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Thank you for participating,

Tommitton

Gregory Hamilton President Aviation Week Network

Acknowledged, agreed, and submitted by

<u>_Jeff Hager</u> Nominee's Signature

Nominee's Name (please print): Jeff Hager

Title (please print): Vice President, Vertical Lift

<u>May 17, 2023</u> Date Company (please print): Elbit Systems of America, Inc.

NOMINATION FORM

Name of Program: AH-64E Multicore Mission Processor (MMP)

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



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.]

ElbitAmericaTM, Inc. produces the Multicore Mission Processor (MMP), one of the most advanced mission processors available, with up to 64 P4080 processing cores.

Serving as the heart of the U.S. Army's AH-64E Apache Helicopter, the MMP delivers accurate functionality of onboard systems—all with significantly increased memory and processing speed, while simultaneously enhancing system-level capabilities and performance. Through proactive focus on reliability and product improvement, the MMP effectively supports the Boeing and AH-64E community throughout multiple fielding activities.

Beyond essential mission processing, the MMP does much more—it ties all systems together with software, sensors, weapons, and flight characteristics to ensure optimal aircraft functions. Improved Size, Weight, and Power (SWAP) of the MMP architecture also allows for additional capability to be efficiently included on the Apache platform without significant redesign of major systems. Proof of the MMPs active success is its functionality supporting this preeminent attack helicopter, giving pilots peace of mind.

The original Apache Helicopter had three electronic processing boxes: a weapons processor, a display processor, and a systems processor. The Boeing and Elbit team worked together to create a Mission Processor (MP) design that combines video manipulation with core mission processing and combined capabilities of these three separate boxes into a single Line Replaceable Unit (LRU). This one LRU, with all three functions, was delivered to the U.S. Army in October 2011. Boeing and Elbit soon realized additional capability was required for the ever-increasing technology demands, so they worked together again to create the MMP, which is now the foundation for the AH-64E fleet.

ElbitAmerica operates production of the MMP at multiple sites to uphold production demand and on-time deliveries, maximize throughput capability, and increase schedule performance. This strategy allowed the MMP team to mitigate delay risk throughout production and accelerate deliveries for key U.S. Army fielding initiatives. Through numerous cooperative work efforts, the MMP team delivers consistent program execution, manages supply chain challenges, and maintains deliveries.

More than 1,000 MMPs have been produced with Mean Time Between Failure (MTBF) rates significantly better than established target criteria, improving overall aircraft operational capability. In Q1 2023, Boeing calculated that Elbit achieved an MMP MTBF 89.3% better than the requirement.

Elbit is committed to providing innovative solutions that anticipate ever-increasing customer requirements, while the MMP supports demands of integrating future technologies to reduce pilot workload and increase mission effectiveness. The MMP's combined capabilities reduce potential failure opportunities. The MMP also enhances upgrades with emerging security and standardization requirements. The affordable Modular Open Systems Architecture (MOSA) capability leverages commercial, off-the-shelf technology, resulting in high performance and scalable solutions that meet critical needs of modern aviators.



DIRECTIONS

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

VALUE CREATION

Value: 15 points

Please respond to the following prompt:

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

Although mission processors are a significant part of ElbitAmerica's (and our Israeli affiliates) product portfolio, the MP/MMP (Figure 1) was our first application of processors for an Apache platform. Providing the MMP to the U.S. Army reinforces ElbitAmerica's capability in designing and manufacturing advanced aviation processors across many platforms. Our decision to create parallel production lines demonstrated our ability to increase production build capability at multiple, simultaneous sites. This enhanced production capacity enhances flexibility within the company and for our customer.



Figure 1: MMP Exploded and Front-Facing Views. The MMP was ElbitAmerica's first application of processors for the Apache platform.

ElbitAmerica's two manufacturing and supply chain sites also allow for potential platform expansion, while reducing overall risk by spreading potential risk factors across multiple sites.

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

Apache pilots use video and audio concurrently at the most critical times—during training and in actual combat. ElbitAmerica's MMP was designed specifically to support these combat activities by protecting Apache pilots while they protect lives and assets around them from the air. Our MMP delivers a



significant tactical advantage, providing reliable situational awareness and ease of pilot workload. It also enhances pilot and crew safety and helps the Apache crew achieve success when flying their most demanding missions.

