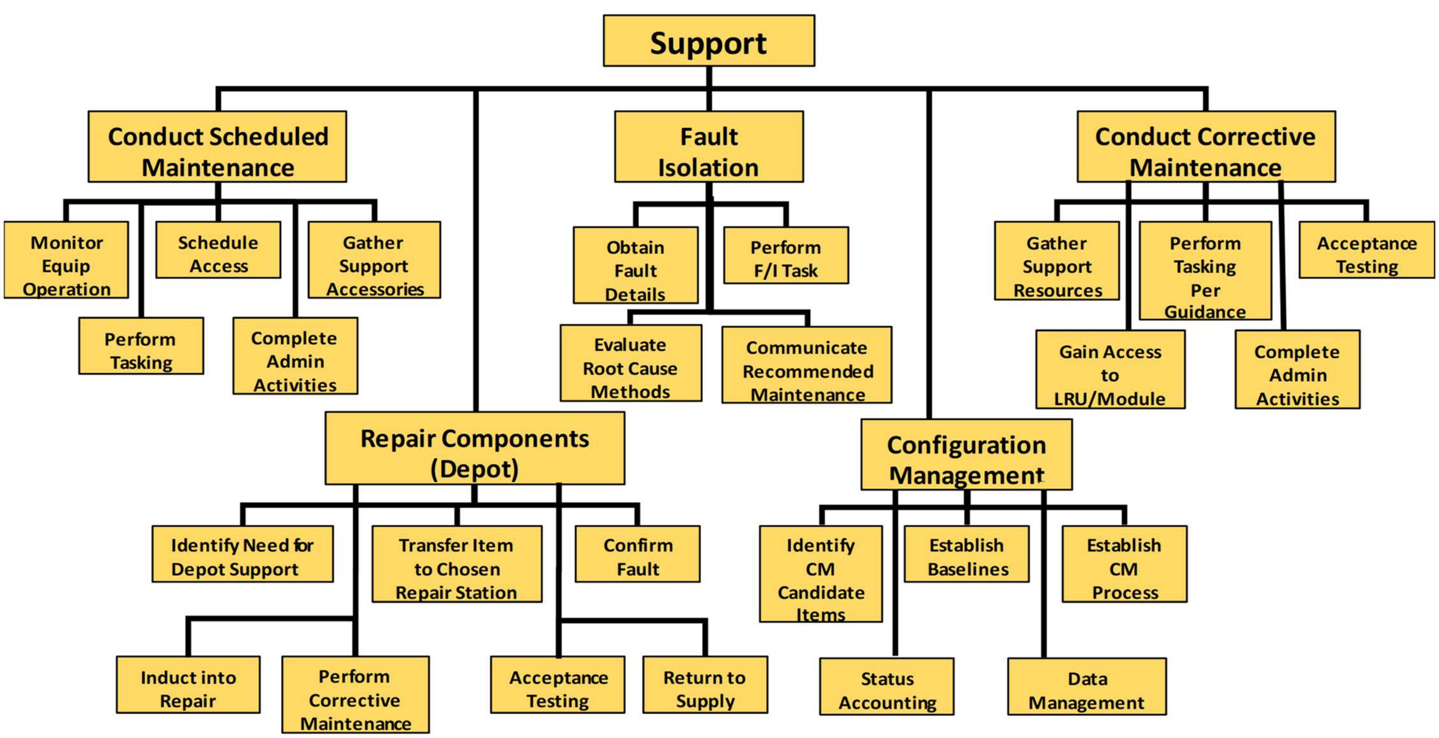


Figure 2

The 1st Ever Virtual Opus Suite User Group is April 16

With recent events, declarations of emergency, travel bans, and generally accepted best practices with regards to social distancing, Systecon's Annual Opus Suite user group will be held virtually. Instead of cancelling, we felt there is significant value to the presentations and news we have to share with the community, so we will be holding a virtual event via Microsoft Teams Live Events. This platform works on all DoD networks and appears to work on all company networks as well. Don't forget to register today as registration will be required to receive the link to join the event. We'll schedule time in the days prior to the live event to test links and troubleshoot IT issues with everyone who has registered.

As a pre-registered participant you will receive an Opus Suite User Group 2020 notebook and Systecon T-Shirt. If you have already registered, please let us know your T-Shirt size and mailing address. (And if you haven't yet registered, please let us know the same when you do).

The finalized agenda includes (virtual) keynotes by the ASN (RD&A) Honorable James Guerts and the Acting Deputy Assistant Secretary of Defense for Product Support, COL James "Mike" Stephens. There will be a review of the new data model and share early access participant's experiences. Continuing from 2019 the F-35 Joint Strike Fighter Program Office CIO, CMDR Thomas Sampson, will review progress on the JSF digital transformation effort. Samantha Alpert, NAVSEA 06L, is scheduled to provide an overview of the Navy Common Readiness Model. We'll demonstrate tools developed to simplify legacy data ETL into Opus Suite and show our new Tactical Optimization and Web Dashboards as used on Apache. Comparing tools, we'll show the results of a deep dive into OPUS10 vs SESAME optimization results. Keeping with annual tradition, modeling tips and tricks will be shared along with Opus Suite development priorities review.

