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

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Thank you for participating,

Gregory Hamilton
President
Aviation Week Network

Acknowledged, agreed, and submitted by

Pratyush Kumar

Nominee's Signature — Date: 4/27/2022

Nominee's Name (please print): Prat Kumar

Title (please print): Vice President and Program Manager, Boeing F-15 Programs

Company (please print): The Boeing Company

NOMINATION FORM

Name of Program: Full-Sized Determinant Assembly (FSDA) Implementation on the F-15 Program

Name of Program Leader: Prat Kumar, Vice President & Program Manager, Boeing F-15 Programs

Phone Number: (314) 233-3965 | (314) 513-2357

Email: prat.kumar@boeing.com

Postal Address: 100 Airport Way, M/C: S100-2280, St. Louis, MO 63134

[X] Customer Approved

- Date: 24 May 2022
- Customer Contact (name/title/organization/phone): Jimmy C. Bailey/Deputy Chief F-15 Division/ AFLCMC/WAQ/(478) 926-2902

[ ] Supplier Approved (if named in this nomination form)

- Date: ______
- Supplier Contact (name/title/organization/phone): ______

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

EXECUTIVE SUMMARY: Make the Case for Excellence *(Value: 10 pts)*
What is the vision for this program/project? What unique characteristics and properties qualify this program for consideration?
(12 pt. Times New Roman) LIMIT YOUR NARRATIVE TO THIS PAGE.

The F-15EX program represents the Department of Defense's (DoD) first production platform to employ Full-Sized Determinant Assembly (FSDA) advanced manufacturing processes. The U.S. Air Force's vision for F-15EX is to be a rapidly-fielded, affordable and future-ready fighter that will serve as a key element of the integrated fleet for decades to come. FSDA relies on digital engineering of the aircraft with model-based designs to allow for precision machining. Parts with full-sized holes, drilled using Computer Numerically Controlled (CNC) machines, are assembled with simple holding tools.

F-15EX is designated a Middle Tier of Acquisition (MTA) Rapid Fielding Program to ensure quick delivery of operationally relevant capabilities to the warfighter. With pressures on budgets and the need to scale up production quickly, the F-15EX program incorporated the FSDA process initially prototyped on the T-X (christened as T-7A) program. The F-15 team introduced digital engineering into an existing platform, one section at a time, to minimize risk and ensure timely execution.

This approach delivered significant benefits to the U.S. Air Force (USAF) and Boeing:

- *Producibility*: The F-15EX is significantly easier to manufacture relative to previous F-15 variants. FSDA sections of the jet are assembled by mechanics with far less need for training, using simple tools. This allows efficient ramp-up of production rate.
- *Higher Quality*: Precision drilling of holes using contemporary CNC machines eliminates the human skill (or lack thereof) as a source of defect creation.
- *Increased Consistency*: Precision machining enables consistent, nearly-shimless assembly of the aircraft. FSDA parts are nearly identical and fully interchangeable.
- *Affordability*: The recurring cost per jet goes down by $2.4M as a result of digitally engineered FSDA manufacturing of the nose barrel, wings, and forward fuselage.
- *Improved Maintenance*: FSDA enables interchangeability of parts facilitating easy replacement, avoiding expensive repair and making it affordable to sustain the aircraft.
- *Capital Optimization*: FSDA eliminates the need for fixed, monolithic tooling and reduces the space needed for factory set up, optimizing capital outlay.
- *Rapid, Seamless Upgrades*: Fully defined digital models enable rapid and affordable insertion of future technologies and Line Replaceable Units (LRUs) in the aircraft.
- *Enhanced Safety*: The FSDA advanced manufacturing process makes assembly more ergonomic, thereby reducing/eliminating the risk of repetitive stress injuries.

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.

VALUE CREATION *(Value: 15 pts)*
Please respond to the following prompt:

- Clearly define the value of this program/project for the corporation
- Clearly define the value of this program/project to your customer
- Clearly define the value of this program/project to members of your team
- Clearly define the contribution of this program/project to the greater good (society, security, etc.)