ElbitAmerica's customer, Boeing, was critical to the successful development of the MMP, as Apache pilots for the U.S. Army require a reliable solution to strengthen mission success and crew safety when flying. Boeing integrated our MMP onto the Apache platform and delivers an improved aircraft to the end user that networks warfare, protects forces, and improves readiness. The MMP provides Boeing with additional capabilities that enhance the Apache platform and presents the aircraft as the most capable attack helicopter option to the Foreign Military market.

"The MMP is critical to the E model Apache fleet; it is the central core that all onboard systems pass through." ~ Colonel Jay Maher, Apache Helicopter Project Officer, on the 1000th MMP delivery event at Fort Worth, TX

While designing the MMP, Elbit also focused on improving the mission for the eventual U.S. Army end customer. The original three components (weapons processor, display processor, and systems

processor), when separate, were often unreliable. Whether it was during training or during an actual mission, if one of the original three mission processors malfunctioned or was not operational, the aircraft could not take off. Systems must operate and fire as required the first time. If they do not, the mission is scrubbed, impacting U.S. Army readiness and mission execution. Our single-component MMP is more reliable for accomplishing and meeting mission requirements.

ElbitAmerica's MMP customers have the assurance of reliability, confidence, and trust that comes down to processor operation and capability. Our long-standing relationship with our industry and end customer, along with understanding of mission needs, allows us to continue our work developing necessary products and solutions to keep the Apache effective into the future.

Likewise, Elbit invests substantial resources to ensure the MMPs function effectively in the fleet, meet all required electronic and mechanical standards, and function under extreme temperature and weather conditions. The rigorous MMP testing prior to completion significantly increases functionality and reliability in these harsh environments.

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

The MMP program is one of the largest at the Elbit facilities. It represents the most complex product built, including the most complex testing requirements compared with other products we produce.

The LRU and components used inside the LRU set the benchmark for complexity and capability. This requires highly skilled people to manufacture, maintain, and test it. Elbit invests in recruitment programs that meet these complex needs.

After recruiting personnel with appropriate skills, significant additional training is required inside the operations team just to become an MMP technician. Recognizing the critical nature of this production line, Elbit invested in MMP-specific training programs with emphasis on testing skills required for success. No other category of employee requires this level of training, and technicians who complete this program have valuable skills applicable to a range of products.

Because of the Apache program's significance, there is substantial team unity and motivation at Elbit surrounding the MMP program. Although we are a contractor partner to Boeing and the military separately, the MMP program is a full team effort with customer and client. Every member of the MMP team, inside and outside Elbit, is engaged and willing to understand the MMP program and work together toward program excellence. Upfront collaboration regarding key requirements and methods to improve



MMP functionality are the foundation of program success. This type of atmosphere creates long-lasting sense of ownership and camaraderie. The results are evident in successful program performance.

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

Within the U.S. Army, the Apache AH-64E Helicopter is the most computer-intensive advanced attack aircraft in the sky today and the most called upon for duty. It was designed to protect nations and individuals and is the premier helicopter and fighting machine for the U.S. Army.

Our MMP was designed to pull multiple systems together into one box, supporting Apache pilots as they protect troops on the ground and pilots in other aircraft. In Panama, the Persian Gulf, Kosovo, Afghanistan, and Iraq, the Apache Helicopter supported Special Operations, National Guard, U.S. Army, and other allied troops while also engaging in ground control maneuvers and helping other aircraft safely land and take off.

ElbitAmerica's MMP was designed to support the overall mission within the U.S. Army to employ the Apache Helicopter in the most dangerous theaters on earth where our warfighters dominate the battle and engage threats with power and precision.

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

ElbitAmerica employs two categories of tools and systems to enhance performance: developmental and production. Our collective team builds a collaborative environment during development, with emphasis on communications and teamwork. When a product moves to production, we implement value streams from inside the production organization, starting with initial production build and moving through various stages of serial production. We also focus on including value in our subsequent product support.

Initial innovation takes place on the development side within the full Integrated Product Team (IPT) structure, including ElbitAmerica, Boeing, the supply chain, and the ultimate U.S. Army Apache customer. We emphasize iteratively refining design to best address end customer requirements to include inferred or derived needs. This cooperative relationship allows communications to flow freely and influences requirements and design decisions. Ultimately, the entire enterprise determines the best path forward, resulting in a more robust product design. This collaborative effort and true partnership with Boeing and the U.S. Army are the hallmarks of MMP program success and the recipe for overall ElbitAmerica success.

