AVIATION WEEK NETWORK 2020 Program Excellence Awards

INTELLECTUAL PROPERTY
(This section must be signed and returned to Carole.Hedden@AviationWeek.com)

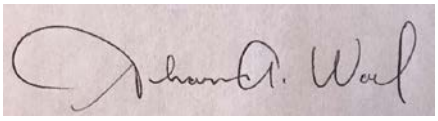
Individuals **outside your company**, including the companies listed above and other third parties, potentially including your competitors and others in your industry, may receive and/or review award submissions. All information submitted should address the program's management, leadership, and processes in a manner that you are comfortable sharing with third parties freely and without restriction, and may not include any classified or proprietary information or materials. Do not include any materials marked Confidential or Proprietary or bearing any similar legend. All responses and other submissions, whether in whole or in part ("Submissions"), shall be deemed not to be confidential, proprietary, and/or nonpublic information of any sort for any purpose.

Without limiting the foregoing, you hereby grant to Aviation Week Network, an Informa business, a perpetual, irrevocable, royalty-free, full paid-up, worldwide license to copy, reproduce, distribute, display, publicly perform, publish, republish, post, transmit, disseminate, edit, modify, and create compilations and/or derivative works of the Submissions (or any portion or excerpt thereof) in connection with its or any of its affiliates' business(es). Aviation Week Network agrees not to edit the Submissions in any way that materially alters their overall substantive meaning. Aviation Week Network may freely assign, license, transfer, and/or otherwise convey any or all of the rights and licenses granted hereunder.

Thank you for participating,

Gregory Hamilton
President
Aviation Week Network

Acknowledged, agreed, and submitted by



_____ 6/12/2020
Nominee's Signature Date

Nominee's Name (please print**):** **Sharon A. Walk** _____

Title (please print): Program Director, SM-3 BLK IB _____

Company (please print): Raytheon Missiles & Defense _____

AVIATION WEEK NETWORK

2020 Program Excellence Awards

NOMINATION FORM

Name of Program: Standard Missile-3 Block IB

Name of Program Leader: Sharon Walk

Phone Number: (520) 419-2001

Email: Sharon.A.Walk@rtx.com

Postal Address: 1151 E Hermans RD

Tucson, AZ 85756-9367

☒ Customer Approved

- Date: 2 June 2020
- Contact (name/title/organization/phone): Deidre Forster, MDA Public Affairs Officer, 571-231-8211

☐ Supplier Approved (if named in this nomination form)

- Date: _____
- Contact (name/title/organization/phone): _____

CATEGORY ENTERED

Refer to definitions in the document "2020 Program Excellence Directions." You must choose one category that most accurately reflects the work described in this application**. The Evaluation Team reserves the right to move this program to a different category if your program better fits a different category.**

Check one

☐ Special Projects

☐ OEM/Prime Contractor Systems Design and Development

☒ OEM/Prime Contractor Production

☐ OEM/Prime Contractor Sustainment

☐ Supplier System Design and Development

☐ Supplier System Production

☐ Supplier System Sustainment

Point Distribution

Executive Summary: Make the Case for Excellence (15 pts)		
Metrics **10 pts** Predictive Metrics (10)	**Program Volatility/ Uncertainty/Complexity/ Ambiguity** **25 pts** Describe overall VUCA (10) Cite examples of team response (15)	**Organizational Best Practices & Team Leadership** **40 pts** Innovative Tools and Systems (15) Unique Innovative Processes for People Development/Knowledge Transfer (15) Unique Practice es for Customer Engagement (10)
Value Creation (10 pts)		

Abstract

In 150 words or less, why is this program excellent in terms of execution?

In 2019, the Standard Missile-3 (SM-3) Block (BLK) IB Production Team delivered 56 missiles to the Missile Defense Agency (MDA), the highest number ever delivered in a single year in the history of the Program, overcoming technical and supplier challenges that surfaced in 2018. These deliveries demonstrated manufacturing maturity, affordability and efficiencies that led to the 2020 award of a multi-year production contract over the next five years – the first ever multi-year award in the history of the MDA. The SM-3 BLK IB Team accelerated deliveries by as much as 50% at the Raytheon Missiles & Defense Redstone Missile Integration Facility (RRMIF) and reduced cycle time in half. In addition to accelerated deliveries, the team reduced test equipment (TE) downtime, helped key suppliers increase their yield, implemented lean manufacturing, and developed a stronger partnership with the MDA customer, Navy Technical representatives, and the Defense Contract Management Agency (DCMA).

Purpose

Provide a 150-word description of the purpose of this program, spelling out all acronyms and correct acronyms

The Standard Missile-3 (SM-3) BLK IB interceptor is a defensive weapon the U.S. Navy uses to destroy short- to intermediate-range ballistic missiles. The interceptor uses kinetic energy, rather than an explosive warhead, to destroy its target. Its "kill vehicle" hits threats with the force of a 10-ton truck traveling 600 mph. This technique is often referred to as "hit-to-kill," and has been likened to intercepting a bullet with another bullet. The SM-3 BLK IB became operational in 2014 and is the only Missile Defense Agency (MDA) Program to achieve the "Full Production" milestone in 2017. SM-3 BLK IB is used to protect the United States, its deployed forces, and allies as part of the Missile Defense Agency's layered Missile Defense System (MDS). To date, Raytheon Missiles & Defense (RMD), a Raytheon Technologies company, has delivered over 400 SM-3 interceptors, of which over 200 were BLK IBs.