If your organization uses Opus Suite, if you routinely leverage the tools or their results to solve complex problems, or are interested in learning more about how to use Opus Suite's unique decision support capabilities to manage complex systems, this event is for you. As in previous years, users with active support agreements may attend at no cost.

We're excited to host this virtual event, continuing the annual tradition of previewing the next Opus Suite release, and to share user experiences within the Opus Suite community. The first Opus Suite user conference was held in 1992, and the event has become an important opportunity to network and contribute to future development of the Suite. This year's theme "When Better Met Faster" highlights how the old adage "Faster, Better, Cheaper: Pick Two" no longer applies.

Learn how the user community has applied Opus Suite to their programs and platforms on April 16. Simply register by emailing optimize@systecon.us. See you online in a month! Stay safe and stay healthy.

Pacific Reach 2019 | Brigade Inspection Tests Soldier, APS Watercraft Readiness

By Capt. Joseph Waicunas and Chief Warrant Officer 3 Matthew Sabo

The Pacific Reach 2019 (PR-19) Brigade Inspection Reconnaissance Exercise Program (BIREP) in support of Army Prepositioned Stock 4 (APS-4) provided an excellent training event while simultaneously validating watercraft readiness and the readiness of Soldiers who deployed to draw and utilize it. Forty-six Soldiers from the 7th Transportation Brigade (Expeditionary) (7th TB (X)) deployed to Yokahama North Dock (YND), Japan, in support of care of supplies in storage (COSIS) of APS-4 watercraft as executed by Army Field Support Battalion-Northeast Asia (AFSBn-NEA). 7th TB (X) Soldiers assisted them in expediting their maintenance and draw procedures. Soldiers drew the Barge Derrick (BD) to exercise AFSBn-NEA's ability to issue equipment within 48 hours.

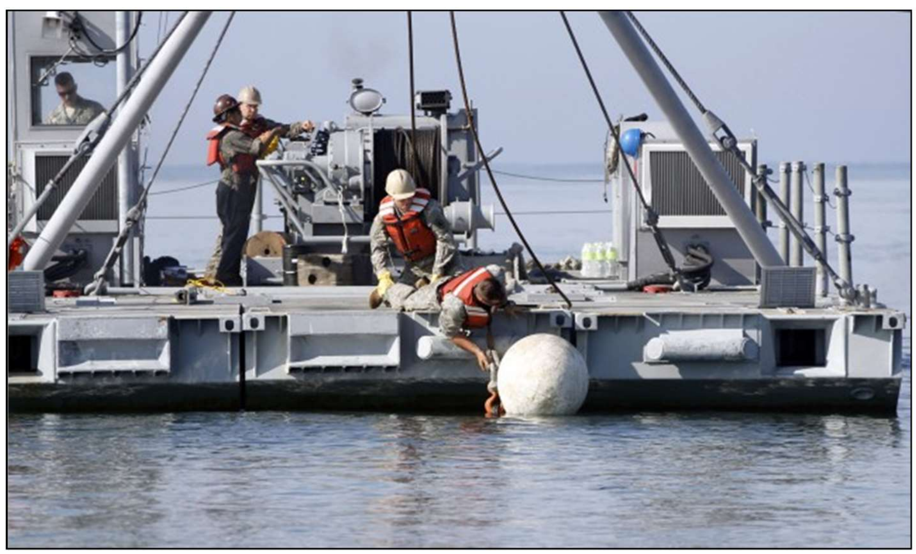
Concurrently, crews exercised various watercraft platforms including the Small Tug (ST), Modular Warping Tug (MWT), and Side Loading Warping Tug (SLWT) in order to test the equipment's maintenance readiness. AFSBn-NEA provides 7th TB (X) Soldiers the opportunity to exercise different platforms and practice rapid deployment procedures to support combatant commanders. Exercises like this do more than simply validate the readiness of APS watercraft and deployed Soldiers. On a broader spectrum, PR-19 actually tested reception, staging, onward movement, and integration (RSOI) as an overall system.

Prior to PR-19, BD-6802 was at the National Maritime Center (NMC) due to major equipment failure. The main cable sheaves and bearings required replacement, cable inspection, and load testing was also required to ensure BD-6802 was available for PR-19. This was coordinated through the Sustainment Below Depot maintenance team for all QA checks and service requirements. AFSBn-NEA received directly reimbursable funding from U.S. Army Tank-automotive and Armaments Command (TACOM) Watercraft Inspection Branch (WIB) for a $250K repair to the BD-6802 via a COSIS contract mod. If not completed, it would have been deferred to on condition cyclic maintenance (OCCM) and AFSBn-NEA would have experienced over 18 months of NMC time on the BD. PR-19 would have been directly affected, potentially canceling operations

AFSBn-NEA's issue process in support of PR-19 started with a HQDA and AMC approved release of Army Prepositioned Assets. Once the authorization memo with list of approved equipment for release was received, AFSBn-NEA's Storage, Maintenance and quality assurance (QA)/quality control (QC) personnel began locating, inventorying and inspecting equipment to ensure 10/20 standards were met prior to scheduled issue date. Simultaneously, the requesting organization submitted a copy of assumption of command orders and a DA Form 1687 to AFSBn-NEA's accountable officer before items were to be issued/received. Once all documentation was in place, arrangements were made for AFSBn-NEA in conjunction with the receiving organization to conduct the equipment issue process that includes a joint inventory, equipment inspection and signing of hand receipts.

