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Thank you for participating,

A handwritten signature in black ink, appearing to read 'G. Hamilton'.

Gregory Hamilton
President
Aviation Week Network

Acknowledged, agreed, and submitted by

Nominee's Signature

7/11/24
Date

Nominee's Name (please print): Casey Anderson

Title (please print): Senior Program Manager, F-16 Viper Upgrade Programs

Company (please print): Lockheed Martin Aeronautics

NOMINATION FORM

Name of Program: F-16 Viper Upgrade Program

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Customer Approved

- Date: 31 May 2024
- Customer Contact: Mr. Nate Frock / Program Manager Fighter and Advanced Aircraft Directorate / USAF / (937) 782-8832

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- Date: 06 June 2024
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- Date: 05 June 2024
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**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?

The F-16 Viper Upgrade (VUP) program was an ambitious effort to modify and upgrade one of the largest fleets of F-16s with new avionics, structural enhancements, and capabilities conceived to meet the customer's requirements. This was the first ever F-16 Advanced Avionics Modification (Viper) in the world and the largest F-16 modification in the 50-year history of the F-16 program. Retrofit of the customer's F-16 fleet started soon after engineering development and kit proof began. Processing all aircraft through the upgrade, the modification line accommodated up to 34 aircraft in-work and ~1,300 subcontractor employees at its peak. Indigenous capabilities were also enhanced or developed as part of the accompanying Offsets program, helping the customer better meet the needs of their current fleet. Through the course of the program, VUP established the go forward configuration for F-16 Viper retrofits and production programs. There are three subsequent F-16 Viper programs worldwide incorporating this architecture.

The milestone of final Viper delivery in December 2023 was widely celebrated at the customer location and in the United States. This application represents the collaborative and innovative efforts on the part of the key stakeholders: United States Government System Program Office - Wright-Patterson Air Force Base (SPO), the F-16 Operator (the Customer), the Indigenous Aerospace Subcontractor (the Subcontractor), and Lockheed Martin Aeronautics (LM Aero).

The VUP program is a massive sustainment project for one of the world's largest F-16 fleets. Reflected in this application are innovations in tools, systems, modeling, collaboration, and customer relationships that synchronized to achieve final delivery in 2023. The significance of completing the outfitting of the Customer's primary means of deterrence provides increased security posture for the Customer. The capabilities and timely delivery by the VUP program has positioned the Customer to better meet the United States strategic national security interests. Many of the solutions developed for this program have become benchmarks for follow-on F-16 upgrade programs, evolving the mission capability and extending the serviceable life of F-16 fleets worldwide. History will provide the perspective of the VUP program as a pivotal evolution in the long history of the F-16 and global defense.

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**

As a lead-the-fleet program, VUP proved out numerous new avionics platforms for the F-16 Viper becoming the V1 configuration. The V1 configuration was the baseline for continual development with three follow-on programs, and the current V5 configuration. The Corporation has realized increased orders through these efforts and enhanced the mission effectiveness for our customers. The F-16 Viper Upgrades portfolio has grown to approximately 20% of the average annual orders for the Integrated Fighter Group line of business. As we proved our capabilities and dedication to the mission throughout the program, we instilled confidence in our customers and opened the new market of modernizing the F-16 into a 4th-plus generation aircraft.

The VUP program has had impacts to the company by developing and expanding the F-16 Viper market:

- Began the development of Viper avionics and systems development for fielded F-16 fleets worldwide;
- Three active follow-on F-16 Viper foreign partner programs; and
- Current development of the fifth Viper configuration.

Numerous processes and practices were newly defined for the VUP program which have been carried forward as standard for LM Aero today. The F-16 Technical Service Report database that enabled the in-country mod team to submit formal request for repair dispositions was developed. The LM Aero Sustainment Management System (SMS) was established, providing a framework for how we conduct business and how we can achieve world class mission capability and affordability, and has now been implemented across LM Aeronautics.