Executive Summary: Make the Case for Excellence *(Value: 15 pts)*
What is the vision for this program/project? What unique characteristics and properties qualify this program for consideration?

- **What is the vision for this program/project?**


The Ballistic Missile Threat

Early in 2019 the Standard Missile-3 (SM-3) Block (BLK) IB Leadership Team (LT) came together to define the program's Vision for the upcoming year and to define program objectives. The vision for the program is to provide the warfighter with the means to defend the nation against ballistic missile threats. The team identified three objectives to help accomplish this vision:

1) Accelerate deliveries; get quality product to the warfighter at maximum volumes to meet Missile Defense Agency (MDA) & Navy ship demand to protect our nation and allies.
2) Achieve predictable performance to build confidence with our customer on the BLK IB missile's maturity to support the Multiyear contract.
3) Improve efficiencies in our builds and processes to increase affordability bringing maximum value to the company, customer and U.S. taxpayer.


The Warfighter's Response

To achieve this vision, the team recognized it needed to make improvements across the board: from how it partnered with suppliers, assessing the build philosophy used on the factory floor, and in building a stronger relationship with MDA and DCMA driven by mutual trust and collaboration. This realization led to changes implemented on the SM-3 BLK IB Program described in the following sections. These changes enabled the most successful year since the program started production.

- **What unique characteristics and properties qualify this program for consideration?**

Due to the complexity of ballistic missile interceptors, the production rate is relatively low compared to other tactical missile/munition programs, which can produce hundreds of missiles in a year. The SM-3 BLK IB interceptor missile has a very specific mission and is designed to be ready at all times for that one critical moment when it will be launched to protect the US and its allies. Once launched, it will accelerate to supersonic speeds, exit the earth's atmosphere, find the target autonomously against the backdrop of cold black space, and impact its target at just the right place to ensure destruction. The complexity of the mission and the consequence of failure stresses the difficulty endured by the team in ensuring reliability of the missile and its criticality to the nation in its deployment by the MDA.

Final assembly of the SM-3 BLK IB missile occurs at Raytheon Missile and Defense's (RMD) state of the art factory located on the Redstone Arsenal in Huntsville, AL. Huntsville has a rich history of space exploration started by Wernher von Braun in 1950 and is now home to many of the Government stakeholders for the overarching Ballistic Missile Defense System (BMDS) as well as many of RMD's industry partners. RMD made a $75 million investment to build a state-of-the-art 70,000-square-foot facility. Designers

utilized a virtual reality chamber to walk through a full 3-D model of the facility to allow for refinement of the design and layout. Architects, engineers, and assemblers were able to walk through the factory of the future before ground was ever broken at the construction site. The factory is a zero lift facility with Automated Guided Vehicles (AGV) transporting missiles from workstation to test cell and back again without needing to lift the missile once.

One of the things that make the SM-3 BLK IB program unique is the people that work on it and the passion they share for the BLK IB missile and its mission to protect our country and allies. These individuals have varied skillsets, backgrounds, locations and perspectives that all contribute to the multifaceted approach to completing tasks and solving problems. It is a program leadership priority to recognize both team and individual achievements; from small everyday victories to larger ones that meet or exceed program stretch goals. The program leadership team has multiple ways to recognize and reward individuals and teams. RMD "Rstars" allows a public "Thank You" to be sent, a "Spot Award" that provides dollar value points for redemption of goods and services, or an "Achievement Award" that provides a direct cash payout. A higher level of recognition of individual and team achievements is the Vice President (VP) of Strategic & Naval Systems (SNS) Product Line "Star Shot" award. This award is in honor of the Apollo 11 50th Anniversary of the moon landing to recognize those who set high goals that seem out of reach and then achieve them. To help build and maintain team cohesiveness, the LT hosts morale events, such as ice cream socials or a BBQ lunch cooked and served by leadership, to recognize completion of program milestones and accomplishments.

Every year the SM-3 program, consisting of both the BLK IB and BLK IIA teams, hosts an event called Quality Day. In 2019, Leaders from the MDA, RMD, and SM-3 suppliers gathered in Jacksonville, FL on August 14 & 15th. The event was widely attended, with 159 customer and industry representatives, including 75 different SM-3 suppliers. Quality Day attendees had the opportunity to tour the USS Roosevelt; an Arleigh Burke-class destroyer that carries SM-3 BLK IB in its Mark 41 Vertical Launch System (VLS) as a portion of the ships combat loadout. RMD co-hosts, Quality & Mission Assurance VP Amy Cohen and Supply Chain Management VP Eugene Jaramillo, welcomed the attendees and emphasized the importance of the SM-3 mission and our partnership with MDA and SM-3 suppliers. This event strengthens the partnership between government and industry participants and helps to hone the vision for completing the mission of the MDA.

The SM-3 BLK IB Program strives for excellence through program execution. As a large program, difficult challenges come up every day with a large scope of work, rigorous requirements, and a diverse set of stakeholders. SM-3 BLK IB can be a daunting program to work on, considering the demands for execution. Facing these challenges has attracted some of the best talent and leadership RMD has to offer. Individuals from the various functions are able to learn from the best in their respective functional areas. It is a mark of pride for the employees at RMD to have spent time supporting a program that is so critical to national defense.