(12 pt. Times Roman)

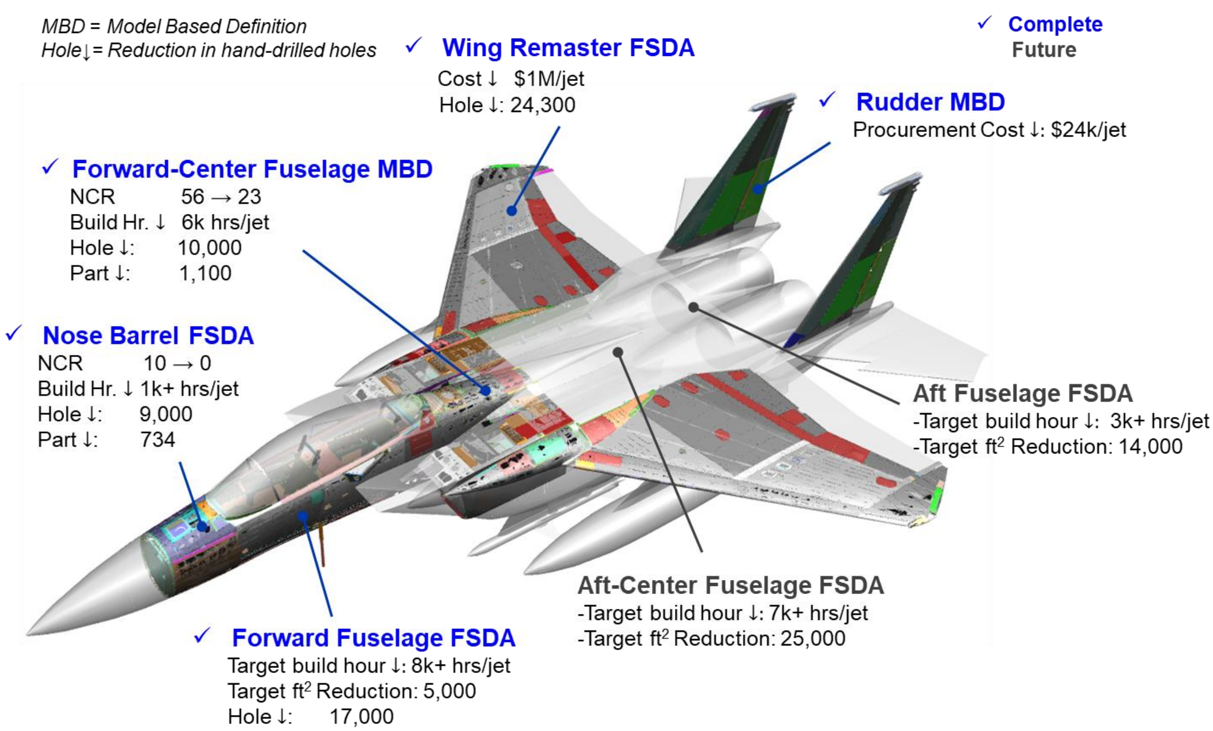


Figure 1: FSDA-Driven Improvements in Cost and Quality

Confronted with the task of maintaining capacity while simultaneously increasing capability in the face of declining budgets, the U.S. Air Force required a solution that was readily-available, affordable and future adaptable. FSDA manufacturing in full rate production helped meet that challenge.

The F-15EX platform meets the U.S. Government's budget targets, is capable of tripling its production rate, is designed for seamless technology insertion in the future and is easier to maintain. It no longers requires hundreds of thousands of hand-drilled holes by a decades-trained workforce. The traditional build, which requires a highly skilled workforce, would have hampered the scaling up of production rate.

Value to Boeing

The F-15EX program represents two pivotal transformations for Boeing: one, the first full rate production platform to employ FSDA advanced manufacturing processes. Two, the renewal of a franchise program.

In bringing the F-15EX to life, Boeing embraced digital design, increased competition within the supply base, minimized monolithic fixtures, introduced increased automation and tooling and reduced hole drilling – all of which resulted in improved quality, ergonomics and affordability. In areas where Boeing fully remastered the airplane to digital design, there have been significant touch labor reductions.

Another key benefit of designing, integrating and testing in a digital environment is that issues could be identified long before they arose in operating and sustainment environments, which ultimately delivers greater value throughout the life cycle of the product. What the F-15EX program has accomplished – on an enduring platform nonetheless – will support state-of-the art manufacturing efforts across the Boeing enterprise.

The F-15 is globally renowned for its unique performance characteristics. With the recent F-15EX, the production line will remain active for the foreseeable future, and the aircraft will remain in operation through the 2050s. Bringing 21st century technology to the design and manufacturing of the aircraft shows the program is still driving positive change in the industry. This not only increases USAF capability, but also promotes the retention and recruiting of top talent for the team.