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

The upgrade of this 30-year old F-16 fleet into the latest F-16V configuration strengthened the Customer's ability to deter military aggression. Beyond the enhanced capabilities, the upgraded F-16V fighter jets provide improved mission-capable rates of the Customer by addressing legacy issues affecting the aging airframes. VUP further provided logistics and system training of the new Viper configuration

for pilots and maintainers, preparing the Customer for maintenance of the fleet and also early preparation for the acceptance of their new F-16 aircraft currently in production. Skills and capabilities from the modification line have been integrated into the Customer's maintenance and depot operations. The accompanying Offsets projects also bolstered and introduced indigenous capabilities and its local industry. Examples include overhaul and repair of liquid oxygen regulators, fan turbine temperature indicators, and flow control valves. Certifying local repair capabilities decreases the lead times for repairs (by 7 months, on average), which are typically constrained by export approvals, competing priorities at the vendors, and shipping times, thus having a direct impact on supply of crucial components to support the fleet.

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

The VUP program provided a rare opportunity for employees of diverse backgrounds to collaborate and achieve a shared goal.

Since 2021, LM Aero deployed 55 employees overseas for support. Team members were challenged to execute in a unique cultural and professional environment. Offices were stationed in the F-16 modification hangars at the Subcontractor's campus. These facilities often required the team to devise and negotiate solutions to deconflict use of resources (such as manpower, facilities, and equipment) and share air space with the adjacent Customer air base while still fulfilling program schedule needs. Modification line teams were essentially "badgeless", working in the co-located environment with Customer members, Subcontractor technicians and management, SPO program management, and the Defense Contractor Management Agency (DCMA) representatives. Employees of all levels had direct Customer interactions and helped establish a culture of collaboration. The LM Aero expatriate team members adapted to the local culture and learned to communicate effectively even while speaking different languages. Living in the local community also provided exposure to the reality of the need for the advanced defense capabilities and, therefore, the important mission of the VUP program.

LM Aero also employed 18 local country nationals, most of whom previously served for the Customer in official capacity, flying or maintaining the F-16s while on active duty. Leveraging local country nationals proved to be a best practice on many fronts, including

- local product and process expertise,
- ability to leverage local relationships for program needs,
- understanding both the LM Aero and the Customer cultures, and
- effective and timely breakdown of communication barriers.

The local country nationals were proud to support the program as a means to continue serving their country in a different capacity and witness the transformation of their entire F-16 fleet first-hand. During program closeout meetings, some noted the experience as life-changing and the most important effort of their career.

Stateside, the program was supported by a large cross-functional team, which was challenged to provide quick solutions to support the in country executing team. As part of the final program push, the VUP Tiger Team was established to provide rapid response and triage capabilities at the LM Aero facility in Texas. The VUP Tiger Team learned to effectively inform and request help from executive leadership

with weekly business rhythms, expanded weekly work schedules to accommodate Customer work rhythms, and was a key part of the production surge that helped ensure successful final delivery in 2023.

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

The impetus of the VUP program was to address concerns for peace in a region of the world shadowed by geopolitical tensions. Contributions of this program facilitate stability by providing the primary means of engagement and deterrence against outside threats for the Customer. The completion of the F-16 Viper upgrade effort in late 2023 directly contributes to the furtherance of security.

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**

Although the F-16 has experienced modifications over its 50 year history, the scope and complexity of the VUP program required an enterprise level redefinition for all partners in the value stream. When making changes of this level, trust is paramount, and all of our changes focused on delivering a vital capability to our customer by making the modification schedule repeatable, reportable and predictable.

LM Aero deployed a team of Industrial Engineering experts to establish a resource-loaded, day-by-day standardized plan, known as crewplans (Figure 1). Employing incentive-based subcontracting strategies, LM Aero obtained full participation from the Subcontractor to not only follow the crewplan but also staff to it. The crewplans also highlighted experience needs with the floor management team whereby LM Aero deployed the appropriate subject matter experts to partner with the Subcontractor where needed.