The SM-3 BLK IB Program faced many challenges at the beginning of 2019. The LT evaluated the challenges that paced the program and formulated a plan to overcome them. The underlying premise for the plan was "Velocity and Efficiency," which Wes Kremer, RMD President, challenged the division to seek ways to go faster, deliver product sooner, and exceed Customer expectations. Wes framed these tenets as a guide to how the team works together to create a productive culture rooted in trust, respect and diversity of thought. One key part of the plan, Velocity, is the means to transform RMD business into an organization with speed and purpose to cultivate new ideas, get product to the Customer faster, and be responsive. Efficiency, also critical to the plan, is the teams capacity to eliminate any of the barriers that may impede the team's ability to deliver quality products on time, at or below cost, and in a safe environment. SM-3 BLK IB embraced the vision of Velocity and Efficiency Wes introduced in 2019 as the tenets to make the program successful.

For 2019, the program established a delivery goal of 52 missiles in order to achieve contractual delivery schedule and meet company commitments. To meet the goal, the team recognized that a number of process and manufacturing improvements were needed to reduce integration times. Examples included the use of pre-builds and pre-staging of hardware to the maximum extent possible to reduce hardware integration and assembly times. To support the increased throughput, the team developed test equipment contingency plans to minimize test equipment downtime through cross-location coordination of technical support and repair parts. Next, the program developed and implemented a "Red Alert" process by using a diverse cross-functional team to resolve impending production issues that could affect supplier or RMD deliveries. Through these actions, RMD and its suppliers were able to reduce make spans, most notably at the RRMIF where All-Up-Round (AUR) integration was reduced by 50%. Realized benefits from the changes were better coordination with suppliers, extensive use of diverse multi-functional teams to resolve issues, and streamlined program communications. The SM-3 Customer (Missile Defense Agency) was an integral partner throughout this process and supported the changes needed that led to increased SM-3 BLK IB deliveries and deployments to the end users.

"52+4" (52 planned missile deliveries for 2019 + 4 additional missiles) became the driving goal for the program in 2019. The driving influences to make the new goal was to help the Customer by providing additional missiles for deployment and the company's goals. The LT identified the path to 52+4 and tracked progress daily in the War Room Meeting. During the execution of the 52+4 plan, an opportunity was identified that would benefit both the customer and the company; if production rounds were completed prior to December, then the entire month of December could be dedicated to Sustainment Operations at RRMIF. Doing this would allow the maximum number of recertification rounds to be returned to the US Navy for 2019. This idea motivated the team, who quickly developed plans and made calls to suppliers to make it happen. On 30 November 2019, the 56th missile, 52+4, was sold to MDA. The program had managed to achieve a normal year's planned production rate plus four additional missiles in only 8 months, setting a new record for the number of production rounds delivered in a calendar year. Additionally, due to the available capacity created by completing the production rounds early, the team was able to deliver the highest amount of recertified missiles in this same calendar year.

VALUE CREATION *(Value: 10 pts)*

- **Clearly define the value of this program/project for the corporation beyond profit and revenue**

Addressing a global threat through innovative kinetic warhead technology in a space environment is a difficult task that the SM-3 BLK IB Program has mastered. SM-3 BLK IB is a flagship program not only for RMD, but also for the MDA. "A missile threat could come without warning and the U.S., along with our allies, must be ready to react quickly," said Dr. Mitch Stevison, SNS Product Line VP at RMD. This proven system provides reliable defense capability to the U.S. and its allies. SM-3 BLK IB is deployed aboard U.S. naval ships, as well as shore-based sites. Its versatility provides the people responsible for national security a system that is capable of reaching threats around the globe.

The mission of SM-3 BLK IB has driven the company to make investments in technology, facilities, processes and equipment to improve performance, testing and production of the missile. The Space Systems Operations (SSO) Factory, in Tucson, AZ, has developed cost savings measures and improved processes needed to improve quality, minimize variability and reduce standard hours to make the missile more affordable. Those lessons learned flow out

to other RMD programs. The highly automated RRMIF facility in Huntsville, AL is a model for future factories and sets a high bar for performance.

- **Clearly define the value of this program/project to your customer**

As stated on the MDA website, the Agency's mission is to develop and deploy a layered Missile Defense System to defend the United States, its deployed forces, allies, and friends from missile attacks in all phases of flight. SM-3 BLK IB is part of the midcourse phase of the defense segment along with the Ground-Based Interceptor (GBI). This means that the SM-3 BLK IB missile extends the midcourse defensive area based on naval deployment and Aegis Ashore sites. The SM-3 BLK IB missile is critical to helping MDA meet their mission.

SM-3 was originally designed to be a sea based ballistic missile interceptor, employed by select U.S. Navy cruisers and destroyers. The initial concept of operations (CONOPS) was to use an Aegis ship's onboard (organic) radar/combat system to defend against rogue nation short to intermediate range ballistic missiles. After the first successful intercepts, it was realized that the SM-3 has significantly more capability and the test regiment was expanded to cover a variety of more complex threats in more challenging scenarios. Operation Burnt Frost demonstrated that SM-3 was clearly more capable that originally understood by shooting down an errant satellite. SM-3 was tested using off-ship queuing from a forward based ship and even satellite testing. A new CONOPS called Launch on Remote, which further extends the engagement window and utility of the SM-3 to intercept beyond the ship's own radar range. The latest deployment mode is a land-based version expanding the missiles deployment capabilities. Foreign allies immediately recognized SM-3's capability leading to significant investments in their own naval capabilities just to attain the SM-3's defensive coverage. The MDA/SM-3 team realized that they could cost effectively insert new capabilities through cost effective spiral technologies and avoid having to redesign an entirely new missile with each threat advancement thus providing the necessary tool to help the MDA meet its mission and defend against ballistic missiles threats.