PR-19 proves Army watercraft is ready at a moment's notice. The goal is to draw the BD within a 48-hour period, but APS-4 was able to issue the BD to 7th TB (X) in under 24 hours. This solidified AFSBn-NEA's systems and procedures for issuing equipment for incoming units in case of potential conflicts. Upon the completion of the BD draw, personnel went straight into COSIS and assisted AFSBn-NEA through the exercise of multiple platforms. Personnel from 7th TB (X) received valuable training on different platforms of the same series Army Watercraft Systems (AWS) they are assigned to at home station. This served to broaden their overall watercraft experience because no two platforms are exactly the same. Concurrently, Soldiers cross-trained on different platforms to increase licensing readiness within the unit.

Continued on Page 10



Sgt. Christian Mashtare, a coxswain assigned to 331st Transportation Company, 11th Transportation Battalion, 7th Transportation Brigade (Expeditionary), guides his vessel in to place as watercraft operators, Pfc. Cliff Taylor and Spc. Zachary Brickner, prepare to hook the vessel to a winch in order to reset the anchors during a combined logistics over-the-shore exercise at Anmyeon Beach, Republic of Korea (ROK), July 3, 2015. The exercise is designed to train U.S. and ROK service members to accomplish vital logistical measures in a strategic area while strengthening interoperability and reinforcing their alliance. *(Photo Credit: Sgt. Chris Perkey)*

What Are Prototypes?

By: Brian Duddy, Professor of Program Management at the Defense Acquisition University

There is considerable excitement, interest, attention, angst and what have you in Department of Defense (DoD) Acquisitions about new programs' use of prototypes, prototyping, and rapid prototyping. There also are some serious workforce misconceptions about what prototypes are and, most important, what they are not. Let me provide some context and expectation management about prototyping and prototypes as increasingly employed in early program stages.

The concept of prototyping defense systems is not new. The Army required delivery of prototype vehicles (called Pilot Models prior to World War II) for a competition that eventually resulted in the venerable "Jeep" vehicle. The prototypes delivered for that program in 1940—the "1/4 ton, 4x4 utility trucks"—bear only a general resemblance to the Willys MBs and Ford GPWs that were mass-produced as the standard Jeep design during the war. There were significant requirements changes (such as vehicle weight) and redesigning to move the Pilot Models to a producible wartime configuration. Fast forward to a more recent example, the Advanced Tactical Fighter (ATF) program also required delivery of two prototype aircraft from each competitor for a fly-off to decide the winner. Those two prototype aircraft, the YF-22 and YF-23, were evaluated by the Air Force and the YF-22 team was selected and proceeded to design and deliver the present-day F-22A.

So then what exactly is a prototype? Is the Bantam Reconnaissance Car the same as a Jeep, or the YF-22 the same as an F-22A? Not exactly. Prototyping is a part—but not the end state—of the design process. A prototype, or "first type" is the preliminary type, form, or instance of a system or system element that serves as a model for what comes later. Contractors, industry, and research organizations develop prototypes for many reasons. Prototypes are used to reduce technical risk, validate designs or cost estimates, evaluate manufacturing processes, refine requirements, or even explore new operational concepts. Risk reduction prototypes materially decrease Engineering and Manufacturing Development (EMD) risk at an acceptable cost. They can be a system such as the YF-22, or can focus on subsystems or components.

Prototypes may not, and in most cases, do not, have all the features or capabilities of the fully designed system. They may not need to have all the features of the final system. Predominantly they are used to demonstrate the ability to achieve certain critical performance parameters, validate computer models or explore improved manufacturing processes. Prototypes are viewed as only a "temporary" step or to serve a specific purpose in the full design process. After they are fabricated, the design process continues evolving until the completed system is verified. Competitive prototypes are produced by two or more companies or teams competing for a contract award. The enduring problem with competitive prototypes, as many industry officials and financial analysts see it, is that the companies are required to spend huge sums of money upfront without any guarantees that they will be able to recoup their investments. So when they explore prototyping, companies limit their work to fabricating a system with the key features necessary to win a contract to proceed to the next acquisition phase.

Considerable design work is required before a prototype can even be constructed. The systems engineering process already is fully under way: Requirements generation and analysis, architecture design, functional baseline determinations—all must be done before even a prototype design can be communicated to a group that will fabricate the prototype. This process involves in-depth modeling and simulation in particular or what we now refer to as Digital Engineering. Design changes, particularly to facilitate manufacturing, are a normal outgrowth of the prototyping process. Prototypes basically are things you learn from, not things you go to war with.

