

20
YEARS

AVIATION WEEK
PROGRAM EXCELLENCE
AWARDS

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Thank you for participating,



Gregory Hamilton
President
Aviation Week Network

Acknowledged, agreed, and submitted by



Nominee's Signature

July 19, 2024

Date

Nominee's Name (please print): **Janice Zilch** _____

Title (please print): **Vice President, Multi-Domain Command and Control (MDC2) Programs** _____

Company (please print): **Northrop Grumman Corporation** _____

NOMINATION FORM

Name of Program: **E-2D Production** _____

Name of Program Leader: **Janice Zilch** _____

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Customer Approved

o Date: **July 19, 2024** _____

o Customer Contact (name/title/organization/phone): **Michael Jorge, Communications Specialist, NAVAIR, (813) 300-1299** _____

Supplier Approved (if named in this nomination form)

o Date: _____

o Supplier Contact (name/title/organization/phone): _____

**PLEASE REFER TO PROGRAM EXCELLENCE DIRECTIONS
AS YOU COMPLETE THIS FORM.**

SECTION 1: EXECUTIVE SUMMARY

Make the Case for Excellence

Value: 10 points

Use 12 pt. Times Roman typeface.

What is the vision for this program/project? What unique characteristics and properties qualify this program for consideration?

[LIMIT YOUR NARRATIVE TO THIS PAGE.]

In an era of military great power competition where information is paramount, the Northrop Grumman E-2D Advanced Hawkeye is the premier Airborne Battle Management Command and Control (ABMC2) platform. With a vision of providing decision superiority to warfighters across the full spectrum of battlespace domains and environments, the E-2D is uniquely positioned to sense, make sense, and act at the tactical level while simultaneously informing operational and strategic planning in theaters around the world.

The E-2 weapon system has a rich heritage and has undergone continuous modernization for over five decades. The most recent iteration, the E-2D, is designed to fly in all weather conditions, operate from land-based and sea-based platforms, and perform its mission over water, across the littorals, and in the high clutter environment over land. The platform has multiple organic detection and tracking capabilities and a suite of Line of Sight (LOS) / Beyond Line of Sight (BLOS) communications equipment, making it a versatile and interoperable asset supporting various missions. Primary among these missions is its role as the surveillance pillar of the Navy Integrated Fire Control (NIFC) architecture, which is critical to Integrated Air and Missile Defense (IAMD).

The E-2D program, embracing the need for rapid innovation to outpace modern threats, has invested heavily in digital systems engineering practices. The program continues to design open mission systems hardware to accommodate future multi-function processors that support software-defined apertures, using virtual and augmented reality to accelerate design, evaluation and repair activities. Throughout these processes, the program leverages artificial intelligence to develop a range of mission-based products, from tactical decision aids to predictive maintenance.

With the only active ABMC2 production line in the United States, Northrop Grumman is currently building aircraft for the U.S. Navy and multiple foreign alliance partners. To accomplish this task, the E-2D Production program team coordinates a global industrial base of over 340 suppliers, ensuring the delivery of over 90,000 parts per month. Once delivered to its manufacturing facility in St Augustine, Florida, its skilled workforce of 580 personnel fabricates the aircraft, performs ground and flight testing, delivers each variant from this single integrated production line with a 100% on-time delivery record over this 17-year program and zero defects in the past three years.

Looking to the future, the Northrop Grumman Production team, in close coordination with their U. S. Navy program management office (PMA-231) counterparts, has developed a technology roadmap, which extends well into the 2040s. These continued incremental improvements will incorporate emerging technologies including autonomy, crewed/uncrewed teaming, resource management and space to ensure the platform's lethality, survivability and affordability.

DIRECTIONS

Do not exceed 10 pages in responding to the following four descriptions.

- Allocate these 10 pages as you deem appropriate, but it is important that you respond to all four sections.
- DO NOT REMOVE THE GUIDANCE PROVIDED FOR EACH SECTION.
- Use 12 pt. Times Roman typeface throughout.