ElbitAmerica also employs the use of collaborative management tools, including QlikView (QV), to provide the Program Manager, program team, and leadership access to a single source of truth (data), available at the click of a button. Access to data is no longer dependent on pulling data from multiple spreadsheets stored in disparate files and locations. Sharing the same data across the team speeds up understanding and decision making and ensures the entire enterprise has the same status.



QV is an innovative, commercial, off-the-shelf business intelligence tool designed for data integration, conversational analytics, that can be used to convert raw data into a knowledge base. It works on the associative model and can move in any direction to search for answers. Our QV suite supports structured dashboards, as well as ad hoc queries, facilitating easy access to data to support quick decision-making. Use of these tools provides insight required to take proactive actions that ensure the entire manufacturing process is smooth and continuous. Implementation of our tools and processes revolves around eliminating problems before they arise. The MMP program is on track and successful in large part because we use leading indicators and analytics to drive behaviors.

All business systems within Elbit efficiently tie data together. Enterprise Resource Planning (ERP) tools integrate sales, financials, planning, production, shipping, warehousing, and materials procurement. Although not unique to contracting, these systems produce innovative results for Elbit using real-time information. These systems also produce innovative results for our customers, including decreased risk of product delivery delays, higher performance outcomes, and increased positive budget oversight.

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

Due to MMP program complexity, the highest skill level from our technical talent pool is required to maintain proficiency throughout product build and testing processes. Process and product yield improvement are key goals of the MMP team to ensure predictive results throughout product lifecycle.

Recruitment of these highly skilled technicians is an operations function. Our operations team sources technicians, screens them for new hire, asks leading questions, discusses the type of technical work involved, and determines skill sets for new, incoming technicians. Following the rigorous onboarding process, selected technicians for the MMP product must undergo a one-month MMP-specific training program prior to work assignment. Even after this intensive training program, not everyone is chosen to work on the Apache MMP project. This is an elite cadre of individuals who are selected, trained, and placed on an MMP team.

Additionally, Elbit selects key leadership personnel who have actual, real-time Apache flight experience and an extensive background with Apache helicopters. These individuals are former military personnel with unique and critical insight in this program.

Within Elbit, employees can move between disciplines and departments with ease, depending on where specific skill sets are needed. Even an employee with a short time at the company who has a high aptitude for and desire to work in the MMP program can move, for example, from management to engineering or MMP program work or vice versa. This unique practice allows Elbit employees to work to their individual strengths and supports the company's decision to move these motivated individuals into the MMP program to better serve the company and the MMP customer. This has proven to be a particularly good retention tool at Elbit, bringing skills and personal motivation together and fostering relationships to best serve the MMP program.

> 10 points: How did you leverage skills and technologies of your suppliers?

Elbit produces the MMP from component assembly through product completion. As a result, supply chain risks we experience are risks all contractors in our industry experience. We negotiated with our key vendors to use supplier-maintained, in-house stores for all consumable assets, and our supply chain supports us with replenishments as needed. Key components are also maintained in the value stream area, located by the production floor, for additional visibility and coordination.



Using the same collaborative approach as our design team, Elbit also partners with unique power supply manufacturers to provide this critical asset and supports long-term agreements to ensure availability as needed. Planning out our purchases for years instead of months and using long-term forecasting to anticipate customer needs in advance of order releases add to the potential for successful execution. Visibility into and confidence in future purchase orders provide stability and confidence in workload, especially for our smaller suppliers. Our partnerships with these vendors are critical to keeping our production line moving as planned, while their feedback helps identify areas for collaboration. Sourcing material from multiple manufacturing locations also buffers potential supply chain issues.

Elbit utilizes two manufacturing sites, which provides advantages to overall manufacturing capabilities. This decision created an unexpected outflow result. For example, multiple manufacturing locations have more rapidly determined if a potential defect is related to a component or to a process issue. This could be more time consuming to discover with one manufacturing site.

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.)

Enterprise Resource Planning (ERP) System Transition. In 2022, Elbit transitioned to a new ERP system, which is always a major organizational undertaking. The new ERP system "go live" date was January 3, 2023. To be successfully prepared for transition, the MMP program had to plan ahead for the data freeze and blackout of our old ERP system during this transition.

Supply Chain and Inventory Challenges. Like all contractors (even prior to 2020), Elbit faces supply chain and inventory issues. In addition, having dual manufacturing sites in different parts of the world presents a unique challenge and opportunity for Elbit.