Value to the U.S. Air Force

The F-15EX has combined global investments in technological advancements in avionics & sensors with digital engineering and advanced manufacturing techniques to deliver $2.4M in savings per aircraft. The F-15EX program delivered the first two test jets to the U.S. Air Force merely nine months after contract, with production jets expected within three years. All of this was accomplished while increasing the production rate from 12 to 18 aircraft per year, with the program aiming to reach a production rate of 24 aircraft per year.

Designed to incorporate an open mission systems architecture powered by a high-speed processor, the F-15EX is built to evolve from day one to seamlessly plug in new technologies such as next-generation sensors, hypersonic payloads and manned-unmanned teaming – better aligning with the U.S. Air Force for future net-enabled warfare. Designing the F-15EX in this way enables the Air Force to use either Boeing or third-party software to maximize the warfighter's flexibility to rapidly upgrade or field new capabilities regardless of vendor.

The F-15, which represents the first full rate production program to implement FSDA, serves as a pathfinder for the manufacturing of next-generation aircraft.

Value to the F-15EX Team

The F-15 team is no stranger to revolutionizing the defense industry. From design through sustainment, the F-15EX program's advanced manufacturing brings exponential benefits downstream – from improved ergonomics and safety to simplifying demands on suppliers. Model Based Engineering (MBE)-driven design also simplifies structures, which relieves pressure on niche supply chain choke points while driving consistent first-time quality throughout the entire process. These qualities established the building blocks for supplier empowerment within the overall process, which ultimately created a successful environment in which FSDA can be executed at scale.

The technological advancements within the design aspect of FSDA allow for the re-engineering of how workers interact with the product. Less holes being drilled creates a quieter working environment, reduces the amount of time being spent in uncomfortable table positions and reduces the risk of recurring injuries. As a testament to this, the FSDA wing and nose barrel teams reached more than 1,000 days without a lost workday due to injury.

Value to the Greater Good

FSDA generates streamlined operation and maintenance processes related to modifications and parts replacement, thereby driving an inherent increase in aircraft readiness. This directly contributes to improved national security and effective resource management, such as ensuring that strategic assets are readily available for deployment.

As digital engineering and advanced manufacturing processes become more widely used across all industries, the F-15EX program offers a case study as to how to increase the competitiveness of the United States industrial base. By implementing FSDA on a full rate production program, work that had previously been performed internationally has now come back to the U.S., thereby strengthening the global competitiveness and capabilities of the country and getting her ready for the future aerospace and defense requirements.

METRICS (Value: 15 pts)

Please respond to the following prompt:

- What are your predictive metrics?
- How did you perform against these metrics?
- How do your predictive metrics drive action toward program excellence? Please provide examples.

(12 pt. Times Roman)

The F-15 program used a robust suite of predictive metrics based on past redesign efforts on the F-15 and other Boeing platforms, focusing on how FSDA could reduce the number of holes and fasteners. The team also analyzed the number of parts that could be reduced in the assembly process, including the elimination of the time-consuming need to create and install shims in the structural assemblies. The visible reduction of build hours and the increase in quality that was portrayed in the team's analysis encouraged the program to replicate the FSDA process for the assembly of the nose barrel, wing and forward fuselage.

Metrics developed in the beginning of the project were utilized to predict the associated build hours, learning curves and costs. Figure 2 below depicts actual performance curves for the wing and nose barrel.