- Include graphics and photos if appropriate; do not change margins.

SECTION 2: VALUE CREATION

Value: 15 points

Please respond to the following prompt:

➤ **Clearly define the value of this program/project for the corporation; quantify appropriately**

The E-2D program is a cornerstone of Northrop Grumman Aeronautics System's (NGAS) financial stability. It represents over \$20B in sales with the U.S. Navy and international partners. NGAS has established a comprehensive development and manufacturing infrastructure in Melbourne and St. Augustine, Florida. The ongoing collaboration between Northrop Grumman (NG) and the U.S. Navy has resulted in sustained investment from both entities. NG and the E-2D program are strategically positioned to capitalize on future sales opportunities, particularly due to the expanding global Airborne Early Warning (AEW) gap. E-2D is the sole operational U.S. AEW production line that provides a viable solution for existing and prospective clients. As a result, this AEW coverage gap has led to a heightened demand for information regarding E-2D from domestic and international stakeholders.

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

Northrop Grumman is proud to be the Prime Contractor for the E-2D Advanced Hawkeye. This program represents the foundational capability ensuring the continued lethality of the U.S. Navy carrier strike groups and the militaries of our coalition and foreign collaborators. With its unparalleled detection, networking, and communications capabilities, the E-2D enables a common operating picture and a distributed decision web, facilitating agile offensive and defensive operations in highly compromised environments.

The E-2 platform, operated by the U.S. Navy for more than 60 years and multiple foreign partners for many decades, has experienced extensive capability upgrades, maturing into its present multi-mission role as an airborne battle management command and control system while simultaneously providing Airborne Early Warning. The platform has consistently introduced new technologies to continue to outpace ever-evolving threats. The robust technology roadmap of the E-2D will keep the platform relevant, and this active production line allows U.S. and coalition forces to continue adding E-2Ds to their inventory to mitigate the growing Airborne Early Warning gap.

➤ **Clearly define the value of this program/project to members of your team; quantify if possible**

The E-2D production program preserves critical skill sets for hundreds of employees, fosters the development of long-cycle trades, and increases team members' standard of living. More than 1,800 people work on the E-2D program, distributed across the U.S., with the two largest concentrations centered in Melbourne (1,076) and St. Augustine (747), Florida. The E-2D workforce takes great pride in being a part of a mission with meaning as they work to provide the most advanced capabilities to the U.S. military and allied partners. This team has a culture of excellence that ensures that they meet customer requirements with unmatched quality.

The St. Augustine site, which is the largest employer in St. John's County and where the production of E-2D occurs, is home to the best and brightest involved in aircraft modifications, component repair and

overhaul, production and assembly, structural fabrication, system integration, ground and flight test and total lifecycle system management. This site has one of the most highly skilled workforces in Florida. The E-2D team is committed to maintaining the highest ethical standards, embracing diversity and being an ideal corporate citizen as they take pride in their work. Their dedication to achieving excellence has propelled the E-2D into the status of being recognized as the premier airborne battle management command and control platform globally, having undergone significant evolution over the past 60 years and transitioning from a specialized U.S. Navy aircraft. Renowned for its performance in the U.S. Navy fleet, the E-2D was recognized as one of the top five U.S. Navy acquisition programs for 2023. With a robust technology roadmap, this team of committed professionals will sustain the E-2D's relevance for decades.

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

The program is an integral part of the community and a key community partner with charitable grants provided to nonprofit organizations and public schools within Brevard County with the following:

- **STEM:** Providing charitable support enhancing STEM (science, technology, engineering, mathematics) learning and the importance of it to grade students K-12. The Melbourne Northrop Grumman employees volunteer within public schools and nonprofit organizations and lead STEM workshops.
- **Military/Veterans:** Providing support to our active military personnel and veterans in various areas, ranging from assisting veterans with the ability to re-enter the workforce to housing and feeding needy veterans. The employees of this program volunteer for USO Care Pack events for active service members.
- **Health & Human Services:** With a major focus to provide assistance to feed the hungry, Northrop Grumman employee volunteers support Rise Against Hunger events to create and package 10,000 meals for those in need.
- **Environment:** Aiding with area nonprofit organizations making a difference to improve the environment, Northrop Grumman employees volunteer to pick up trash along Brevard County roads and beaches and participate in improving the quality of the Indian River Lagoon.

