2014 Program Excellence Award

The Aviation Week Program Excellence Award initiative was developed in 2004 in recognition of the need to develop future program leaders who in addition to facing challenges similar to those of the past, will also have to deal with increasing technical, organizational and business complexities. This effort has resulted in improvements in several key areas, but execution challenges remain. Concurrently, the Department of Defense and NASA have expanded focus on professional development for strategic program leaders. This award process is designed to identify best practices in areas of needed improvement and to celebrate performance accomplishments.

The goal of this initiative is to recognize and promote program excellence in terms of performance, leadership capability, and outstanding lessons that can and will be shared broadly within the aerospace and defense community. By taking part in the submission process, nominees agree to be part of this program to share information.

Framework
The criteria for this award are based on the best elements of program/project leadership excellence programs developed by the Strategic Project Leadership Program of the Technological Leadership Institute, the NIST Malcolm Baldrige National Quality Awards, and the NASA/USRA Center for Program/Project Management Research.

The award will examine four critical areas according to the following framework:

For 2014, the evaluation will also include focus within these four categories on utilization of earned value as a more agile/responsive tool; further risk/issue/opportunity management processes to assure teams address risk and capitalize upon opportunity; understanding of integrating export opportunity into program operation; and innovation in business models, processes, teaming approaches and overall execution. The Evaluation Team will determine finalists and winners on the basis of scores in these four categories. The winner(s) will be featured in Aviation Week & Space Technology and at www.AviationWeek.com, as well
as honored at the annual Aviation Week Aerospace & Defense Programs Conference to be held November 19-20 in Phoenix, Arizona.

Entries will be evaluated on the basis of performance for the previous 36 months.

Nominations are encouraged from commercial aerospace, space (commercial and defense), defense and security sectors and should be made in one category only:

- Sub-System R&D/SDD
- Sub-System Production
- Sub-System Sustainment
- System R&D/SDD
- System Production
- System Sustainment
- Special Projects

In each category and based on meeting a threshold score to be determined by the Evaluation Team, finalists will be chosen on the basis of scoring on Phase 1 and Phase 2 entries and analysis by the Evaluation Team. Aviation Week retains the final responsibility for selection.

The Evaluation Team reserves the right to choose no winners and to name an Overall Winner, if the nominations so warrant, based on the combination of scoring against the criteria, best practices, and game-changing leadership.

2014 Evaluation Team
The Evaluation Team for the 2014 Aviation Week Program Excellence Awards includes:
Michael Bruno, Deputy Managing Editor-Military, Aviation Week
Jean Chamberlin, VP Program Management, Boeing Defense, Space & Security
Ed Hoffman, Chief Knowledge Officer, NASA
Ron Morey, Sr. Director Fixed Wing Solutions, Rockwell Collins
Warren Nechtman, VP Program Management & Business Operations, Honeywell Aerospace
Detra Sarris, Corporate Director of Programs, Northrop Grumman Corp.
Aaron Shenhar, Founder, Strategic Project Leadership
Jesse Stewart, Professor of Program Management, Defense Acquisition University
Jeffrey J. Wilcox, VP Engineering, Lockheed Martin Corp.

Intellectual Property
Note: Individuals outside your company review award submissions. All information submitted should address the program’s management, leadership, and processes, and not any otherwise classified or proprietary topic. Do not include any materials marked Proprietary. All documents will be copied and distributed via the Internet to the aforementioned Evaluation Team and will be considered as public knowledge.

By submitting an entry to the Aviation Week Program Excellence Awards program, you are indicating agreement to participate in outreach efforts to share Lessons Learned/Best Practices in an effort to raise the bar on program leadership across the industry. Entries may be also used for comparative research among programs to draw conclusions and lessons learned across the industry.

Format of Submission
The Program Excellence Awards process involves two phases of evaluation.

Phase 1 – Nominees submit, in narrative format, their perspective on why the program excels and identify the teachable lessons in program execution within the past 36 months (beginning January 2011). The focus in this narrative should be how the program has successfully addressed challenging issues or met seemingly difficult requirements. Note that while the technology involved is an aspect of complexity, the technology itself is not being evaluated – the leadership and execution of the program are being evaluated.

Limit this narrative to four pages, 12 point Times Roman typeface with 1” margins.
- Include with the narrative a one-page biography of the program leader, including what sets this individual apart as a leader.
Identify by name a representative of the program customer, and include phone and email information. Customers will be asked for go/no go decision regarding consideration of this program for the Aviation Week Program Excellence Award.

Phase 1 is due April 1, 2014 to chedden1@cox.net / carole.hedden@aviationweek.com

You must use the tabular format provided to submit your nomination form. You should use 12 pt. Times Roman font to fill in the tables. Submit your document as a PDF file.

Upon completion of Phase 1, narratives will be reviewed for “fit for excellence” and qualified nominees will then be provided with the Phase 2 submission form by no later than April 21. The Phase 2 forms will be due June 30, 2014. Finalists and best practices will be identified by no later than September 7.