- **Clearly define the value of this program/project to members of your team**

Along with delivering a historic number of missiles in 2019, there were other notable achievements by the program that are a great source of pride for the team. The 400th SM-3 delivery in October 2019 was a tremendous milestone in the history of the program. In recognition of this success, Government and Industry partners gathered in Huntsville, Alabama to commemorate this milestone. At the ceremony, Wes Kremer, President of RMD said "The SM-3 missile is arguably one of the most advanced missile systems in the world with an exceptional flight test record of approximately 90 percent."

Team members on the SM-3 BLK IB program feel fortunate to know that the work they do helps to provide for the national defense of the United States and its allies. Deploying SM-3 BLK IBs on ships around the world enables the United States Navy to provide a layer of protection against ballistic missile threats wherever deployed. There is a tremendous amount of pride among the team members for being part of this historic program, which was the first MDA program to achieve full-rate production status in 2017, that equips our sailors to carry out their national defense mission, and continually rise to the occasion to overcome technical challenges. Program leadership continually challenges the team members to strive for excellence instilling a "can do" attitude to all levels of the program.

As a part of the factory onboarding process, the importance of the product is emphasized to new and current employees joining the program. They will be part of the team assembling a key component for the ballistic missiles defense system for the nation. Many of the employees have been on the program for

years because they feel a sense of pride in the work that they do every day. They know that each day the part of the missile they are providing is the tool the warfighter needs to protect our nation. The work they do is difficult and they do it with pride. The programs many successes are built upon the dedication and pride that comes from each employee.

- **Clearly define the contribution of this program/project to the greater good (society, security, etc.)**

Although the system has never engaged a hostile threat, it serves as an important deterrent to those who would wish to do harm to the US and its allies. SM-3 BLK IB Program has had numerous successful test intercepts and one very interesting real world deployment. President George W. Bush ordered that a non-functioning satellite be shot down in an operation code-named FTM-15 Operation Burnt Frost. The satellite, named USA-193, was engaged by the USS Lake Erie and shot down by a SM-3 BLK IA variant of the missile. The purpose of the mission was to destroy the satellite that contained a toxic substance, hydrazine fuel, which if allowed to enter into the earth's atmosphere, would have been a hazard to human health over a wide area in the event of impact with the surface. This successful intercept was a major accomplishment for the sailors, government, and RMD.

The flexibility of deployment on Navy ships and land-based launchers makes the SM-3 BLK IB system a critical component of the nation's global defense system against Ballistic Missile Threats. The Aegis Ashore deployment in partnership with American allies in Romania and Poland allows for a large area of protection of NATO allies with a minimal footprint. RMD is aligned as one company around a vision for a *Safer, more Connected World*. This is what we hope to achieve for ourselves, our customers and the communities we serve.

METRICS *(Value: 10 pts)*

- **How do your predictive metrics drive action toward program excellence?**

Metrics Drive Program Priorities: Performance Information Excellence (PIX) Metrics Dashboard

The primary tool utilized by the program to capture program health and identify opportunities and potential risks to execution is the RMD Performance Information Excellence (PIX) dashboard. The PIX metrics provide a high-level overview of key performance indicators that allow program leadership to gain insight into the performance of the program, to include On-Time-Delivery (OTD), rework/scrap rates, purchase order placement for supplied parts, schedule position for make parts, and first-pass test yield (FPTY). "PIX enables rapid visual issue identification to detailed causal information across programs and factories not available before" Kristan Even, Production Control Sr. Manager.

The dashboard utilizes a color-scheme based on pre-established thresholds to provide a visual indicator to the viewer of a metric that is approaching, or has tripped a threshold. The system is linked to the production-control database Process Reinvention Integrating Systems for Manufacturing (PRISM) that is utilized by the enterprise, mining the data and filtering it into a presentable format. Anyone can select the specific metric tile and dive into the data to determine root cause of the threshold violation.

Owners for the various metrics are assigned to functional leads most appropriate for a given metric (ie. defects metric to Quality Manager, etc.). Any metric that trips a threshold requires investigation by the assigned lead to determine cause and recommended corrective actions that are then reported to the program leadership team. All actions are incorporated into either the daily war room cadence review or the critical chain as deemed most appropriate.

Using Data Sets to take Action: Line-of-Balance (LOB) Controls/Simulations

The program executes a weekly line-of-balance (LOB) review where requirements for supplied and make hardware is reviewed. This review provides the Operations team the opportunity to interface with Supply Chain to get a better understanding of delivery projections and potential impact to assembly plans. Specific applicable items identified as risks during the PIX dashboard reviews are flowed to this meeting for further tracking and closure.

All line-of-balance information comes from PRISM utilizing the Kinaxis tool. Kinaxis allows the ability to simulate a desired build schedule at the missile-level and provides "need dates," based on established lead times loaded in PRISM, for all parts in the missile Bill-of-Material (BOM). During the program's surge in the latter half of 2019 to meet accelerated deliveries a simulation was prepared using Kinaxis to outline the needed execution schedule to meet delivery goals. The data revealed what material did not support the acceleration plan. The program used this data to develop action and mitigation plans to address these gaps in order to pull material in to meet the schedule need. All of this information was tracked at the program Daily War Room meetings and in the weekly LOB.

Kinaxis is a relatively new tool developed a few years ago at the enterprise level to help Operation Managers better predict factory performance. Historically programs have only used the tools reporting function to look at current program state and address discrepancies. The simulation capabilities of the tool were under-utilized. The SM-3 Program was the first to leverage the full simulation capability of the tool to forecast manufacturing and delivery schedules. The program has extended the use of Kinaxis simulations to identify schedule risks, which are incorporated into the program's Risk and Opportunity register, and to help inform financial planning and reporting for Earned Value Management reporting.