In addition to contributing to the local community, ensuring national security is also a paramount focus of the program. E-2D is designed to seamlessly analyze, fuse and distribute multi-domain information into a command-and-control system of systems, supporting all domains and levels of war. As the offensive and defensive coordinator of the Carrier Strike Group, the E-2D provides dominant, continuous, and interoperable command and control and surveillance for the protection of the fleet. The E-2D platform also provides search and rescue guidance, navigational assistance, and communications relay. Operations where the aircraft has played a key role include Iraqi Freedom, Enduring Freedom, Tomodachi (Japan's Tsunami and Fukushima Nuclear Accident) and Joint Task Force Katrina.

SECTION 3: ORGANIZATIONAL BEST PRACTICES AND TEAM LEADERSHIP

Value: 35 points

Use 12 pt. Times Roman typeface

Please respond to the following prompts:

- **15 points: Describe the innovative tools and systems used by your team, how they contributed to performance and why**

As Northrop Grumman evolves, the technology that drives the E-2D to add capabilities must evolve to continue providing value to the U.S. Navy customer. To drive this evolution, the St. Augustine Manufacturing Team is leveraging efforts across the Northrop Grumman Enterprise that are working on maturing its Digital Thread Technology. As this technology matures, Northrop Grumman can bring it to bear to support future retrofits to the E-2D aircraft. Some of these technologies are game changers.

The use of the HIVE (Highly Immersive Virtual Environment) allows technicians the ability to observe a 3-D view of what they are building using virtual reality headsets and 3-D drawings. This capability underscores challenges in design including the inability to access a fastener, inadequate space between components obstructing wire routing, and numerous blind spots that the Engineering team might not have identified during the design phase but become apparent to an experienced technician. This enables the team to anticipate the scenarios they will encounter upon the aircraft's arrival and the necessity to carry out retrofits. It empowers the technician to assess the manufacturability of the design prior to the construction of the prototype, thereby mitigating risks, reducing change orders and minimizing rework. The ability to use augmented reality headsets to visualize simulations of full-size E-2D aircraft and all the tools and support equipment required against the backdrop of an empty hangar allows the manufacturing team, support groups, and the customer to see the manufacturing layout. This ability also will highlight pitfalls before the first aircraft arrives or the first toolbox is purchased. The use of those same headsets can also facilitate improvements and efficiency in the build.

These advanced technologies enable technicians to create comprehensive, full-size visual representations of three-dimensional (3D) drawings directly over the components of the aircraft they are modifying. Additionally, these technologies provide access to virtual work orders, notes and fastener callouts. For the first time, this information is accessible at the technician's fingertips and also in front of them as a visual image. This visual representation significantly reduces the likelihood of misaligning clips or misrouting wires, as the precise location and routing of components are clearly highlighted over the aircraft structure. Leveraging of laser projection technology allows the team to reduce hard tooling and to project the hole locations, critical features and fastener callouts directly on the aircraft structure often allowing technicians to work removable structure items off the aircraft and providing a more ergonomic workspace outside, on a bench, with the same ability to pick up key characteristics and bank points that may have been needed to position the hard tooling inside the aircraft. Advances in Wi-Fi technology and small hardened shop floor tablets allow the mechanic to access technical data inside the aircraft where often, due to size restrictions of the barrel of an E2, leaving your workstation to obtain this information can be time intensive and disruptive to the build process. Altogether, the combination of benefits from these technologies tied in with the continued evolution of the design and future improvements continue to reduce risk and creates value for the U.S. Navy customer.

10 points: Define the unique practices and process you used to develop, lead and manage people?