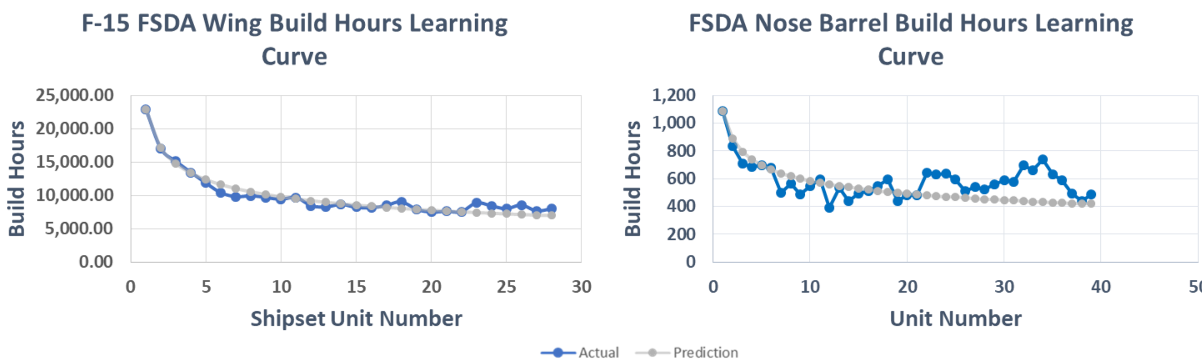


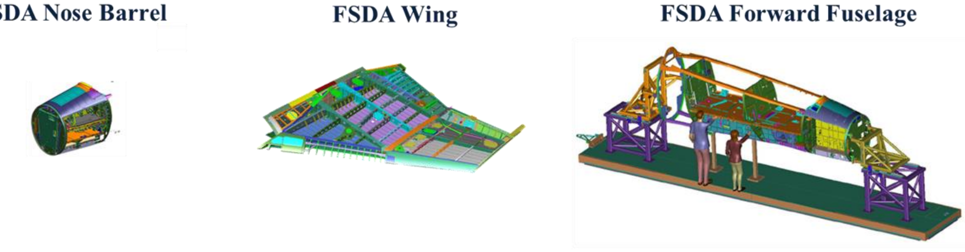
Figure 2: Build Hour Learning Curves

The strict adherence to CNC process parameters established for FSDA eliminated a majority of the shimming process, a very time-consuming activity that had negatively impacted costs, part counts and quality metrics. Ultimately, the program achieved the 100% shimless design that had been predicted.

In terms of the number of parts consolidated, holes eliminated and incorporation of FSDA, the F-15 program was able to predict the number of tools to eliminate from the legacy build process. Initially, a 90% tool reduction was predicted. Ultimately, the team achieved a 97% reduction on the nose barrel and a 90% reduction on the wing.

Incorporating full-sized holes by the supplier through the use of CNC machines improves quality metrics for non-conformance by eliminating the need to drill holes by hand at time of assembly. This tends to be one of the more challenging quality issues with the build of legacy structural assemblies. While initial predictions pointed to a 90% reduction of noncomformances (NCR), the program experienced a 65% to 100% reduction across multiple efforts. Specifically, the wing shop witnessed a decline from 95 NCRs to 12 NCRs per ship set.

Based on the reduced part and tooling counts, the F-15 team developed a target metric for Production Floor Space Efficiency, aiming for a 50% reduction. This target was achieved on the wing and surpassed by the nose barrel, which witnessed an 80% reduction in required floor space for assembly.



	FSDA Nose Barrel	FSDA Wing	FSDA Forward Fuselage
Hole Reduction	9,000 ↓	(Remaster)	17,000 ↓
Tools	141 → 4	5,200 → 520	41
Detail Parts	1015 → 281	-	3,600 → 2,250
Fasteners	13,000 → 3,600	17,500	46,500 → 28,700
Drilling NCRs	10 → 0	20 → 7	To Be Determined
Floor Space	6,200 FT^2 → 1,300 FT^2	27,200 FT^2 → 13,500 FT^2	32,000 FT^2 → 8,000 FT^2
Stations	16 → 3	24 → 9	43 → 12
Labor Hours	1,000 → 500	6,000 → 3,700	12,000 → 4,000

Figure 3: Nose Barrel, Wing and Forward Fuselage FSDA Metrics

Immersive build was also used to help improve Model Based Instructions (MBIs) and train operators. The use of digital engineering allowed visualization to be at a 1:1 scale before parts were available, helping identify size and space constraints for manufacturing.

Predictive metrics were also a critical component of the F-15 program's success, driving the actions and behaviors that the team took to meet the delivery of key components. This created a culture of continuous improvement and provided crucial lessons learned in preparation for a section-by-section FSDA approach. These predictions further enabled the F-15 program to update the factory layout (and space requirements), while also benefitting from realized build hour savings to allow for higher production rates to meet important customer needs of a critical weapons system.

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

Please respond to the following prompts:

- *10 pts:* Describe areas of VUCA faced by your program and why.
- *15 pts:* Explain how your team responded to these challenges.