Risk and Opportunity

RMD has a robust Risk and Opportunity (R&O) toolset that allows for collaboration across all functions and supports estimate at complete (EAC) preparation. The purpose of RMD's R&O management process is to identify technical and programmatic risks that could have cost or schedule impact to the program. Regular R&O meetings, walks and EAC reviews help to identify potential program risks and opportunities for which mitigation (for risks) or capture (for opportunities) plans are developed in order to improve schedule or cost performance. The risk identification process allows the program to set aside an appropriate level of management reserve (MR) dollars to address identified risks. Risk mitigation plans develop the strategy for reducing the probability of realizing the risk; opportunity capture plans develop the actions needed for realization of the benefit. R&O plans are tracked in a database and are regularly status by the actionees to program leadership. Managing risk and opportunities is an important aspect of RMD program execution and helps to ensure program and customer requirements are met.

An example of how the risk process helped the team develop a proactive plan to meet commitments and reduce schedule risk, was an issue of multiple non-conformances with a key component at a critical supplier. During several supplier visits the program became aware that a number of non-conformances were being identified, and if not corrected, would affect the supplier's ability to deliver on time. The team developed a risk mitigation plan with a cross-functional team that included their supplier partners. Program leadership allocated funding to enact the plan, and the supplier was delivering again within a matter of weeks, averting the potential schedule slip.

No one metric tool enabled the great success experienced by the program in 2019. It was the coordinated effort of utilizing all tools at the program's disposal and seeing the connections that could be made between them. The team leveraged the real power of metrics by looking beyond the data to what it is telling you and what opportunities lie beneath the surface.

DEALING WITH PROGRAM CHALLENGES (VOLATILITY, UNCERTAINTY, COMPLEXITY, AMBIGUITY, OR VUCA) *(Value: 25 pts)*

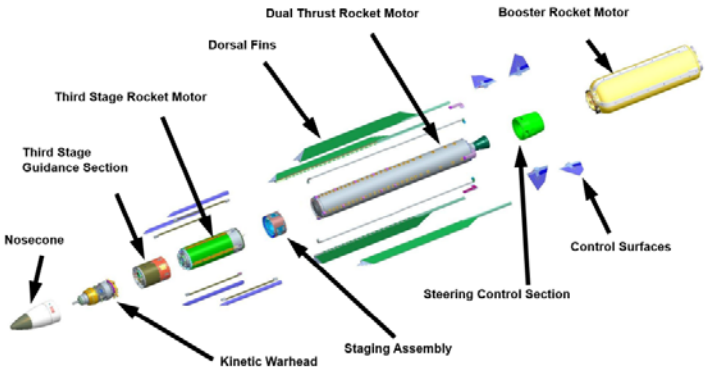
- *10 pts:* **Describe overall VUCA faced by your project/program.**

Challenges Arise

2018 was going to be the year that the SM-3 BLK IB Program realized all the benefits of being a mature production program. At the end of 2017, the program received the honor of being the first MDA program to be designated a Full Production Program. During 2017, the program had achieved the planned the planned delivery capacity of 52 per year. There was a high level of confidence that the program had eliminated all the challenges and uncertainties of development and was now moving forward as a predictable, reliable producer of a vital asset to the nation's defense.

However, 2018 brought a number of challenges, most notably there was a technical challenge related to an assembly process at the missile level. The technology that comprises the SM-3 BLK IB missile is complex and the processes used to manufacture the parts can be equally as complex. The RMD team and customer community recognized the importance of ensuring compliant hardware and took the time needed to find root cause and implement a corrective action to the process and ensure material compliance from the supplier.

One of the complexities of the SM-3 Program is efficiently coordinating with the large cross-country customer community extremely knowledgeable in system performance. It is important to keep this community involved in the process of discovery and problem resolution and vital to get buy-in to resolving technical issues. To improve the efficiency of problem analysis and resolution, it is essential for the program to keep a strong connection with customer counterparts to foster understanding and collaboration on technical issues.



- *15 pts:* **Cite specific example(s) and how your team responded.**

Responding to Uncertainty

Sometimes the changes needed to cause a leap in performance are not large in scale, but rather a series of minor tweaks that collectively serve to change a culture. This was the case for the SM-3 BLK IB program. There was a recognition by the leadership team that the program had become too dogmatic. To be a full-rate production program, required a change in how the program's culture thought, acted and approached issue resolution. For production programs, efficiency matters. Every minute lost adds up to hours, which adds up to days, weeks, months, and ultimately impacts the product delivery. Early in 2019, SM-3 BLK IB Program welcomed a new Director and Production Program Manager (PM) who challenged the team to produce 52+4 missiles in a calendar year to meet customer commitments and send a signal that the BLK IB missile was mature and ready for a 5-year multiyear contract. This challenge was the catalyst for change.

Change started by instituting a daily stand-up, called the War Room, closely modeled after the stand-ups performed in the factory. The goal of 56 missiles in 2019 was the first thing the team saw when they came into the meeting. All the programmatics were stripped away and a narrow laser focus was placed

on identifying the line-stoppers preventing the ability to build to plan, or receive hardware from suppliers. Help needed to address issues was the primary focus. Leads from all of the functions were required to be at the meeting and any communication needs between them were addressed face-to-face, immediately. The Director emphasized accuracy and speed as critical. The War Room became the hub, where members of the extended teams supporting the program could come to get attention and help on the issues preventing success, but all of the team's focus was on the shared goal of 56 missiles.