To establish a stable delivery cadence in an environment of historically high turnover while implementing new international and U.S. Navy configurations, the E-2D Production team needed to re-think how to onboard and train new employees, along with intentional knowledge transfer. With a realized touch labor attrition at an all-time high between 2022-2023 and a workforce nearing retirement age, the E-2D Production team grew their first- and second-year population by nearly 200%. In Q1 2024 alone, the team increased the touch labor headcount by more than 10%. To retain artisanal product knowledge and minimize disruption, the E-2D Program coordinated an approach to stabilize the workforce while expanding training opportunities and reducing build variability. The manufacturing team developed several tools to facilitate this effort:

- **Operations Organization Planning Workbook** – A comprehensive organizational management tool crafted to synchronize the requirements of the organization with the ambitions of its employees, utilizing resources such as the one-on-one reporting mechanism, certification management, and links to career development hubs.
- **Focused Leader Development Project** – Initiated the engagement of external specialists to conduct an unbiased evaluation and formulate a comprehensive 34-week project aimed at enhancing the daily management practices of the Manufacturing and Mission Assurance frontline leaders.
- **Aeronautics Systems Training for Advanced Refinement (ASTAR)** – Implemented Job Enhancement Training (JET) programs, Best Leader Training initiatives, the incorporation of process video integration into shop work instructions, the establishment of standards for the new-hire learning curve, and performance measurement frameworks.
- **Manufacturing Engineering Knowledge Base (MEKB)** – MEKB serves as a comprehensive digital library, offering a collection of tutorials and “How-To” guides derived from lessons learned in the context of employee development and the transfer of job-related knowledge to early career engineers. This initiative is designed to assist Manufacturing Engineers in executing their designated work within industry-standard software, thereby ensuring that the process of Aircraft Configuration remains consistent from the design phase (TeamCenter) through to procurement (SAP) and production and maintenance (MES).
- **Innov8 and 360 Meetings** – Provides a culture that involves manufacturing shop floor technicians with innovative and creative solutions for productivity improvements to bring those ideas to the table with the team.
- **Mission Assurance Model Based Staffing** – A data visualization tool used to determine appropriate inspection staffing levels. The E-2D Daily Callboard Visibility dashboard displays all the relevant callboard volumes across the site by day and time, allowing the appropriate shift in resources to address high volume callboards.
- **Manufacturing Predictive Staffing Process** – An integrated staffing model, which amalgamates historical performance trends with anticipated future needs, facilitates the formulation of proactive recruitment and training strategies. The team leveraged years of trend data on touch labor attrition, new hire learning curves, and seasonal lost time, along with productivity, backlog, and throughput requirements, to build a Staffing Requirement Analysis (SRA) tool. This tool generates a staffing plan based on a model that incorporates hiring lead times and training needs, thereby creating a comprehensive and predictive staffing profile. These components also contribute to a schedule forecasting model, enabling the team to efficiently manage schedule performance by considering the entire Cost Performance Index, overtime, attrition, backlog, Heads on Board, lost time, Letter of Authorizations, etc. The E-2D Production program successfully implemented this plan, resulting in the recruitment of 34 new technicians within a three-month period, representing a 10% increase in staffing levels, a focus on efficiency enhancement, and the execution of a de-staffing plan to improve cost performance.
- **10 points: How did you leverage skills and technologies of your suppliers?**

Northrop Grumman collaborates with industry-leading suppliers to develop high quality systems and components to meet customer requirements and deliver advanced capability. Our supplier performance is the result of collaborative team-based management using Subcontract Management Teams (SMT), which are multi-discipline across all business functions and supply chain tiers. E-2D generational enhancements leading to the current E-2D and beyond are the result of leveraging the expertise of our supply base, who employ advanced design and manufacturing processes.