LM Aero leadership authorized the deployment of Integrated Logistics Information & Automation System (ILIAS), an aircraft and modification management system, to the VUP program to improve production management. ILIAS was able to connect the Subcontractor's warehouse information, parts demand, aircraft modification status, and time-based maintenance required on the aircraft and the components. This software provided LM Aero, the Customer, and SPO increased visibility into performance, constraints, engineering issues, and part requirements, which then drove action from all parties to resolve and assist.

The combination of the crewplans and ILIAS transformed the mindset of the Customer's workforce, and they began adapting the work sprints called Standard Work Breakdown Structure (SWBS). SWBS are defined portions of work to be accomplished in a given period of time. For the VUP program, each SWBS was an incredibly fast 7-day sprint. This mindset helped drive a focused urgency to keep aircraft progressing through the manufacturing process. Once implemented, it provided consistent schedule recovery!

With the foundation provided by standardized crewplans, additional manpower, and ILIAS, LM Aero was then able to use a discrete event simulation tool, Simulation Modeling with Intelligent Objects (SIMIO) to predict the program's completion date and to systematically mitigate potential manufacturing bottlenecks. The SIMIO model (Figure 2) identified aircraft power, hydraulic and fuel operations were high risks. Armed with this data, the Subcontractor enhanced their campus layout to add aircraft stations capable of those operations, launched a hiring campaign targeted for those skillsets, and built custom-manufactured, stainless steel aircraft sunshades that allowed for open cell fuel operations outdoors. All of these actions reduced aircraft flow time and developed a buffer that prevented impacts to overall production schedule due to single aircraft delays. Through the listed enterprise strategic changes and stakeholder team effort, we were able to finish the program in December of 2023 ahead of earlier SIMIO model projections of mid-2027.

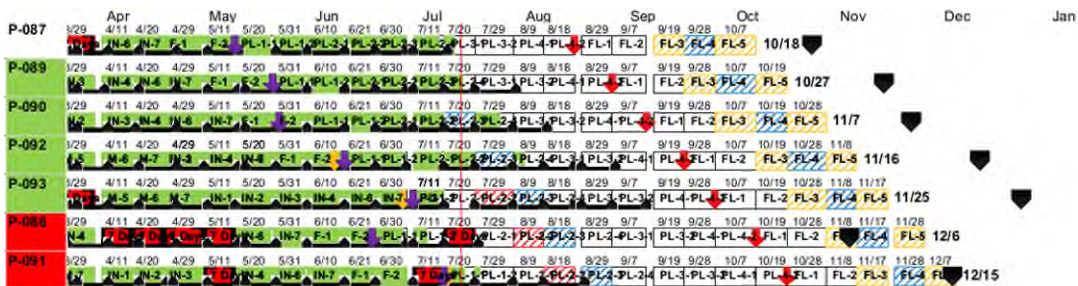


Figure 1 Aircraft Crewplan Performance Progress: On-Plan (Green), Behind Plan (Red)

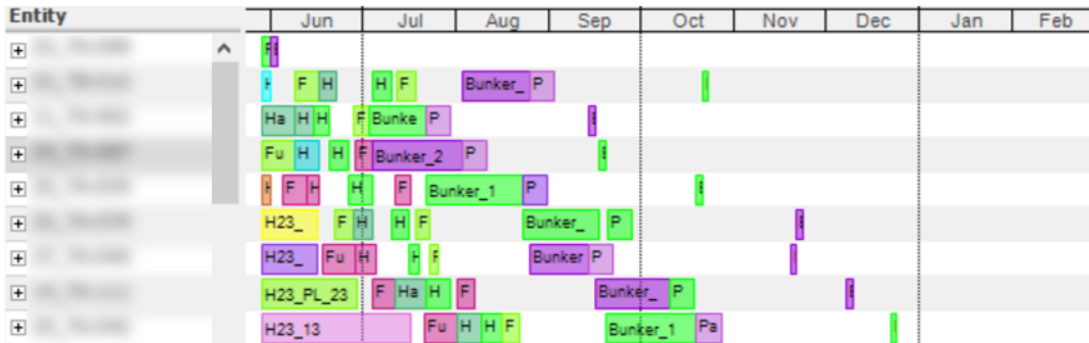


Figure 2 SIMIO Model results depicting Crewplan Impacts from Operational Constraints