The next step was to analyze the critical path and formalize a process to address mitigating barriers. To do this, the program implemented RMD's Critical Chain process. The critical path architecture was particularly helpful in working through the hardware installation process problem. The critical path team drilled down into the specific next steps needed to move the ball forward. Steps were defined and assigned and the person accountable for that action was required to report to critical path on a daily basis until the action was complete. Often specific issues were identified in War Room and then transferred to the critical path for formal tracking and closure.

To aid in the critical path methodology a Red Alert process was instituted. Red Alerts could be called by any functional or program lead at any time, on any day. An alert was initiated when efforts on the critical path had reached an impasse and required cross-functional alignment and leadership support to make a decision. The LT understood that when an alert was called a meeting was going to happen within a matter of hours to discuss and make a decision. The key being that the team made the decision, together, unified across all functions; the team spoke with "One Voice." This empowered those charged with executing the plan.

For example, with a hardware process issue, Engineering and Operations formed a tiger-team responsible for developing a path forward. The team reported progress directly to the daily critical chain meeting run by the PM. Investigation revealed non-compliance issues with sub-tier hardware that was affecting the hardware install process. The parts affected are built and processed in large lots by the supplier and due to the large quantity of this contaminated hardware on-hand, a solution to quickly get new compliant hardware became paramount to meet the 52+4 missile delivery goal.

A New Path Forward: Aggressive Opportunity Identification and Action

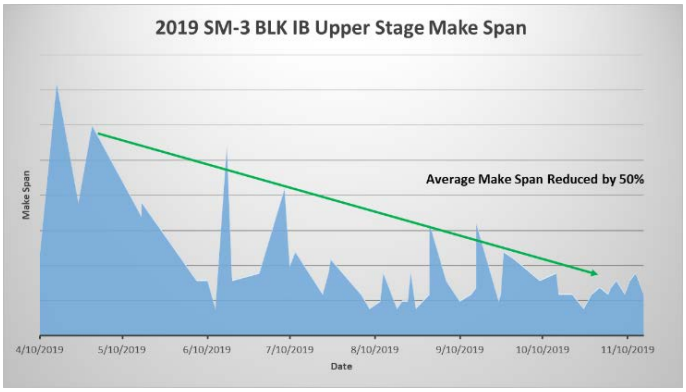
To meet the need for compliant hardware, the tiger-team worked together and developed a new installation process to mitigate the effects of the contamination and ensured a good install. This new procedure was developed through cross-functional collaboration; including members of the engineering community, operations engineers, the technicians on the floor and tooling specialists. New tooling was needed to support the new installation procedures. Typically, new tooling designs can take more than 3 months to incorporate into the build process. The new hardware installation tool was designed, tested, and implemented in 8 weeks.

This process change needed support and approval from the customer community. The engineering team utilized monthly Technical Interchange Meetings (TIMs), called Mini-Tech, with the customer's Engineering community. During these meetings, technical topics and issues were reviewed and discussed with the Customer Engineering community to foster collaboration. By engaging the customer specialists as part of this process, it enabled a smooth transition when the formal change paperwork was provided to the customer for approval. In the span of approximately 5 months, the team was able to identify the root cause of this issue, develop a new installation process and tool design allowing the program to achieve contractual delivery schedule and meet company commitments.

Innovative Process Changes to Enable Accelerated Deliveries:

- Drop-shipment of needed hardware to point-of-use
- Modifications to shift coverage to extend work hours
- Build-short plans

Finally, the operations team identified and evaluated a number of steps in the established assembly process where efficiencies could be realized. The Operations team leveraged the collective wisdom of factory leadership, operators on the floor, industrial engineers, and outside evaluators to come up with a plan to execute to the goal. Results of this analysis included drop-shipping hardware directly from suppliers to point of use, modifying shift coverage and manpower allocation at RRMIF to provide 7/day a week production, and developing a plan to build hardware "short" as the factory team awaited the approval of the hardware installation process.



Building-short was the key factor done at an All-Up-Round (AUR) assembly-level that enabled accelerated deliveries. The AUR team developed a modified work instruction that allowed the team to build the back half of the missile into the super-structures while waiting for compliant hardware for the front half. The team was able to stockpile a dozen pre-built back-sections of the missile in advance of receiving compliant hardware. Upon arrival of the hardware, minimal labor was required to produce a completed missile.

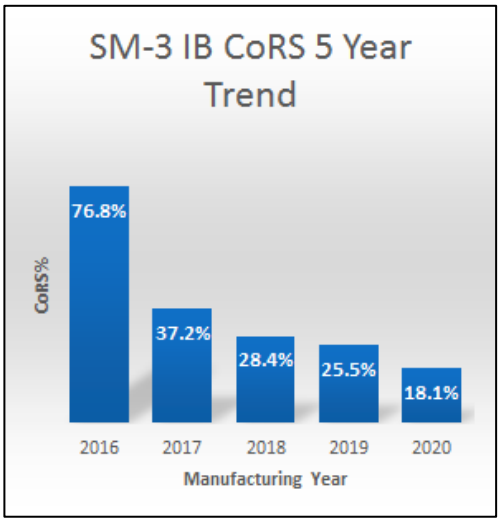
In less than one year, the program was able to position the program to be one-month ahead of contract schedule. SM-3 BLK IB sold 56 missiles in eight months, 4 more than was part of the original plan, and more than had ever been sold in a previous full calendar year. The series of tweaks in the process caused a change in culture that permeates the program today. This has given the program, company, and the nation a product that provides for our protection and confidence in delivering missiles as planned.