SECTION 4: DEALING WITH PROGRAM COMPLEXITY (VOLATILITY, UNCERTAINTY, COMPLEXITY, AMBIGUITY, or VUCA)

Value: 25 points

Use 12 pt. Times Roman typeface

Please respond to the following prompts:

- **10 points: Describe UNIQUE areas of VUCA faced by your program and why. (Please avoid the issues surrounding Covid-19 pandemic, which was faced by all programs.)**

In 2023, MDC2 experienced execution challenges resulting from a destabilizing geopolitical and macroeconomic environment in concert with recent demographic transitions in its workforce. The E-2D production line faced unprecedented turnover and attrition resulting in turnover of half the touch labor workforce. The program went from a stable/experienced line to an unstable line in a span of 12 months. Also, during this phase, backlog increased to more than 40,000 hours because of parts shortages between MYP1 and MYP2, workforce destabilization, the planned ramp up in production rate, and the incorporation of several obsolescence and capability upgrades. Production entered 2023 with a high potential for missing contractual delivery dates.

- **15 points: Explain how your team responded to these challenges. What changes did you make, what were the results?**

The program worked closely with the customer and factory to scale production to the most economical manufacturing quantity (EMQ). The program also undertook an initiative to restructure supporting labor to accommodate this new production rate. These actions drove financial stability across all of Production Performance obligations while continuing to meet contractual delivery dates and zero defects.

The E-2D Production line in St. Augustine developed a strategic plan to ensure the shop had a robust and executable plan that would ensure near term on-time deliveries as well as long-term and sustainable performance in quality, cost, schedule and safety. The strategy was built around three pillars:

1. Hiring and developing people to perform efficiently and effectively across all functions.
2. Stabilizing the factory's performance to schedule to get the line back into a predictable cycle.
3. Fostering a culture of shared ownership and accountability to set challenging goals and deliver predictable results.

The E-2D team reinvigorated the Integrated Product Team Concept of Operations, invested in its people development, and developed the critical metrics and meeting rhythms to stay on top of performance.

SECTION 5: METRICS

Value: 15 points

Use 12 pt. Times Roman typeface

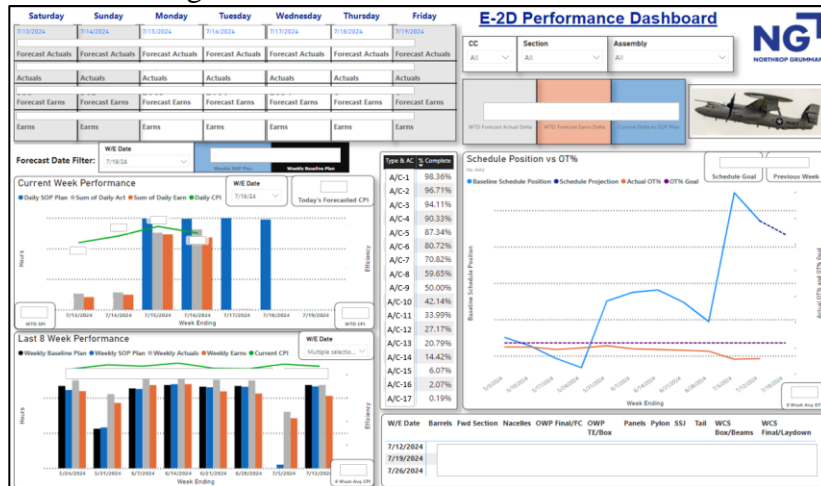
Please respond to the following prompts, where predictive metrics indicate items that provide a view of how yesterday's actions and today's actions will affect the future timeline, cost or other requirement.