Another significant factor to the success of the VUP program was incoming condition of the aircraft at induction. This F-16 fleet has been operating in a humid, subtropical environment for the entire 30-year history of operation. The magnitude of Over and Above (O&A)¹ work, defined as work not covered by line items under the basic contract but necessary to fulfill the contract, was significantly greater than planned. To actively manage this unplanned work, we established a thorough Memorandum of Understanding (MOU), which provisioned for DCMA personnel to be on-site to quickly adjudicate work requests and defined responsibilities for LM Aero functions and the Subcontractor (Quality Assurance Representatives, Industrial Specialist, and Administrative Contracting Officer). The review process allowed LM Aero to reduce supplier costs by an average of 15%. This comprehensive MOU is now utilized on F-35 Sustainment programs and also provided the framework for a Joint Operating Procedure between the Subcontractor and LM Aero to manage O&A.

¹ <https://www.acquisition.gov/dfars/252.217-7028-over-and-above-work>.

A shared database was developed to facilitate timely communication of required inputs (such as repair dispositions, cost estimates, review comments, and approval signatures), thus reducing wait times and minimizing delays on the modification line, and avoiding verbal direction and confusion. The database also enabled LM Aero to conduct predictive analysis for parts shortages and repetitive work requests, leading to recommendations to the Customer on parts and repairs that could be solutioned prior to inducting legacy aircraft to the VUP facility. A novel “Forward Supply Point” was established based on this data for spare parts and expand the pre-induction checklist to over 100 points, which reduced unplanned work on later aircraft by 30-40 write-ups. This database was later integrated into the ILIAS software for seamless operations.

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

The successful completion of this program required complete commitment from the LM Aero team supporting across Texas and in country, and it was truly a global effort worked 24 hours a day. LM Aero was mindful of the fact that our modification could not be successful without our partners within the USG, the Customer, and the Subcontractor. A ‘badgeless’ operation was established at the Subcontractor facility with full transparency among SPO, DCMA, and Customer personnel. USG and Customer personnel were also included in many program meetings to expedite communications and solutioning.

The proactive management of O&A established credibility and trust between the industry team of LM Aero, the Subcontractor, and - most importantly - our USG and the F-16 operator customers. These relationships enabled good faith edification of the processes and complexities which supported negotiations on schedule delays as part of the monthly Schedule Council and quarterly Adjudication Board where parties would equitably review delay and disruption claims and provide schedule relief. Substantiated delays would be incorporated into the continuously updated SIMIO model and affected aircraft crewplans, allowing production leaders to continuously make informed decisions founded in real-time status.

The LM Aero VUP Tiger Team was accountable to executive leadership to provide speedy decisions and support. We conducted daily scrums that were led by a certified six-sigma black belt. We used a tiered escalation process for issue resolution, with multiple examples of LM executive leadership engagement to prioritize parts delivery from sub-contractors. The lessons learned from VUP contributed to the development of the Sustainment Management System that LM Aero is now deploying across modifications sites on all aircraft platforms.

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

Supply chain challenges were a primary risk for the VUP program requiring strong partnerships with our supply base to meet our urgent needs. The first challenge that we overcame was that of pneumatic and fuel tubes in the aircraft. Depending on the part number, lead times could extend over a year, and cannibalization was incredibly risky due to the concerns of damaging the donor aircraft’s parts. LM Aero partnered with the USG, the Customer, and the Subcontractor to re-write the manufacturing specifications that allowed the Subcontractor to use a 3-D scanner and a 3-D tube bending machine to use tubes removed out of the aircraft to serve as the manufacturing standard. Raw tube stock and end fittings were

obtained from various supply sources, including Defense Logistics Agency (DLA), Customer warehouses, and LM suppliers, and the material enabled the Subcontractor's tube shop to manufacture tubes with an incredible 1-2 week lead times, preventing further delays to the crewplans.