(12 pt. Times Roman)

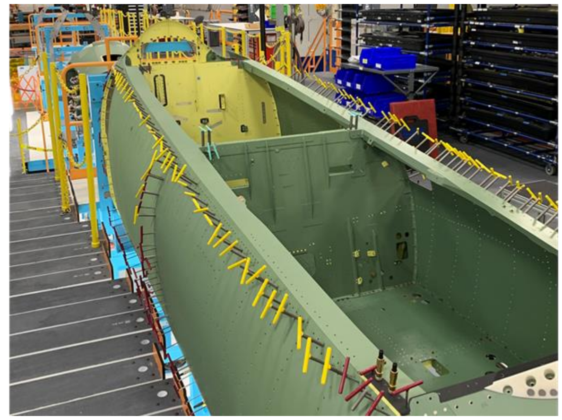
First Full Rate Production Implementation of Full-Sized Determinant Assembly

Even though new start programs at Boeing such as T-7 and MQ-25 had prototyped FSDA work, F-15 is the first full rate production program to implement this new technology in the factory. The team needed to get the first few prototypes right and ensure that the key assemblies came out on time with high quality every 13 days. In transitioning to the full rate production implementation of FSDA, the team had to ensure not just the first-time fit, but also the perfect alignment of tens of thousands of holes on the wing and forward fuselage. If the team failed, it risked production of this critical weapons system for the U.S. Air Force and customers around the world.

High precision manufacturing using contemporary CNC machines enables FSDA only if the FSDA supply base ensures strict adherence to process parameters in their factory with unprecedented levels of process control and oversight. Maintaining process and yield consistency is a true lesson learned for the F-15 program and is an imperative to maintain alignment. The F-15 team discovered that even a small percentage of misaligned holes could result in costly rework and production disruption.

To get this right, the F-15 program remastered/redesigned one aircraft section at a time, starting with the simpler sections. The team started with the nose barrel, which has 13,000 holes with simple interfaces. This area of the aircraft contains a large array of avionics installations. The F-15 team redesigned the nose barrel to be more modular for future change, while also implementing FSDA principles. The program achieved a 1,000 hour reduction in building the nose barrel and required 2 mechanics to assemble it, down from 20 mechanics at the previous manufacturer – Korea Aerospace Industries (KAI). The program reached steady state on the learning curve by 4th shipset and eliminated all defects, around 10 per shipset. Success on the nose barrel convinced the frontline factory workers who were initially skeptical to adopt this new approach.

Building on the confidence of the nose barrel, the F-15 program expanded FSDA work to a remastered wing. This effort was an order of magnitude more complex (24,000 holes) than the nose barrel and provided valuable lessons learned, including alignment, fitment and parts control. After stabilizing FSDA production on the wing for about 2 years, the F-15 team moved to a redesigned forward fuselage. This was the most complex activity to date due to the diverse systems component of the redesign. The forward fuselage systems include landing gear, cockpit design, wiring, environment control and ejection seats, among others. The step-wise approach was key to reducing volatility and uncertainty at a time when the F-15 program was doubling production rate in the factory from one jet per month to two per month.



This intentional incremental approach allowed the F-15 team to transform how this iconic jet is manufactured, one section at a time.

Each Supplier Stand-Up is a Development Effort

This approach requires precision drilling and strict process control of full-sized holes at our suppliers. Building capabilities at each FSDA supplier well before they start shipping is central to success of this new approach. An FSDA culture in the supply base goes well beyond the normal process of moving a statement of work to a new supplier. Each supplier needed to be treated as a new development effort with:

- *Detailed engineering requirements, VERICUT simulations of CNC machining and Coordinate Measuring Machine (CMM) reviews of provided designs*: Getting these reviews done in a timely manner was particularly challenging during the pandemic but it made all the difference in getting the supply base ready for FSDA.
- *Deployment of quality engineers at supplier locations to ensure proper training and strict compliance to the new process control requirements*: In several cases, it required behavior change from supplier machinists. Given the fact that all holes are drilled to nominal, their machinists could not stop CNC machines until all holes were fully drilled; otherwise the reference dimensions could be lost.
- *The implementation of a first part qualification process*: The F-15 team needed to move well beyond a typical first article inspection and adopt a first part qualification process. This up-front process required intensive product and technical compliance to drive sustaining quality with continuous feedback to suppliers, emphasizing a good fit every time.

Engineering Concurrency and Complexity

On schedule-constrained programs such as a new model (F-15EX), a significant level of concurrent engineering is required. In many such situations, the iterative nature of engineering and production development has been the norm. However, given the amount of effort it takes to get the supply base ready for FSDA production, the F-15 team had to complete all engineering built-to-print drawings, model-based definitions and model-based instructions well in advance. This allowed the team to streamline design and production processes and reduce complexity for our suppliers.