Provide charts/graphs that illustrate performance to these metrics:

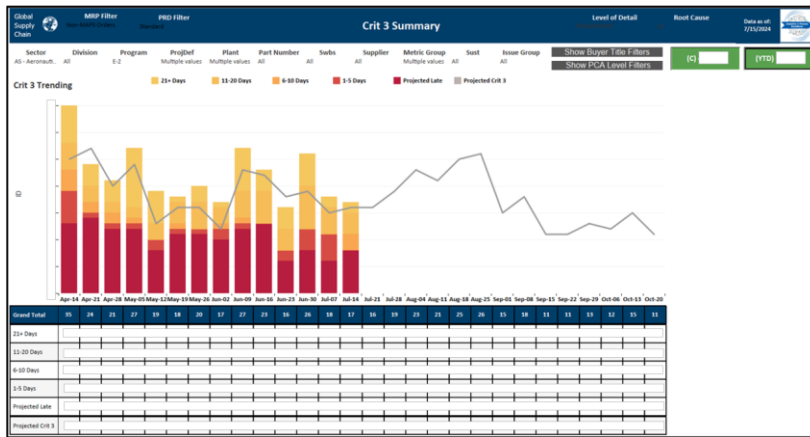
➤ **What are your predictive metrics?**

In order to stabilize the production rate, the team needed to implement a disciplined structure of metrics and reviews. The team took an integrated approach to realized and predictive performance measures to determine the metrics that would be reviewed each week. This large set of metrics covers all areas, including, but not limited to, tooling, staffing, training, supply chain performance, quality and schedule performance. Criteria were determined for each metric that rated the metric as “Red,” “Yellow” or “Green.” The “Red” rating indicated that corrective action was needed to improve the performance/process for the team to sustain long-term production rates with a less experienced workforce successfully. A “Green” rating indicated that the team was on track to execute consistent production rates successfully. By paying close attention to the metrics and allowing the metrics to drive corrective actions, the team was able to drive to success. Below are just a few examples of the program’s predictive metrics.

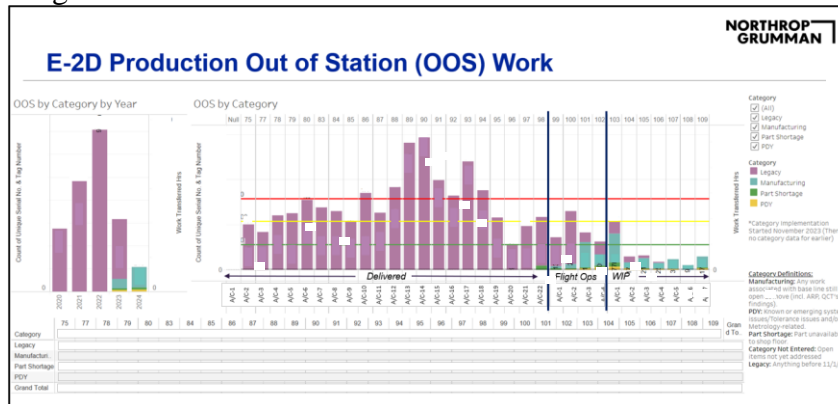
- **E-2D Production Performance Dashboard** – The E-2D Performance Dashboard is an example of how the E-2D Production team continues to innovate its processes and tools. The dashboard represents critical cost and schedule requirements elements, along with historical performance trends, that allow the team to predict its performance and make proactive adjustments. These were previously static, backwards-looking Excel-based metrics that are now live, web-based tools that are customizable and forward looking.



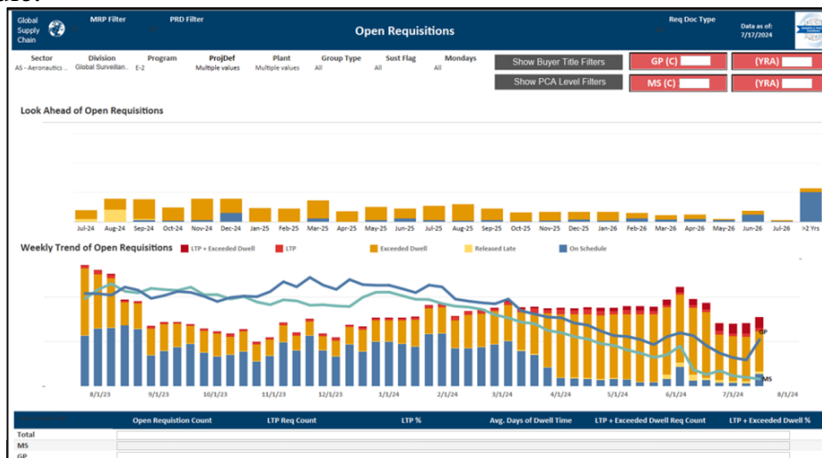
- **Critical Part Shortages Metric** – This metric predicts how well the supplier’s material delivery commitment dates support the manufacturing schedule. Critical material shortages are measured by severity of impact to the manufacturing process. Crit 1 is the most severe, where the shortage is stopping the production line, followed by Crit 2 & Crit 3, where the impact of the shortage is less impactful, workarounds can be considered and there is more time to react.