GPU System-on-Chip Design Early Mortality. The Elbit team experienced an issue in the MMP program regarding a GPU's system-on-chip design that evaded all qualification activity but became apparent when the component indicated an early mortality in the fleet. This GPU component was obsolete, and our engineering team had to develop a unique component healing and inspection process.

Obsolete Component Volatility. This unique area of VUCA affects our ability to effectively mitigate this issue through the forecasted production horizon. The supply chain team struggled to identify these obsolete components with sufficient time to find and include alternatives.

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

Enterprise Resource Planning (ERP) System Transition. We structured our program in such a way that materials would arrive early to be kitted for production and released before the data freeze (the "black out" period). We then planned to manually track our work and materials to not interrupt production. Due to advance enterprise-level planning and disciplined program management of the team, the MMP line



suffered no production interruptions during transition to the new system. In fact, completed MMPs were delivered ahead of the blackout period to ensure there was no impact to our customer's build plan.

Supply Chain and Inventory Challenges. To resolve this unique area of VUCA involving dual manufacturing sites, we used insights from the ElbitAmerica's two manufacturing sites (in the U.S. and in Israel) to inform and manage the MMP production effort. Both teams work closely together to proactively resolve potential supply chain and production build issues. Frequent communication between our teams ensures issues are elevated and resolved quickly. The team leaders created a common understanding of where challenges were and moved resources and attention to address emerging issues before they impacted production. Feedback from one team was shared with the sister production team for early warning of potential concerns.

As a part of the Aerospace and Defense supply base, we generally need much lower quantities than commercial product sales. This requires proactive supply chain management to ensure we get the needed priority from our predominately commercial suppliers. Our collaborative approach to working with our vendors provides opportunities to proactively identify and address concerns in the lower-level supply chain. We also work to develop long-term relationships with a range of suppliers, including having multiple sources where possible.

In the last three years, Elbit demonstrated ability to deliver MMPs on time. Current Boeing Mesa on-time delivery rating is 97.14%, while MMP production is 100% on-time.

GPU System-on-Chip Design Early Mortality. To resolve this area of VUCA, Elbit worked with Boeing and the U.S. Army to implement a unique component healing process at both manufacturing locations, which effectively resolved the performance anomaly. Working across the entire team allowed us to quickly identify, design, test, and implement the new process, which successfully resolved the component failure issue. The unique and successful healing process was then implemented on all deliveries. Our teamwork approach to the MMP program laid the foundation for this process improvement and collaborative resolution to chip mortality. MTBF reliability improvements benefit from process and product improvement measures and protection of obsolete components for the future.

Obsolete Component Volatility. To mitigate this area of VUCA, Elbit management decided to build in advance of existing requirements to support future U.S. Army programmatic needs. This decision added an additional layer of mitigation to the COVID event, which affected all supply chains. This also allowed Elbit to support accelerated MMP deliveries throughout the U.S. Army fleet.

Working closely with Boeing, Elbit accepted the challenge to better identify obsolescence by proactively analyzing and aggressively managing potential component obsolescence. Since 2016, Elbit has been protecting the horizon of the MMP program, even when we do not have contract funding in place. This approach allows us to ensure obsolescence is covered through the production fielding horizon.

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?

Elbit uses a host of tools, techniques, and best practices that provide leading indicators of threats and opportunities. Our metrics are quantitative and have objective measures that trigger warnings when smaller variances appear, allowing us to get ahead of potential situations.

Because all programs fill in a scorecard for execution metrics, individual programs are made aware of trends, and portfolios and the enterprise can readily see trends across programs and act to head off potential problems. We can also see real-time data on project costs and performance according to plan, allowing us to see variances as they happen, as opposed to getting a financial report up to a month later.

Risk Management. Our Risk Management tool contains detailed analytics for us to act on when assessing impact of unknowns to our program, so we can appropriately apply resources to reduce threats and exploit opportunities. The tool keeps a record of all changes, so we are able to see trend data over time and create reports with very specific details on data items we focus on.

Management Review. Our QV Management Review dashboard (Figure 2), for example, provides insight into four focus areas. These are areas specifically required by AS9100 to evaluate customer satisfaction:

- 1. Customer Voice
- 2. Process Execution
- 3. Supply Chain
- 4. Process Improvement

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Figure 2: Management Review Dashboard. The Management Review Dashboard provides data Elbit examines to catch potential failures and look for trend opportunities.

