2013 Program Excellence Award

Phase I Submission
Name of Program: F135 Engine Program

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Bio for program leader:

Christopher M. Flynn
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Chris Flynn is vice president, F135/F119 Programs & Maintenance Data and Support Equipment (MDSE). In this role, Chris is responsible for the development, production and sustainment of the F135 and F119 fifth generation fighter engine. In addition, Chris leads Pratt & Whitney’s MDSE team, supporting all military and commercial product lines and providing customers with innovative and cost-effective maintenance solutions.

Prior to this assignment, Chris held the position of vice president, Manufacturing Programs, Military Engines. In that position, he was responsible for program management excellence and executing the industrialization and cost reduction plans for the F135 as well as other military engine programs. Chris has prior experience in Military Engines as director, F135 Programs, and as director of the F119 Program.

Chris joined Pratt & Whitney in 1984 and has held positions of increasing responsibility in Engine Test, Flight Test, Project Engineering, Manufacturing Liaison, and Program Management. Chris was also the manager of Military After-market Services, where he was responsible for production and strategic growth for all military engines aftermarket activity. He has served as the F100-PW-229 Program Manager and guided development of the initial engine enhancement program for the F100-PW-229 engine powering F-15’s and F-16’s around the world.

Chris earned a Bachelor of Science degree in Mechanical Engineering from Rose Hulman Institute of Technology and a Master of Business Administration from the University of Connecticut.
F135 PROGRAM EXCELLENCE, BASIS FOR RECOGNITION

The F135 engine, the sole propulsion system for the F-35 Lightning II Joint Strike Fighter, has matured through development and initial low rate production phases. The future success of the program lies in the ability to respond to the challenges of increased production ramp rates, continued cost pressure and sustaining safety, reliability and readiness support of our customers as increasing numbers of operational aircraft take to the skies. Not an unusual for a new engine program except for the added uncertainty of sequestration, schedule and volume change, and international customer participation. Despite the dramatic changes since program inception, P&W, through the application of Achieving Competitive Excellence (ACE), standard work tools, the disciplines of EVMS and IMS, exceptional leadership and a dedicated, well trained workforce, continues to deliver performance excellence and customer delight.

F135 PROGRAM PHASE TRANSITION: SDD TO PRODUCTION AND SUSTAINMENT

The F135 design and development was built upon an evolution of technologies to meet the unique requirements of the fifth-generation F-35 weapon system. The unique design of the F135 combines stealth technologies with high thrust-to-weight performance to provide exceptional maneuverability and survivability. The development phase of the program has been extended through CY2018 enabling continued support and completion of the F135 ground test and F-35 flight test program plan.

The F-35 Joint Program Office declared Initial Service Release (ISR) of the F-35 for both CTOL and STOVL variants in CY2010. Since then, the unparalleled 98% mission readiness rate of the F135 during flight testing has been a significant contributor to the F-35 meeting or exceeding critical performance criteria in its safe and reliable introduction into operational service. Keys to the F-35’s ability to achieve its objectives are the reliability, affordability, performance and supportability of its Pratt & Whitney F135 propulsion system. Initial deliveries of production of operational configuration F135 engines began in CY2010.

The F135 is currently in low rate initial production. The final assembly line in Middletown, Connecticut has the tooling and the skilled workers demonstrating a 2X capacity year over year improvement. Pratt & Whitney has delivered 87 production F135 engines through 2012. Concurrently, Pratt & Whitney sustains the F135 through configuration management, engineering, services, modifications, modernization, supply chain management, maintenance and heavy repair.

The F135 engine has accrued over 25,000 test hours, 1055 sorties and over 1550 operational flight hours. Throughout development testing and initial operational deployment, there have...
Pratt & Whitney’s Integrated Program Management process, coupled with its ISO-9001-certified procedures, emphasizes teamwork, quality of product, and integration of requirements and schedule across the F135 Enterprise. Chaired by the Program Director, the Integrated Program Management Team (IPMT) has overall authority for budget, allocation of resources and schedule, and responsibility for achievement of customer requirements and affordability goals.

The F135 IPMT includes voting membership for the system-level team leaders, functional specialists, and subcontractor program managers. Although ultimately responsible for successful program execution, the Program Director uses the IPMT to assist him in making informed decisions and to facilitate execution of the management plan.

Pratt & Whitney’s Engineering Standard Work (ESW) provides methods for capturing both process and product knowledge. It provides a disciplined approach to achieving business process with efficiency and agility and to producing high-quality products that are ready for reliable service. The application of ESW provides a means to record, control and access the elements of standard work necessary to produce definable and predictable products in a repeatable manner and to record and retain the results of the work as quality records as required by written procedures.