The Integrated Servo Actuators (ISA) were another part shortage constraint overcome by utilizing supplier skillsets. Existing refurbishment options required export approvals, shipment overseas, and competing priorities at the certified repair lines in the United States. To mitigate this wait time, LM Aero facilitated a direct purchase order between the ISA manufacturer and the Subcontractor to certify local ISA refurbishment by the Subcontractor. This action greatly reduced schedule impacts for the VUP modification line, as repairs could be completed in 1-2 months, over a year faster than typical repair sources, allowing serviceable parts to support the modification line when needed. This effort was so successful that the Customer began sending their unserviceable ISA's directly to the Subcontractor for local repairs.

The Subcontractor also had a highly capable electrical harness shop that enabled resolution to many critical part shortages throughout the program. In the last year of the modification, a significant shortage of harnesses to complete the final 25 aircraft was discovered. Subcontractor electrician foremen and LM Aero engineers analyzed all the harness shortages and available stock of loose wire assemblies and excess harnesses, and together were able to provide a road map of how to fulfill the requirements. Due to the partnership of the above stakeholders and Subcontractor's expertise and dedicated support, a harness shortage that threatened catastrophic schedule delays was overcome with minimal impact to the aircraft delivery schedule.

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

Volatility: Geopolitical pressures, presidential elections, part shortages, work stoppages, and completion pressures defined the final years of the program. Teams worked in an environment of tension, managing to execute a production environment while processing 20-25% of the Customer's F-16 fleet through the retrofit line at any given time.

The final year demand of the program to deliver the greatest number of aircraft in any single year caused the modification line to outpace the supply chain, magnifying the impact of part shortages and creating several instances of aircraft work stoppages even as late as June 2023. Facing this challenge, the four key stakeholders devised a concept for mutual support of parts and collectively established a rotatable pool of frequently needed components to mitigate shortages that threatened to stop the production line. At the same time, the Subcontractor developed several creative means to continue progress on the aircraft by resequencing work scope and completing tasks as able. Four aircraft experienced work stoppages in the

second quarter of 2023. But with the triage by the VUP Tiger Team, rotatable parts, and the flexibility of travelled work by the Subcontractor, all impacts were overcome, and schedule recovered.

Uncertainty: Three primary areas of uncertainty brought great schedule risk to the 2023 completion: variable supply chain lead times, Over and Above scope, and workforce attrition. Variability in supply chain lead times forced the LM Aero and Subcontractor teams to establish processes and methods to complete work when it was possible, but not necessarily when it was planned. ILIAS and SIMIO models supported analysis of traveled work and informed the opportunity for available work. Despite several work stoppages, the schedule impacts were overcome later in the year due to the support of parts from the Customer and manpower surges by the Subcontractor.

Additional uncertainty was the condition of the legacy aircraft upon induction to the retrofit line. The associated unplanned work, known as Over and Above (O&A), was inadequately estimated for the entire program and became a multi-million-dollar program of its own on top of the retrofit effort. In order to properly manage the magnitude, a thorough O&A process was established and assigned its own program management team early in the program. Close collaboration with the USG allowed LM and the Subcontractor to timely evaluate, quantify, procure, and supply tens of thousands of items required to address the O&A gaps. The Subcontractor was able to increase staffing when necessary to bring delayed aircraft back to schedule, particularly in the final 18 months of the program.

To mitigate the risk of workforce attrition, a demand-leveled skillset matrix was developed based on remaining aircraft in work and highlighted the critical support needed to complete the program. LM Aero also prepared completion incentives to these key personnel. The Subcontractor's executive management frequently held factory-wide meetings to connect with the personnel, and technicians were guaranteed placement and priority on other Subcontractor programs after completion of VUP. Due to these collective efforts, the attrition risk was averted and a smooth repatriation process for LM Aero was underway as the final delivery neared.