Production Recoverability

The principle of Lean Manufacturing drove the F-15 team to eliminate all of the “waste” in the production process. In an ideal world, optimized tools and inventory are needed in exact amounts to meet the production rate. However, when implementing a new approach such as FSDA production, the F-15 team had to cater for a certain amount of built-in recoverability in the factory to overcome uncontrollable factors. For example, the program added assembly jigs in the wing shop to keep production active even when disruptions occurred.

Kanban is a Japanese term that translates to "signal card," referring to the reorder slip to procure more supplies. Roughly 10 days before the assembly start date, production station leads send a request for the next kit. They also keep "SOS" cards for missing parts in the kit to keep track. The FSDA kits arrive from a warehouse well before the first supply runs out, and production continues without hindrance. This reorder call creates a PULL system to pull inventory as it is needed as opposed to a system-generated PUSH.

Keeping a System View in Mind

At the outset, the F-15 team designed the wing production line to optimize tooling and floor space, and created a flow so that each wing was built in half the time of the overall factory takt. This meant that the first Left Hand (LH) wing is manufactured in half the takt time, followed by the Right Hand (RH) wing. While this lowered the tooling and material inventory, the wing shop needed to move at twice the rate of the rest of St Louis site.

The F-15 team realized that this arrangement was creating a dissonance in the system – the Defense Contract Management Agency (DCMA) and other support processes moved at the speed of the rest of the factory. This meant that wing shop didn't always get attention at the faster speed it needed, disrupting the flow in the shop and upsetting the production process.

The team recognized this system mismatch by the second jet and pivoted to a concurrent LH/RH wing build process. This pivot required the addition of more assembly jigs and more work-in-process material. However, it synchronized the wing shop to the overall site takt and improved flow in the factory. This turned out to be a big breakthrough in stabilizing FSDA production of the wings.

ORGANIZATIONAL BEST PRACTICES AND TEAM LEADERSHIP *(Value: 35 pts)*

Please respond to the following prompts

- *15 pts:* Describe the innovative tools and systems used by your team
- *10 pts:* Define how you developed, led and managed people
- *10 pts:* How did you leverage skills and technologies of your suppliers?

(12 pt. Times Roman)

The F-15EX team implemented a number of innovative systems and tools during the production implementation of FSDA.

Innovative Systems – FSDA as a Team Sport

This effort required a cross-functional, integrated partnership that was necessary for the successful implementation of FSDA into an active production line. The mindset instilled within the team is that FSDA is a team sport and it takes everybody working as one to succeed. This could be seen in the cross-functional surge support of team leaders walking the floor daily to identify and eliminate bottlenecks. The establishment and utilization of a democratized parts database allowed all functions to access a mutual repository of information, while weekly functional deep dives drove cadence in all FSDA activities.

Innovative Tools – 3D Designs and Simulations
Unique 3D design tools for prediction and structural simulations were utilized to improve processes and communication. Hololens glasses were developed for the Operations team to allow them to visualize 3D data projected on the wing to drive efficiency and manufacturability in the wing shop.

Assembly simulation of the new factory line allowed for the validation of manufacturing plans and facility layout. In addition, process modeling – which accurately represented processes including their inherent variability and interdependencies – was used to plan, design and improve proposed manufacturing, logistics and other operational systems in order to simulate process behaviors and conduct predictive analysis on potential changes.

Innovative Processes – Supply Chain Readiness
To drive supply chain readiness, the F-15 program implemented daily "Line of Balance Reviews" with suppliers. This new practice enabled the sharing of 3D models with suppliers for a full understanding of FSDA requirements and ensured that stringent FSDA requirements were met. To validate the fit up of critical FSDA parts and ensure first-time quality, fit checks were performed before first station.

Developing Our People – Workforce Training
Manufacturing with FSDA required the workforce to learn new processes, such as using model-based instructions and adapting to shimless builds. By leveraging the digital design of the new structures, the Engineering team delivered a virtual training regime to the Manufacturing team through virtual build that reduces risks and provides feedback to improve the build process. Build reviews were conducted with the Operations team during the Engineering Design Phase. After engineering release, preliminary Work Instructions (WIs) were then reviewed with the Operations team and modified based on their feedback. After the WIs were released, they were reviewed with Operations prior to first build.