In the case of the ATF, the Air Force wanted demonstration of some key features through the prototype delivery and subsequent flight evaluations. Those features were stealth, super-cruise (ability to fly above Mach 1 without using an afterburner), maneuverability, handling qualities, and the ability to serve as testbeds for two different prototype engines. Conversely, there were many features that the prototype ATFs were not demonstrating, such as avionics maturity. These first aircraft were constructed with only enough avionics to ensure safety of flight. They did not incorporate fully mature and integrated avionics, but they didn't need to do so at that point in the design process. The prototypes delivered to the Air Force were sufficient, as intended, for selecting a design team to proceed into EMD.

How does prototyping actually work in practice for smaller subsystems? During my private-sector university research days, I led a team working on a design for a small internal-combustion engine for an unmanned aerial vehicle (UAV) that would run on so-called "heavy fuel" or JP-8. The Army was looking for a heavy-fuel engine to replace the 38-horsepower (hp) gasoline powerplant on the Shadow UAV. Under a grant from the Army Research Lab, my research team set about to find such an engine—or see if one could be modified to meet the Army requirements.

Continued on Page 8

Prototyping

Continued from Page 7

When no suitable off-the-shelf replacement engine could be found, we partnered with a small company that had an idea for converting small internal combustion engines from operating on gasoline to heavy fuel but had not yet proven the concept. The initial phase of our research was focused on the key Army requirement of demonstrating heavy fuel operation on an engine in the same power class as the existing engine. We selected an existing 20-hp, two-cylinder aircraft engine that we felt was adequate to use as a prototype testbed to validate the company's conversion process from gasoline to JP-8. If that initial demonstration succeeded, we planned to scale up the conversion to a larger, four-cylinder prototype version. The conversion parts were designed, fabricated, and installed on the 20-hp version at the same time an engine test stand/test cell was developed and constructed. My team demonstrated JP-8 heavy fuel operation on the 20-hp engine using the conversion design. We then migrated the concept to the four-cylinder, 40-hp prototype and again validated the heavy fuel operation and sufficient engine power for this to be considered as a suitable candidate replacement for the existing Shadow engine.

Although the two prototyping efforts were successful in the two key areas that the Army focused on, there were many other important design features and requirements we were not then able to explore during this early risk-reduction prototyping phase of the program. For example, while operating our test engines, our team experienced the difficulty of trying to tune four independent carburetors on the cylinders and began conceptual design of a fuel injection system that would replace the carburetors.

There were other limitations to what we could do with our prototypes. During further engine testing we experienced a failure of the main engine bearings due to the different orientation of the engine on a UAV versus a manned aircraft. We had no opportunity to do any detailed platform integration or installed performance testing with the Shadow itself, which would be an important next step after demonstrating the stand-alone engine performance. Important design considerations such as engine aerodynamic cooling, low-temperature or high-altitude performance could not be tested in our test cell.

We did not do any characterization of the acoustic or infrared signature of the modified engine. During testing, we realized extra warmup and start time would be required by the use of heavy fuel intended for turbine or compression-ignition engines. Although we were able to achieve the required engine operation time to pass a Federal Aviation Administration qualification test specified by the Army, there was no opportunity to evaluate the long-term reliability and maintainability of the engine and propeller in field conditions. Also no consideration was given to production of the future engine or eventual unit cost.

None of these system features and attributes were settled through the early prototyping, nor was that intended. Instead these requirements could be characterized or optimized only by system-level platform integration and a complete design and verification process. Our engine prototypes did their job as intended—they demonstrated key system capabilities—but they were only an intermediate step to a final design. The prototypes as we operated them would never be accepted as the configuration of the completed engine design. They were truly the first of their type, and much more work lay ahead.

So what are the full-up system articles used for development test and verification at the end of EMD? They are not, in the true sense, "prototypes." They are, in fact, full-up test articles that have all the features of the system design, but may not necessarily be made using mature production processes. These systems go by several names: qualification test articles, first articles, engineering development models, or EMD test articles. They are much more than prototypes and calling them that is a bit of a misnomer. As shown with previous examples, prototypes were used to demonstrate some, but not all, system requirements. In contrast, these EMD test articles must, by definition, meet all the requirements of the specification(s) in order to verify the final system design. In a perfect world, they would be made on the same line as the production articles, but they need not be. The key condition is that they need to work like production articles to be verified against the specification. The next step after verification is the fabrication of Low Rate Initial Production articles to be used for operational test. Those must, also by definition, be production representative.

Prototyping and competitive prototyping are very useful tools in design and acquisition, particularly for early decision making, but there are many other tools in the system-development process.

Brian Duddy, a retired U. S. Air Force Lieutenant Colonel, now is a professor of Program Management at the Defense Acquisition University, where he teaches Program Management and Systems Engineering.