Complexity: This was the first, largest, and most complex F-16 upgrade attempted in the 50-year history of the platform. Since inception of VUP in 2012, three follow-on Viper upgrade programs have been initiated – yet none of them as complex as this first upgrade program. The magnitude of the O&A demand on the program essentially converted what started as an “upgrade” program to an “overhaul” program. Working with a 30-year old platform, O&A issues would often highlight legacy parts that were no longer in production. Legacy parts demand forced the Customer and SPO to pull from non-traditional sources across the vast fleets and material supporting F-16 worldwide. It should be noted that these challenges were managed with non-English speaking technicians following English technical orders, drawings, and released engineering. Work plans had to be tailored to the work culture and styles of the Customer, which demanded flexibility and adaptability by the in-country team to manage the operations day to day.

Ambiguity: Information quickly ages in a fast-paced operation and relationships atrophy without constant communication. Production line rhythm coupled with the variety of daily issues created a challenging environment for information flow. LM Aero and the SPO teams devised weekly and monthly cadences grounded in data from the production line (ILIAS and SIMIO modeling) to maintain common understanding of schedule impacts, aircraft delays, part shortages, and other risks. The Schedule Council was established with clear, unambiguous goals and requirements, to assess schedule impacts and

attribution to either party for responsibility. Because these discussions can be contentious by nature, a separate Adjudication Board was established to make timely decisions and attributions of ownership. Mutually defining how the teams would address matters of disagreement *ahead of time*, LM and the SPO had an agreed upon concept of operations to provide clarity through occasional disagreement.

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?**

To ensure quality and safety, various metrics were closely tracked across the modification site.

Examples include:

- Production Floor Walk-Around Defect Analysis: Findings were tracked by category to identify root causes and drive corrective actions.
- To mitigate staffing risk from safety mishaps, on-site leadership built safety into the culture through Lockheed Martin's Target Zero Leader program. The VUP program was awarded the 2023 Lockheed Martin Corporation Environmental Safety and Health Excellence Award for outstanding safety performance.
- Quality Inspection Pass Rate: Acceptance rates for quality buy-offs were tracked with annual improvement goals.
- Foreign Object Debris (FOD) Audit Rates: Senior leaders performed routine and random inspections to prevent foreign objects from damaging personnel or products.
- Customer Reported Defects: Outgoing Product Quality Level tracked reported issues providing for analysis and implementation of corrective actions.

To manage schedule, VUP continuously updated:

- SIMIO models for constrains identification and mitigation;
- Schedule Performance Indices and Cost Performance Indices at the aircraft and SWBS levels; and
- ILIAS supply chain dashboards reflecting parts supply performance against need dates

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

At the modification site, LM Aero and the Subcontractor focused on improving the quality of our products over time in all reported areas. The most comprehensive indicator was the quality of the final product delivered to the customer. The trend on Outgoing Product Quality Level (OQPL), calculated based on post-delivery reports after the Customer's acceptance inspections, portrays how the team was able to significantly decrease the average customer-reported defects even as number of aircraft deliveries increased. Figure 3 demonstrates the effectiveness of the controls developed and implemented to mitigate.

The SIMIO-model program completion dates were tracked with weekly updates. The stop-work events in 2023 were reflected in the modeled program completion date and spurred action by all parties in the recovery. Ultimately, impacts were overcome with successful completion in 2023.