The integrated process of restructuring meeting cadence and communication flows in the program leadership level, implementing process-driven accountability, placing a narrow focus on improving the key stakeholder relationships required to be successful, and looking beyond the traditional modes of assembly procedure to realize efficiencies, is what provided the framework for the program's success to deliver 56 rounds in 2019.

ORGANIZATIONAL BEST PRACTICES AND TEAM LEADERSHIP *(Value: 40 pts)*

- *15 pts:* **In executing the program, what unique and innovative practices, tools and systems frame your program and help you achieve program excellence**?

A collection of tools are used by the program to aid in schedule execution. All factories use Statistical Process Control (SPC) Analysis to understand trends in test data and torque values. By understanding how certain test data is trending the team can identify a potential failure (usually test equipment related) before it happens. Calibrated torque wrench values are checked every day on a torque verifier to confirm that the appropriate values are being met and the data is analyzed to identify any potential wrenches that are starting to trend out of calibration.



The program utilizes a process called RMD Failure Reporting, Analysis and Corrective Action System (RFRACAS), where all defects are coded, grouped and analyzed on a monthly basis. Defects are then rated to determine frequency, consequence and severity to help the team understand the "level of pain" that a given coded defect is causing. The RFRACAS data is combined with a key metric, Cost of Rework and Scrap (CoRS), to identify projects to remove unnecessary, redundant tests, as well as modifications in process and design changes to increase yield and throughput. For example, in the Guidance Section Factory, one of the biggest drivers of rework was the wet application of a paste adhesive for antenna and insulator installation on the guidance section shroud. The team identified a more efficient means of bonding the antenna with a film adhesive, which increased yield and reduced cycle-time and rework.

The SM-3 BLK IB Program has a geographically split leadership team between Tucson, AZ and Huntsville, AL. Tucson is the headquarters for RMD and the SSO Factory is located there, which produces the Guidance Unit and Guidance Section. The missile integration facility (RRMIF) is located in Huntsville. This provides the program the benefit of having LT support onsite in both factories. Program LT has created an atmosphere of connectivity to where location is a non-issue in the program's normal daily cadence. Huntsville is also the home to two major suppliers for SM-3 BLK IB and a third in Anniston, AL. The close proximity to these suppliers allows quick reaction time to solve problems that may arise with deliveries or installation of hardware. It is not unusual for SM-3 BLK IB engineers and factory technicians to visit one of these suppliers to collaborate in solving an issue.

A reoccurring challenge the program leadership faced was slow decision making while facing critical supplier and technical issues. The LT needed rapid decision making capability in order to facilitate quick resolution and keep the production line building. The Program Operations Manager (POM) recognized the need for a defined process to accelerate decision-making and proposed a "Red Alert" meeting. The process calls for having the LT meet as soon as possible after a critical issue is identified. Recognizing the criticality of a material delivery slip by a supplier, the first Red Alert meeting was called by the POM to address this issue. The Program LT met soon after the issues became known and swift action was taken to overcome the issues. These Red Alert meetings became a vital part of the program cadence and led to accelerated decision making, saving time when the program had no time to spare. The image is a description of the run rules the team established to facilitate the Red Alert meetings.

Raytheon

RED ALERT RUN RULES

- Anyone on the program LT can call a meeting for something deemed to require immediate LT input or decision
- Stay tactical
- Actionable steps are product of meeting
- Quorum required
  - If quorum member cannot attend then send empowered delegate (full decision making capabilities)
- Should not be a bottle-neck or impediment to decision-making

Process:

1. Initiator sends short group text to Leadership Team:
   - RED ALERT (OPS) – Production stop (Hardware Type)
2. Alert sender sets up meeting within 30 minutes of ALERT
3. Meeting is conducted with quorum present
4. Action plan prescribed steps begin immediately
5. Action plan is tracked to completion in normal meeting cadence

As the team grew together, they started challenging one another to push the limits of what was possible as they defined a path to overcoming obstacles to achieving the programs objectives. Tracking progress towards completion became a major focus during the War Room Meeting. There were multiple obstacles that all had to be overcome and eventually those paths had to converge to allow for a steady predictable cadence in building missiles. The suppliers needed to deliver compliant hardware, Engineering and Quality had to understand any changes, and Factory Operations needed repeatable processes for successful hardware installation. MDA and RMD leadership wanted to see consistent improvement on the production delivery schedule.

As the production program moved into the summer of 2019, production was accelerating, suppliers were delivering to established recovery schedules and the factories were fine-tuning their rhythm. By the end of August 2019, the program had completed and delivered thirty missiles. August was an especially productive month, the program delivered thirteen missiles, which was a new record for the most missiles delivered in one month. At this point, it became clear that the program was on the path to success for the year. Customer satisfaction had improved in both meeting contractual requirements and collaboration.

By October 2019, the SM-3 BLK IB Program had sold 45 missiles and was only seven missiles away from the goal of 52 missiles. The program had returned to a favorable status on all metrics and was on schedule to the contract. Based on this, the company asked that the program to push to exceed its goal for 2019. Based on evaluation of capability and hardware availability for the remainder of 2019, the program leadership team accepted the challenge and the War Room once again became a driving force to success.