Engineering Standard Work uses a document management system that provides version control and access security for all documents. Pratt & Whitney’s ESW provides up-to-date work instructions, criteria documents, workflow maps, resource plans, design standards, and reference documents for use by Engineering for managing and controlling design, development and product improvement activities.

Pratt & Whitney’s Engineering lesson learned management process prevents potential future mistakes and mistake recurrences. The goal of the Lessons Learned process is to ensure engineering issues resulting from test and operational events are driven to root-cause understanding, and corrective and preventive action closure - avoiding future mistakes and preventing problem recurrence. The knowledge derived from experience is used to enhance product design. Pratt & Whitney Integrated Product Teams (IPTs) review Lessons Learned at the initiation of each new design task.
VALUE CHAIN OPTIMIZATION

With a high percentage of F135 content being provided by suppliers, the program’s success is significantly influenced by the performance of subcontractors. Therefore, a key element of Pratt & Whitney’s strategy is a comprehensive Subcontract Management Plan capitalizing on lessons learned and best practices from both military and commercial engine programs.

Pratt & Whitney’s procurement system, which is approved by the U.S. Government, employs a focused process known as Strategic Sourcing to select subcontractors and suppliers. It uses specific supplier evaluation criteria to ensure Pratt & Whitney is partnered with the best suppliers: manufacturing excellence, strategic compatibility, superior technology, world class quality, delivery performance and cost leadership.

The supply chain is under constant surveillance by Pratt & Whitney’s Supplier Quality Assurance (SQA) organization, which conducts periodic audits to ensure suppliers are following agreed-to processes and quality control procedures. The SQA organization also works with suppliers to reduce the cost of poor quality and improve productivity using Achieving Competitive Excellence (ACE) tools.

Initiatives, such as supplier lead-time reductions; direct-shipping; report cards; material reduction and standardization; online bidding and communication; volume and long-term agreements; and supplier integrated product development (IPD) involvement, contribute to a successful F135 Program. The quality culture embodied in the ACE program recognizes and rewards supplier excellence, resulting in Long-Term Relationships Based on Quality and Performance.

A key feature of Pratt & Whitney’s IPD process is the Integration of Major Subcontractors. Pratt & Whitney administers key subcontractors through Integrated Product Teams (IPT’s). The IPT’s are responsible for major hardware components, from F135 design through sustainment. The IPT’s provide clear visibility into supplier performance and opportunities for improvement. From the onset of the program, Pratt & Whitney’s Subcontract Management Plan has been focused on the objective of a smooth transition to subsequent F135 Program phases including production and sustainment. The essence of this strategy is to achieve the Lowest Life-Cycle Cost (LCC).
F135 WAR ON COST

The Cost Challenge
In conjunction with a disciplined approach to development phase activity, the combination of achieving production ramp deliveries and the optimization of the supply base, P&W has been successful to achieve the affordability promise made to the JPO.

Pratt & Whitney Develops the F135 War on Cost
In response to the F135 affordability challenge, the War on Cost was developed. The War on Cost is a focused cost reduction effort initiated in the 2nd quarter of 2009 and continues today. Dedicated resources were identified to drive cost reduction in four critical areas: purchasing, engineering, process improvements and overhead. With a goal to reach the customer’s expectation of an $8M engine by the 250th unit (T250), the purchasing team was challenged with developing sourcing strategies and leverage volume spending across all programs to negotiate cost reductions with suppliers. The engineering team was tasked with implementing engineering and design changes to improve the producibility and affordability of both purchased and internally manufactured hardware. The process improvement team was asked to use process improvement tools and methodologies to improve efficiencies and drive improved productivity. Last, the overhead team was charged with identifying improvements in indirect manufacturing costs to reduce the factory burden and lower the F135 engine cost.

F135 War-on-Cost Application of A.C.E. Tools
The cross-functional War-on-Cost team used the Achieving Competitive Excellence (A.C.E.) tools to improve affordability on the F135 engine:

- Standard Work: To develop, fund and track more than 600 cost reduction initiatives being worked by cross functional teams.
- Six Step Visual Workflow Process: The process to identify cost saving ideas, to mature them and to ultimately capture the savings.
- Passport Process: Gated allocation of task funding to ensure efficient use of government and P&W investments.
- Task Milestone QCPC: Track turnbacks for missed milestones, identify drivers, determine root cause, and implement corrective actions (fix systemic issues).
- 6S: A master database was developed to document and manage all cost reduction tasks.

War-on-Cost Results
The results achieved by the F135 Affordability Team, tasked with executing the War on Cost, have met program commitments, with $5.5M (35%) in cost reduction since its kick off. Over the course of 2011 and 2012, the F135 program was able to deliver a total of $2.9M in cost reduction through teamwork and coordination in four focus areas; purchasing, engineering, operations and overhead rate reduction.

The War-on-Cost effort has become a standard for all P&W programs, as well as a best practice