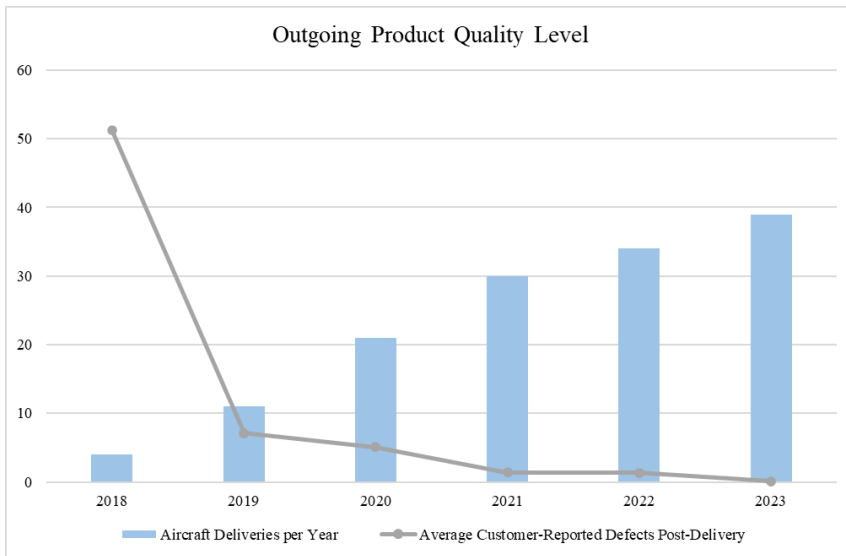


Figure 3 Quality Improvements Shown By Decrease in Defects Reported After Delivery

A more telling indicator of VUP’s ability to improve performance over time was the significant decrease in span times required to complete modification on an aircraft, as shown in Figure 4. The average span time for deliveries in the last year of VUP was 65% less than the average span time for the first year of deliveries. This was accomplished using ILIAS as a single source of truth data, enabling a single perspective on program execution and reducing the time for decisions.

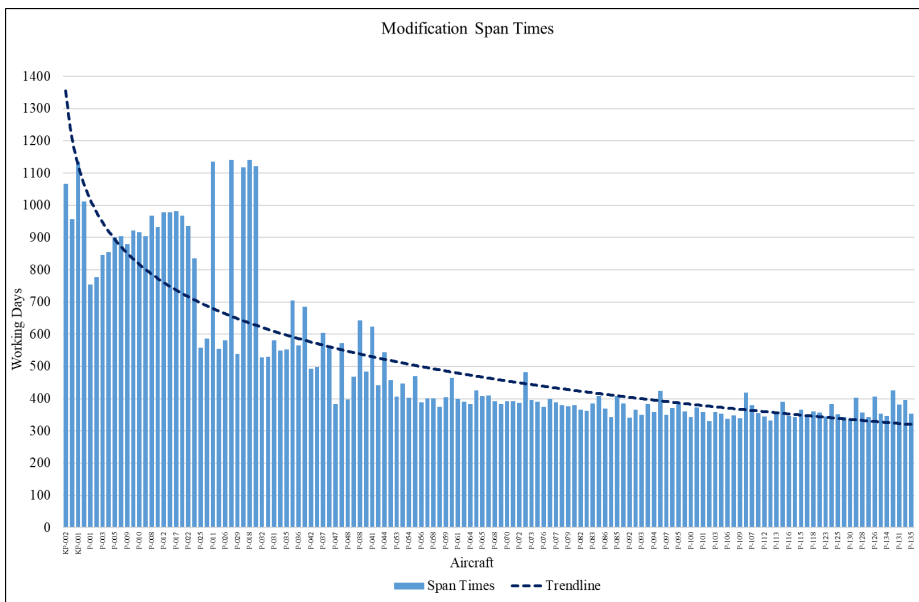


Figure 4 Aircraft Modification Span Times throughout the Program

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

While early projections from the SIMIO model forecasted 0-2 aircraft deliveries per month and an overall program completion in 2027, our team utilized these metrics to understand areas of constraint so that targeted improvements could be developed. The impacts of our continuous improvement efforts were

most clearly seen in the significant reduction of aircraft modification span times (Figure 4) throughout the program. Ultimately, program performance exceeded the forecast models and customer expectations when the last aircraft was delivered on December 19, 2023.

Our SIMIO models, schedule performance indices, and cost performance indices forecasted completion dates of crewplan milestones and predicted bottleneck resources based on current performance trends. Production leaders utilized these projections and indices to lead their strategies on resource allocation and prioritization. For example, in situations when our flight schedules or engine runs conflicted with exercises at the neighboring Air Force base or local school exams, we reviewed our metric conditions to understand how we could reshuffle our tasks. The data allowed us to make key decisions and maintain solid relationships with the local community. Ultimately, VUP achieved 21 consecutive months of contractual deliveries of 3 aircraft per month.