- *15 pts:* **What unique and innovative processes and practices are you using to develop people and transfer knowledge and how do you know they are working?**

The challenges and technologies SM-3 offers is what draws the best and brightest talent that RMD has to work on SM-3. There is onboarding which consists of an overview of the program's history and background on the development of the technology used by SM-3 BLK IB that helps assimilate employees. The Program Management Office (PMO) provides onboarding to new employees to the program focused on the broader culture of the program and who's who in the organization to help the new employees feel comfortable approaching leadership. This personal approachability is important to the LT and the Director sets this example by personally participating in new employee onboarding.

Rear Adm. Wayne E. Meyer had the philosophy of "Build a Little, Test a Little, Learn A Lot" regarding early development of the Aegis System. This philosophy still walks the corridors of MDA and the RMD team understands the need to do and to learn. Leadership routinely looks for opportunities to put engineers or other program members in positions where they have the opportunity stretch, learn, and grow with the full support of the LT around them. This type of growth opportunity has produced many highly capable individuals, some of whom still serve the SM-3 Program and some who have gone on to support other programs and risen to leadership positions within RMD. As a testament to the fertile training ground SM-3 BLK IB is for leadership, the company has seen multiple VPs rise to leadership including the current RMD president, Wes Kremer who was at one time the Director for SM-3.

Due the complexity of the subassemblies and sections, assembly work in the factories remains largely a human activity. RMD has taken steps to automate where possible with innovative material handling like AGVs for example, but people putting their hands on hardware accomplishes much of the work. The people who work in the factories are extremely valuable resources to the company and ensure the missiles RMD provides to the warfighter will work every time. This is a huge contribution to the company and to national defense. The Operations LT has taken great strides in cross training the assembly and test

personnel in order to keep the team challenged and interested in the work we have to accomplish. This cross training also allows the work force to address surges in demand when necessary.

- *10 pts:* **What unique practices are you using to engage customers and how do you know?**

An important part of maintaining a successful customer relationship is frequent and transparent communications. The SM-3 BLK IB Program is a large and complex program that requires the RMD and Government team to work diligently to maintain alignment across the many parts of the program. A series of standing meetings and communications described in the following paragraphs represent the most critical means of gaining alignment between RMD and the Government team.

Each of the PMs on the program has a counterpart at MDA responsible for managing the scope of work awarded to RMD. The Production PM meets with his counterpart on Monday and Wednesday each week for a thirty-minute teleconference Tag-Up. The Sustainment PMO also joins the call as there is a great deal of overlap between the Production and Sustainment scope. This allows frequent communication on status of important topics that can be discussed in a small group. Request for information or actions can come from all participants. The regularity of this call and the support of both Sustainment and Production PMs make this an efficient way of keeping program leadership informed and aligned.

Twice a month a Production Technical Review is held by Video-Tele-Conference (VTC) between MDA in Dahlgren, VA and RMD sites in Huntsville, AL and Tucson, AZ. The agenda is focused on production related topics and includes the LT. The agenda includes production schedule, flight and section testing alignment, supplier delivery status, and special technical issues. As issues emerge, they are added to the agenda and tracked until resolution. In this forum the larger audience of the government community can gain alignment, raise concerns, and provide direction within this collaborative environment.

The SM-3 BLK IB Program works closely with the Defense Contract Management Agency (DCMA) and the Navy Technical Representative (TechRep) in the factories and Program Office. The POM and PM meet regularly with these important customer counterparts in order to address topics of concern and ensure efficiency in ongoing operations. The TechRep is a quorum member or invitee to all program technical boards, to include Material Review Board (MRB), Configuration Control Board (CCB) and Failure Review Board (FRB). As happens from time to time issues arise and these standings meetings have built a solid relationship between the Program Office and these partners to allow for quick resolution. Alignment between Government and industry to achieve a common goal of excellent and compliant contract execution fostered the environment for unparalleled success for SM-3 BLK IB in 2019.

As a part of effective contract execution, business finance and contracts organizations need to work effectively across the government/industry partnership to remain compliant to applicable regulations and laws and not impede progress on contract execution. At any given time there are numerous contracts and financial transactions that are sometimes every bit as complex as the technical issues associated with going to space to “hit a bullet with a bullet.” Program leadership recognized the importance of ensuring effective communication between the finance and contracts organizations and established a Business Review meeting every other week. This meeting occurs on the opposite week of the Production Technical Review, which enables maximum participation in both meetings. The agenda is hyper-focused on business finance and contracts topics in order to make the meeting as productive as possible. This forum has been beneficial in resolving business issues, setting priorities, and building relationships.

The Engineering community for the SM-3 BLK IB Program includes some of the brightest minds from the government and industry: MDA and RMD, as well as the supply base engineering team, the team from the Applied Physics Lab at Johns Hopkins, The Aerospace Corporation, and the reliability division from the Naval Surface Warfare Center, Corona. The team spans the United States and includes the Pacific Missile Range as well since flight test are a critical part of the production program. Coordination and planning are critical for success and the standing Mini-tech monthly meeting allows for a large audience to join together in person, on VTC, and by phone. This full day meeting covers all key technical issues for all parts of the program: production, sustainment, development, service life, etc. Having all interested parties participate allows for informed, inclusive discussion on the topics affecting the program. Insight is gained leading to accelerated resolution thereby helping the program gain velocity towards fulfilling contract commitments.

2019 proved to be a banner year for the SM-3 BLK IB Program, setting records, building relationships, and helping the warfighter protect against the threat of ballistic missiles.

We are defining the future of aerospace and defense with breakthrough technologies that push the limits of known science.