These tools expedited training and provided "hands-on" experience before parts arrived to the assembly line. Before first-time parts entered their first station, the manufacturers at the station completed physical practice runs with a dual purpose: (1) to test the team's virtual familiarity with the components and (2) to ensure all articles met required specifications.

Developing Our People – Transferring Knowledge across the Enterprise
A wealth of FSDA knowledge was introduced to the F-15 program by Enterprise experts that participated in prototype applications of FSDA parts and processes. As these experts assimilated into, and further defined, the F-15 program – from Supply Chain Management to Engineering – hundreds across the program's workforce learned about digital design best practices for the first time.

The knowledge base was further expanded with an emphasis on continuous learning and a growth mindset among our people. For example, first-time loads into a new station for FSDA were welcomed as learning opportunities, a crucial step for the team to work down the learning curve. This mindset extended to our Structural Engineering team's employment, and frequent analysis, of a build to package visualization that broadcast the team's progress to plan. Continual reviews and collaboration improved the team's acumen with digital design and capability to meet future challenges.

Exposing our people to a productionized application of FSDA, along with lessons learned from each phase of the program's journey, has multiplied the number of Boeing employees that can share their knowledge across programs. Developing the F-15 team has enabled the future development of workforces throughout the Boeing Company.

Developing Our People – Engagements with our Customer

Interactions with our customer facilitated the proper execution of the FSDA implementation and introduced large portions of the F-15 workforce to how our customers value our product and identify areas for its improvement. Our people get to interact with this perspective in a range of forums – from technical reviews during technical interchange meetings and design reviews to customer visits to the wing shop and production line. In 2021, there were over 30 visits to the production line from the USAF, U.S. government officials and foreign customers. These interactions challenge the workforce to understand and think like our customers – enabling them to approach challenges with fresh motivation and anticipate new roadblocks.

Developing Our People – Special Projects

The implementation of innovative principles and tools on the F-15 program afforded an abundance of high-visibility projects for high-potential leaders, both within and outside of the program. These assignments ranged from overseeing the stand-up of new stations for forward fuselage to leading cross-functional integration for different sections along the journey. Providing challenging opportunities plays an integral part in the program's effort to develop its future leaders.

Leading and Managing Our People – Bolstering Community and Broadcasting Vision

Maintaining a culture of pride among F-15 teammates drives the program to embrace innovation and collaboration to meet the program's vision. As such, the F-15 workforce is commonly referred to as "Eagle Country" by members and leadership. Three forms of engagement form the backbone of the program, sharing the collective vision for FSDA and beyond:

- *All-Employee Engagements*: Virtual and in-person quarterly engagements provide a roadmap for the program and solicit feedback from the team on areas of improvement.
- *Teammate of the Month:* The F-15 leadership team recognizes one teammate each month for their contributions with an F-15 "Rage Eagle" (the mascot of the program), a feature in the weekly bulletin and other awards.
- *Spotlight Videos:* These periodic videos are distributed to "Eagle Country" and highlight a recent development among the program, from the stand-up of the wing shop to the successful completion of the first FSDA nose barrel.

These engagements, along with activities like small group roundtables and factory walks, bolster the F-15 community's alignment to the vision while celebrating achievements that could otherwise go unseen.

Leveraging Suppliers – Skills and Technologies

New digital design for legacy parts allows the implementation of the FSDA concept that leverages the present-day capability of our supplier’s CNC machines to control hole location and part fitment. This allows our suppliers to drill matching holes, significantly improving quality on the assembly line. Additionally, parts during assembly could now fit without the need for shims, and fasteners are simply inserted in the pre-drilled holes that align accurately enough to meet engineering requirements.

Boeing’s FSDA supplier assessment process looks at not only the supplier’s machining and inspection capabilities, but also at the heart of the supplier’s process control. Knowing that FSDA is a small percentage of any given supplier’s backlog, it is critical that Boeing assesses and evolves the supplier’s capability to manage traditional vs. FSDA machining approaches, while keeping FSDA best practices at the forefront of the supplier’s FSDA journey. To achieve the effective implementation of these best practices, Boeing Supplier Mangment chose a highly selective group of suppliers to support the F-15’s FSDA statement of work. These suppliers demonstrated the abilty to rapidly embrace the cultural and tactical changes required for a successful FSDA program and continue to be valuable partners in Boeing’s success.