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For example, real-time failure data and proactive analysis of Rolled Throughput Yield (RTY) is possible using QV to identify and resolve potential failure trends throughout assembly build and test processes. Our quality and engineering teams investigate all processes to improve quality and yield and eliminate errors. This is an Elbit-wide practice, not just for the MMP program.



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Target

Subcontractor Data Items (SDRL) Management. We also use our Data Management QV application to manage Subcontractor Data Items. This application provides an easy-to-use and easy-to-understand graphical representation of project and program data requirements and is monitored by the IPT and leadership. This tool allows us to better predict when resources will be required to support data item development, as well as to provide insight into customer approval status to minimize risk to future program closure. The application looks at time-slices over program lifecycle, providing insight into individual data requirements, data owner, due date, and "days to go" countdown.

Program Execution Metrics. Every ElbitAmerica program is required to evaluate and report monthly Program Execution Metrics. These metrics are monitored by program, business, and executive leadership and provide insight into six critical attributes (or metrics) to program success:

- 1. Overall Program
- 2. Customer
- 3. Technical
- 4. Quality
- 5. Schedule
- 6. Financial Performance

Each metric is evaluated against common criteria and reported as green, yellow, or red status. This allows us to react and focus resources to avert potential performance erosion when any individual metric turns yellow or red.

How did you perform against these metrics?

Prediction of Requirements. We made a prediction of MMP requirements across the fleet and took internal management actions to build ahead of existing requirements to satisfy potential future requirements. Our management team routinely and continuously questions, "Are we doing the right thing by building ahead?" However, it soon became clear that building ahead enabled Boeing and the U.S. Army to implement other activities requiring MMPs much faster than originally planned. We predicted the coming need and took initiative to build ahead.

Additional contract awards for MMP assets is the best evidence that Elbit performed well against metrics. We delivered against recent contracts in less than half the required lead time. Our U.S. Army customer was satisfied because it enabled them to begin placing MMPs on every Apache Helicopter, facilitating a single unified Software Operational Flight Program (OFP) across the U.S. Army fleet.

"The MMP represents the central piece of hardware required to update over 189 version 4 Echo models to a single and common configuration providing unmatched capability parity across the entire Echo model fleet." ~ Colonel Jay Maher, on update of all Apache helicopters to the MMP

SDRL Requirements Management. We proactively look at future data delivery requirements, as well as past performance, to better manage our data deliveries to customers (see example in Figure 3).





Figure 3: SDRL Performance Application. Our SDRL Performance Application supports collection, verification, sharing, reconciliation, submission, securing, auditing, and archiving of deliverables data.

Program Execution Metrics. If a program's Overall Execution Metrics turn yellow or red (meaning one or more metrics are red or two or more metrics are yellow), additional return-to-green plans are activated and monitored by program and executive leadership. The intent of return-to-green plans is to ensure effective mitigation plans are in place quickly and appropriate resources are aligned to support moving the program back to green status. Figure 4 shows an example of MMP program performance in 2022. The Program Execution tool gives the PM and leadership easy, visual access to current program health, as well as leading indicators of potential future performance issues if any downward trends are identified in any metric.

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2 - AH-64 Apache MMP Production		Overall	
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		Quality	
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		Financial	

Figure 4: 2022 MMP Execution Metrics.

On Time Delivery Metrics. An example of our delivery performance and the output from the OTD tool is shown in Figure 5. Our QlikView On-Time Delivery tool allows us to closely monitors and track internal on-time delivery performance. The on-time delivery performance of our MMP production program shows that, while not perfect, we have process and tools in place to closely monitor, predict, and achieve high delivery performance.





Figure 5: On-Time Deliveries (OTD) Metrics

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

Build-Ahead. ElbitAmerica's management decision to implement build-ahead plans was so important to our operating systems that build-ahead plans and management of our product lines became part of our standard operational requirements. Our directives were to build to the management-approved schedule. We implemented build-ahead inside our system, and once the management decision was made, it ensured we had predictive results, even during chaos created by an unforeseen event such as COVID. This allowed the U.S. Army to implement a retrofit program that could not have happened in the same timeline without availability of this product. Elbit continues to search for and demonstrate opportunities to improve Apache capability and is moving forward with innovative products and solutions for future Apache applications using the excellent capability already found in the MMP.

Proactive Planning. While processing capabilities continue to evolve and technology improves, ElbitAmerica's predictive measures and proactive plans allow the MMP to remain the foremost processor for the AH-64E Apache Attack Helicopter.