Aligning Your Product Support Strategy and Life Cycle Sustainment Plan

Bill Kobren, CPL - Director, Logistics & Sustainment Center Foundational Learning Directorate, Defense Acquisition University (DAU)

While writing this column, “Aligning Your Product Support Strategy and Life Cycle Sustainment Plan (LCSP)”, I came across a statement in Chapter 4 of the Defense Acquisition Guidebook that reads: “…in this chapter, the terms “sustainment” and “product support” are used synonymously.”

While they were used synonymously in that particular chapter, speaking for myself, I am not convinced that the two terms are in fact entirely synonymous. While the terms product support and sustainment are often used interchangeably -- and to a large degree they overlap -- there are several significant differences. Product support spans the system life cycle from requirements to disposal (e.g., is inextricably linked to life cycle management as outlined in 10 U.S.C. 2337 aptly titled “Life Cycle Management and Product Support”), including the integration with systems engineering, design interface and designing for supportability aspect during system design and development. Indeed, the statute clearly states “The term "product support" means the package of support functions required to field and maintain the readiness and operational capability of major weapon systems, subsystems, and components, including all functions related to weapon system readiness.”

Sustainment, on the other hand, is more narrowly defined from an operational perspective in Joint Publication 3-0 as “the provision of logistics and personnel services to maintain operations through mission accomplishment and redeployment of the force”, without the same degree of acquisition, life cycle, or total life cycle systems management aspects.

In fact, J.P. 3-0 goes on to state that “the sustainment function includes tasks to: (1) Coordinate the supply of food, operational energy (fuel and other energy requirements), arms, munitions, and equipment. (2) Provide for maintenance of equipment. (3) Coordinate and provide support for forces, including field services; personnel services support; health services; mortuary affairs; religious support (RS); postal support; morale, welfare, and recreational support; financial support; and legal services. (4) Build and maintain contingency bases. (5) Assess, repair, and maintain infrastructure. (6) Acquire, manage, and distribute funds. (7) Provide common-user logistics support to other government agencies, international organizations, NGOs, and other nations. (8) Establish and coordinate movement services. (9) Establish large-scale detention compounds and sustain enduring detainee operations.”

While inculcating many aspects of sustainment, what sets product support apart in my mind are a number of key aspects of product support that the joint definition of sustainment does not address, including:

- the acquisition aspects, including but by no means limited to program office, program manager, and program executive officer oversight,
- “cradle to grave” life cycle management,
- systems management, regardless of whether we’re talking weapon, business, space or software systems,
- acquisition activities, including but by no means limited to such activities as analysis of alternatives, materiel solutions analysis, system design and development, market research, engineering development, life cycle cost management, test & evaluation, supportability analysis, reliability growth, and manufacturing and production, among a myriad of others,
- product support strategy and product support package development,
- integration of the multi-disciplinary Integrated Product Support (IPS) Elements,
- product support arrangement development and execution, including sustainment key performance parameter (KPP), product support metrics,
- sustaining engineering decisions including repair verses replace decisions along wtih system demilitarization and disposal decision
- executed by life cycle logistics functional community, which is defined by the DoD Logistics Human Capital Strategy (HCS) as “…the planning, development, implementation, and management of a comprehensive, affordable, and effective systems support strategy. Life cycle logistics encompasses the entire system’s life cycle including acquisition (design, develop, test, produce and deploy), sustainment (operations and support), and disposal. The work translates force provider performance specifications for system operational availability and readiness into tailored product support, designed to deliver specified and evolving logistics support performance capability parameters. Life Cycle Logistics shapes all the functions of logistics into product support that spans the entire system life cycle...”
- product support activities are overseen by a statutorily authorized and officially-designated Product Support Manager (PSM) responsible for achieving the product support responsibilities outlined in 10 U.S.C. 2337.

Viewed holistically, these activities form the basis of total life cycle systems management (TLCSM), another foundational aspect that differentiates product support from sustainment. Logically, this means product support serves as the overarching construct under which sustainment activities ultimately fall.

To a degree, you can see the same differentiation play out when it comes to life cycle logistics functional community verses the more broadly-based supply, transportation/deployment/distribution and maintenance aspects of the so-called “Big L” logistics (for additional context,

Continued on Page 11

Brigade Inspection Tests Soldier, APS Watercraft Readiness (*Continued from Page 6*)

With any exercise, events are often time-compressed, and this was the case with PR-19. During the course of the BIREP, 7th TB (X) assisted AFSBn-NEA in completing 60 days of work in just a 10-day period. Soldiers operated and stressed 10 platforms in support of APS-4 COSIS initiatives which validated readiness levels for the INDOPACOM region. 7th TB (X) and AFSBn-NEA Soldiers' efforts during the BIREP and COSIS helps strategic planners understand the capabilities of AWS for contingency operations.

While supporting APS-4 initiatives, 7th TB (X) Soldiers were able to conduct internal mission essential task (MET) training to maintain their operational readiness. This dedicated time to train was a force multiplier for both units, as it provided unconstrained time to perform within their military occupational specialties, which consists of 88K (Watercraft Operator), 88L (Watercraft Engineer), and 88H (Cargo Specialist). The BD completed 12 lifts which increased a junior crew's proficiency on the platform while simultaneously exercising a strategic asset showing the platform's readiness to assist combatant commanders as needed. The ST crew exercised two platforms, which enabled AFSBn-NEA to expedite their annual usage process.