- Out of Station (OOS) Work Metric** – This metric categorizes work that has moved between aircraft build stations and drives resolution of root causes to prevent recurrence. OOS Work refers to tasks that are not completed at their originally planned station on the production line and need to be moved to a different station for completion. This movement can be due to various reasons such as quality issues or part shortages.



- Open Requisitions** – This metric predicts the health of the procurement schedule. Purchase requisitions are released according to the Material Requirements Planning (MRP) schedule and must be placed on purchase order by a supply chain acquisition professional (aka ‘buyer’). Each requisition is synchronized with the product build schedule, and this metric measures the velocity and throughput of the procurement function. This metric tracks requisitions more than two years in advance to keep the team on schedule.



➤ **How did you perform against these metrics?**

- **E-2D Production Performance Dashboard** – Because we can now make decisions based on real-time and predictive information, we have consistently maintained a positive schedule position for 6+ months, while seeing our efficiency improve and unit costs reduce.
- **Critical Part Shortage Metrics** – Program is performing at a high level, tracking very few Crits right now (several dozen) across a bill of material of over 35,000 purchased material part numbers. Our performance has improved significantly over the past several years, as we had several hundred Crit items at the beginning of our Multi-Year Production (MYP2) contract.
- **OOS Work** – Program has been performing well year-to-date and is green against the new red/yellow/green thresholds that were established earlier this year.
- **Open Requisitions** – Program has been performing well year-to-date on requisition placement.

➤ **How do your predictive metrics drive action toward program excellence? Please provide examples.**

The metrics and processes tools have enabled the team to identify emerging trends and deviations from anticipated outcomes, facilitating real-time decision-making to enhance program excellence.

- **E-2D Production Performance Dashboard** – This metric enhances program predictability in terms of quality and financial performance, while upholding Northrop Grumman’s longstanding record of 100% on-time deliveries and zero instances of quality escapes.
- **Critical Part Shortage Metrics** – This metric highlights supplier deficiencies in meeting requirements, the criticality of these shortages, and trends among suppliers. The Crit 1/2/3 methodology offers a structured approach to prioritize material shortages, addressing each with the appropriate urgency and mitigating potential impacts. It also enables build teams to develop contingency plans for situations where suppliers are unable to fulfill production needs. This forward-looking approach allows for proactive engagement with suppliers to expedite deliveries that align with the production team’s scheduled needs.
- **OOS Work** – The production team utilizes this metric to monitor the status of out-of-station work weekly, aiming to halt any negative trends and promote prevention. It illustrates a shift towards prevention and a positive trend over the past 18 months. In 2022, the team encountered challenges with scheduling, which is likely attributed to high levels of OOS work. Through collaborative efforts with the Inventory Planning Team (IPT), the team’s ability to adhere to schedules, properly staff, and prevent part shortages has significantly improved, reflecting the progress in 2022 to 2023, and again from 2023 to 2024 YTD.
- **Open Requisitions** – This metric motivates the supply chain teams to order materials promptly and optimize procurement resources. It provides visibility into the volume of open requisitions over a more than two-year horizon, which corresponds to the workload for procurement buyers. Should requisitions remain open, it allows for the reallocation of procurement resources to address these aged requisitions.