Throughout the 10 days of training, the ST crews conducted hip, stern, and push tow training. The most impressive feat was the movement of one Landing Craft Utility (LCU-2000) within the bay which helped build the crew's confidence. It was a confidence booster because the LCU is one of the largest pieces of watercraft and this stressed the ST to support maintenance objectives for AFSBn-NEA. The MWT crews conducted sea trials of six MWTs, and one SLWT which helped AFSBn-NEA by putting over 50 hours on the vessels and more effectively stressing their capability. The crews conducted hip tow training and allowed their junior Soldiers to operate the vessels. This helped them learn systems and functions for when they eventually become coxswains. The crews loaded mini-containers on the MWTs and transported them across the bay to exercise pier side operations. The MWT crews also helped AFSBn-NEA personnel break down MWTs while dry docked, and Soldiers will be able to use these techniques at the 7th TB (X)'s home station of Fort Eustis, Virginia, if the need arises.
The support from AFSBn-NEA, and U.S. Army Pacific Command (USARPAC) provided a great training opportunity for 7th TB (X) Soldiers and showcased AWS capability. At the same time, AFSBn-NEA was able to exercise its issue and draw procedures, and conduct COSIS in an expedited amount of time for multiple platforms, which freed them to conduct maintenance on other items which needed more attention.

In the end, this exercise proves the relevancy of AWS. The capability these platforms bring to the fight is astronomical. If a downed LCU needs to be recovered, an ST can salvage it. The BD has the capability to save the DOD millions of dollars a year in contracted lift costs. The MWTs are the core behind moving causeway pieces in support of Joint Logistics Over-The-Shore (JLOTS). AFSBn-NEA BIREP and COSIS allowed 7th TB (X) Soldiers to gain valuable experience, while saving both time and money for APS-4. In the future, this exercise should be expanded to include LCU, LCM, and actual causeway pieces to fully exercise all equipment and provide additional training opportunities for Soldiers. The key is unencumbered training days, and AFSBn-NEA is able to provide this to 7th TB (X) Soldiers while simultaneously assisting AFSBn-NEA's overall objectives.

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Soldiers assigned to 331st Transportation Company, 11th Transportation Battalion, 7th Transportation Brigade (Expeditionary), set a modular warping tug gangplank during a combined logistics over-the-shore exercise at Anmyeon Beach, Republic of Korea (ROK). The exercise is designed to train U.S. and ROK service members to accomplish vital logistical measures in a strategic area while strengthening interoperability and reinforcing their alliance. *(Photo Credit: Contributed photo)*

Product Support Strategy and Life Cycle Sustainment Plan

– Continued from Page 9

"a distributed and long-term activity that requires the alignment of the program office, requirements community, systems engineers, sustainment commands, logistics community, resource sponsors, and others."

Several other related definitions might also prove to be helpful in illustrating the subtle differences in terminology:

- *Product Support*.-The term "product support" means the package of support functions required to field and maintain the readiness and operational capability of major weapon systems, subsystems, and components, including all functions related to weapon system readiness. (Source: 10 U.S.C. 2337)
- *Integrated Product Support (IPS)* - A key life cycle management enabler, IPS is the package of support functions required to deploy and maintain the readiness and operational capability of major weapon systems, subsystems, and components, including all functions related to weapon systems readiness. The package of product support functions related to weapon system readiness, which can be performed by both public and private entities, includes the tasks that are associated with the Integrated Product Support (IPS) Elements which scope product support. (Source: DAU Glossary)
- *Total Systems Approach* **-** The Program Manager shall be the single point of accountability for accomplishing program objectives for total life-cycle systems management, including sustainment. The PM shall apply human systems integration to optimize total system performance (hardware, software, and human), operational effectiveness, and suitability, survivability, safety, and affordability. PMs shall consider supportability, life cycle costs, performance, and schedule comparable in making program decisions. Planning for Operation and Support and the estimation of total ownership costs shall begin as early as possible. Supportability, a key component of performance, shall be considered throughout the system life cycle. (Source: DoD Directive 5000.01, Para E1.1.29.)

So let me conclude this admittedly lengthy blog post by posing a few final questions as food for thought:

- What do you think? Does this make sense?
- Do you agree that the terms product support and sustainment, while overlapping, are not entirely synonymous?
- If so, do you also agree that that weapon system sustainment is a subset of product support?

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Cross-Service Collaboration Yields Management Efficiencies for Diminishing Resources

By Jay Mandelbaum, Tina M. Patterson, Chris Radford, Allen S. Alcorn, and William F. Conroy

Diminishing manufacturing sources and material shortages (DMSMS) remain a very significant issue for the Department of Defense, with significant resources committed to limiting the problem. Given the long lives of DoD systems relative to the items and technologies used to build and support them, DMSMS problems are inevitable. There is good news, however: proactive DMSMS management can reduce the cost of resolving those problems.

How does proactive DMSMS management help? It's all about the window of opportunity to do something about emerging DMSMS issues. Proactive DMSMS management reduces cost by identifying issues as early as possible through a risk-based monitoring of items in the system. If a program does not discover a DMSMS issue until there is a failed attempt to buy an item, resolution options often are limited and usually only more expensive alternatives are feasible. Proactively identifying issues as soon as information about them becomes available usually increases the number of resolution options available and creates opportunities for an increased number of lower-cost alternatives because there is more time to fix the problem before an impact occurs.

This article illustrates DMSMS management efficiencies achieved via collaboration between the Naval Air Systems Command (NAVAIR) and the U.S. Army Aviation and Missile Research, Development, and Engineering Center (AMRDEC).

These efficiencies lead to greater team proactivity and, ultimately, lower DMSMS resolution costs for the partnering organizations.

Cross-Service Collaboration

NAVAIR's DMSMS management team is the logistics technical authority responsible for the development, sustainment, and execution of NAVAIR DMSMS and obsolescence management policy and processes. Its mission is to mitigate the impact of obsolescence and

Continued on Page 12

Cross-Service Collaboration *- Continued from Page 11*

DMSMS issues on total ownership cost by providing relevant subject-matter expertise to NAVAIR program management offices. The AMRDEC Obsolescence Engineering team includes more than 40 engineers and researchers who develop obsolescence engineering strategies and constantly monitor products and parts availability issues. Since 1987, the team, located within AMRDEC's Engineering Directorate, has supported aviation and missile programs combating the ever-present threat of obsolescence.

Both collaborating organizations previously performed similar functions independently—they both apply tools and resources as part of their support to programs. For example, the teams' research functions do the following:

- Facilitate the analysis of bills of materials (BOMs) using a suite of predictive tools primarily
- for monitoring electronic parts.
- Perform market research by contacting the applicable vendors to ensure that accurate data (e.g., points of contact, pricing, end of production) are obtained for mechanical and commercial off-the-shelf parts.
- Access the original equipment manufacturer and aftermarket manufacturer websites.
- Access federal supply sources such as the Defense Logistics Agency (DLA), Land and Maritime, Standard Microcircuit Cross Reference, and Qualified Products Database as well as additional commercial tools.

The need for a centralized database or tool to facilitate these research functions and disseminate the results became evident as the number of programs supported by the NAVAIR DMSMS team grew.

After evaluating a range of potential options, NAVAIR selected the Multifunctional Obsolescence Resolution Environment (MORE) tool-database to meet its needs. MORE is a government-owned engineering analytical obsolescence and DMSMS management information system developed and maintained by AMRDEC. MORE centralizes workflow for researching the status of electronic parts; accessing availability data, analysis results, and discontinuance alerts; and compiling and disseminating information gleaned from subject matter experts.

While the possession of these capabilities influenced the selection of MORE, an even greater factor in favor of MORE was AMRDEC's willingness to truly partner with the NAVAIR team. Thus, cross-service DMSMS management collaboration was born! The following illustrates examples of the synergies that have already been gained via this real-world, joint, multi-service DMSMS– obsolescence partnership.

Benefits of the Collaboration

During the first year of partnering, the MORE parts library increased in size by approximately one third when the NAVAIR parts were included. Further increases are anticipated because only a small portion of the total NAVAIR BOMs was loaded initially. From the perspective of NAVAIR alone, when those initial BOMs were loaded, more than 15 percent of the parts were already common to the AMRDEC and had been researched and were in the MORE library. This 15 percent likely will increase because many of the NAVAIR parts must be researched before determining whether they are in the parts library.

With an expanded parts library, there is a greater likelihood that any parts investigated by new AMRDEC or NAVAIR customers will not only already be in the library, but can also be automatically researched. And this provides a significant time savings over a manual process. In fact, beyond the 15 percent commonality, many of the initial NAVAIR unique parts were automatically researched by MORE. Finally, the increase in the MORE parts library leads to an increased number of parts added to subscription tools that underlie MORE. Over time, this will increase the recognition rate of the parts libraries within the subscription tools.

According to Chris Radford, NAVAIR Obsolescence Management Team technical lead, "The MORE library when combined with the AMRDEC team provides a service and capability that no one else in the industry provides. It's a one-stop shop with a program designed around MORE that provides not only complete documented work instructions from part research to program management of DMSMS, but also a unique part auditing program that ensures that bad data and research are not added to the library, either willingly or unwillingly.

"This is the key to a successful DMSMS program," Radford added. "No matter what tools you use, there is a high percentage of false data that exists. The MORE process is constantly reducing this bad data to ensure that its contents are more accurate than any other tool because the data is validated. This proactive management process is the key to DMSMS cost avoidance based on program efficiency. Most programs are still searching for the individual part metrics, hoping to save big dollars, not realizing that the manpower costs they are spending to reactively solve these problems generally offset the costs saved. Good DMSMS programs don't save their customers money overnight—rather, they establish a consistent

Continued on Page 13

Cross-Service Collaboration - *- Continued from Page 12*

program that enables the customer to proactively manage all of their parts and systems and streamline future efforts."

Both NAVAIR's and AMRDEC's proficiencies have increased as a result of the collaboration.

Although NAVAIR also uses other tools to facilitate the research and identification of alternate parts and part statuses, MORE leverages the information provided by those tools. It enhances and compares their outputs, thereby providing the user with more accurate parts availability statuses.

The AV-8B ground-attack aircraft program offers several examples of efficiencies already realized because of the partnership. The AV-8B leveraged AMRDEC DMSMS training documentation not only to train new staff on how to use MORE, but also on how the parts research process works.

The MORE partnership allowed the AV-8B team to streamline its obsolescence team, process, and structure; it is now managed by a small core group, reducing costs from $633,000 in FY 2014 to $290,000 for FY 2017.

According to Jesse Powell, the AV-8B obsolescence manager, "Collaboration and leveraging existing processes and tools across the services should be our number 1 goal. We often spend too much time doing our job that we forget that there are other services within DoD that may have already solved the problem. The Army and NAVAIR collaboration through the MORE tool is just one example of how we (all DoD) can work together to reach a common goal. The AV-8B program at NAVAIR has shown that collaboration can lead to saving for the program office, and I look forward to continuing this collaboration into the future."

AMRDEC's part research proficiency has also improved as a result of the NAVAIR addition of a large number of Military Specification (MILSPEC) items into the MORE database. In addition, NAVAIR input on AMRDEC processes helped to further refine and enhance MORE processes. Specifically, NAVAIR reviewed and provided comments on MORE's MILSPEC work instruction and is collaborating on requirements for a MORE sustainment module currently in development.

Michele Ozier, a team lead at AMRDEC and in particular the AMRDEC lead for the NAVAIR collaboration, spoke of the mutual benefits of the combined efforts: "We at AMRDEC are excited to collaborate with NAVAIR. We believe that the resulting identification of commonality, standardization of processes, shared ideas, and synergy will be a great benefit to both organizations, and most importantly, to our customers—the warfighter."

MORE can also facilitate determining resolution options to DMSMS problems through a capability to view all platforms that are using a given part. Consequently, when a program office is trying to determine the most cost-effective resolution to a common problem, it can easily identify what other platforms have done and take advantage of those efforts.

Taking Collaboration to the Next Level

The AMRDEC–NAVAIR collaboration in the use of the MORE tool represents just one of eight strategic objectives being pursued to expand collaboration across the whole DoD enterprise. Another of those objectives is commonality. The goal of this strategic objective is to demonstrate the value (including reduced costs, improved program schedule, and other efficiencies) of a proactive DMSMS program leveraging information sharing. This objective was created in recognition of lost opportunities for common resolutions. Data sharing previously occurred only within a service among the customers of the same independent DMSMS management provider, between the users of common tools, or as a result of periodic meetings of various working groups. Sharing also occurred across DoD where common resolutions were developed for DLA-managed electronic items or in rare instances, such as tungsten-rhenium wire, when it was determined that an enterprise resolution was preferred.

A third strategic objective deals with the establishment of DoD centers of excellence. When a DMSMS problem occurs, resolution options are analyzed to determine the most cost-effective approach. The comprehensiveness of the analysis depends primarily on a program office's experiences with the capabilities of resolution providers. This experience is typically limited because program offices often limit their choices to only the subset of potential service providers that they commonly work with. The goal of this strategic objective is to create an easy-to-use database of a large number of service provider capabilities that program offices can use to help determine the most cost-effective approach to resolving DMSMS issues.

These strategic objectives are only achievable through various forms of partnerships. The NAVAIR and AMRDEC partnership is not just one example, but a first step. Robin Brown, the DoD DMSMS/obsolescence lead, said, "I want to

Continued on Page 14

Cross-Service Collaboration - - Continued from Page 13

make the case for us to build on this partnership to include not only all DMSMS management across DoD but also the resources that DMSMS practitioners rely upon to resolve problems." Benefits are already being witnessed through the NAVAIR–AMRDEC partnership; therefore, it is credible that further benefits can be realized by expanding the collaboration further across the DoD enterprise.

Conclusion

While the services use numerous unique systems and platforms, it is important to understand that many common components exist on these systems, regardless of function, application, or the environments in which they perform. In the past, because of how programs are segregated and managed, these common parts were likely monitored and researched independently by multiple programs or not tracked at all. This has resulted in duplicated effort and inefficient use of resources. Collaboration, enabled by a centralized database, delivers benefits to all players involved in component research and mitigation by reducing time and cost and by using a team of subject matter experts (rather than a single person) to participate in reducing DMSMS risks. These efficiencies lead to improved proactive DMSMS management and thereby decreased DMSMS management and resolution costs.

About the Authors

Jay Mandelbaum has been instrumental in developing ways to use value engineering to resolve obsolescence issues in the course of researching obsolescence policy, guidance, and training f at the Institute for Defense Analysis (IDA).

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