**Submission and Questions**
Questions and submissions should be directed to
Carole Rickard Hedden
Project Leader, Aviation Week Program Excellence Initiative
chedden1@cox.net / carole.hedden@aviationweek.com
505.239.9520

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Phase I Submission
Name of Program: PW1500G Propulsion system Certification and Flight Test Program

Name of Program Leader: Graham Webb
Phone Number: 860-565-8712
Email: graham.webb@pw.utc.com
Postage Address: 400 Main St, M/S 165-10, East Hartford, CT 06033

Name of Customer Representative: Mr. Rob Dewar
Phone Number: 514-955-7916
Email: Robert.dewar@aero.bombardier.com
Bio for program leader:

Graham Webb is the Program Vice President for Pratt & Whitney’s PW1000G PurePower Engine Family. In this capacity he is responsible for managing program execution for the PW1000G engine models for the Bombardier CSeries, Mitsubishi Regional Jet, and Embraer EJet G2 aircraft. Graham was previously the Program Chief Engineer responsible for overall technical execution for all of Pratt & Whitney’s PurePower engines including the Airbus A320NEO and Irkt MC-21 aircraft 30K lb thrust variants.

Prior to this assignment, Graham was the General Manager of Pratt & Whitney Rocketdyne (PWR) Florida and Mississippi Operations where he led the profit and loss operations of the Space business with responsibility for the hydrogen fueled RL10 upper stage engines for the Atlas V and Delta IV rockets, the Space Shuttle Main engine turbopumps, the LOX/Kerosene RD-180 main boost engines for the Atlas V rocket, and the X-51 Scramjet Hypersonic Engine Programs.

Graham joined Pratt & Whitney from ALSTOM where he was General Manager of Gas Turbine Engine Technology and Development. Graham led the development and successful fielding of the GT24 (60Hz) and GT26 (50Hz) sequential combustion F-Class heavy duty industrial gas turbine engines which are deployed within combined cycle power plants for high efficiency, low emission power generation.

Prior to ALSTOM, Graham was the Director of Engineering for Honeywell International’s Military, Helicopter, Marine and Industrial Gas Turbine Engine Product Line. During this time Graham led the development and successful production implementation of T55-714A turboshaft engines for the Boeing CH-47 Chinook Helicopter.

Graham holds a Ph.D. degree from Georgia Institute of Technology in Material Science, and has published numerous technical publications. He is a Project Management Institute certified Project Management Professional (PMP).

He has successfully led development of gas turbine, hypersonic and liquid fueled rocket engines throughout his career. His leadership style embraces the concepts of emotional intelligence for team motivation and participation. He also fully embraces the fundamental principles of the Program Management Institute (PMI) for project management, as adapted for the development of complex systems with high technology content. His strong technical background, coupled with a solid understanding of project management principles has enabled him to successfully complete multiple engine development programs of high system level complexity and new technology content throughout his career.
On September 16, 2013, aviation history was made.

That’s when Pratt & Whitney’s (P&W’s) PurePower® Geared Turbofan™ (GTF) engine successfully powered Bombardier’s new CSeries airplane during its maiden flight. The takeoff was so quiet that thousands of people in attendance almost missed the event, according to numerous media reports. The significant reduction in engine noise is just one of several attributes that highlights how the PurePower engine will transform air travel and the aircraft industry. The GTF engine’s “game-changing” architecture that includes enhanced fuel efficiency and environmental performance, as well as significant operational cost improvements critical to the U.S. airline industry, marks a major event in the history of flight and is worthy of the adjective “revolutionary.”

P&W’s GTF engine has demonstrated the most significant improvement in commercial propulsion since the advent of the high-bypass engine on the Boeing 747 in the early 1970s. Indeed, the development and certification of the GTF engine by P&W was the most important achievement in aeronautics or astronautics in the United States in 2013, demonstrating that the American aerospace industry continues to lead the world in aerospace propulsion innovation and technology.

Over the past three years, thousands of members of the extended international PW1500G propulsion system program team worked together seamlessly to deliver the PW1500G GTF engine’s “game-changing” architecture through the engine validation program leading to certification by Transport Canada, followed by the highly successful first flight on the CSeries aircraft. Key deliverables and performance measures for this time period of January 2011-through December 2013 were the execution of the engine validation program, completion of Transport Canada certification deliverables, and the completion of Safety of Flight (SoF) requirements for the Bombardier customer.

The PW1500G propulsion system program is an international partnership led by P&W with major design responsible collaborators including MTU in Munich Germany, and GKN (formerly Volvo Aerospace) in Trollhatten Sweden. Design effort also occurred at Pratt & Whitney Canada which is the holder of the Engine Type Certificate, in addition to major suppliers including the United Technologies Aerospace Systems (UTAS) Engine and Controls division. The engine was certified by Transport Canada Civil Aviation (TCCA) Agency, the same agency that will ultimately certify the CSeries aircraft. In addition to the engine, the PW1500G propulsion system program included responsibility for the design and development of the nacelle, Engine Build Up (EBU), mounts and exhaust for the CSeries aircraft that are provided by United Technologies Aerospace Systems (UTAS) Aerostructures division (formerly Goodrich).

Fundamental tenets of this program included: rigorous application of Engineering Standard Work (ESW) for design and development; development of a scalable, common core for all GTF engine variants; development of all technologies to a maturity level of TRL 6 prior to the Critical
Design Review (CDR), a 3D “Common Engine” configuration management process to ensure physical interface compatibility including instrumentation; establishment of automated IT multi-site installations for exchange of approved technical data required for foreign locations and design collaborators to ensure full export compliance and mitigate export escape risk, and implementation of a fully compliant ARP4754 customer requirements validation process.

Core to successfully executing this program, was the deployment of an Integrated Program Management Team (IPMT). The IPMT led the coordinated execution of the program throughout all elements of the business, ensures that program decisions are made with the input of all affected stakeholders, and that decisions are communicated to ensure aligned implementation of direction. The IPMT’s collective efforts were aligned to a defined Integrated Product Development (IPD) process, a gated process based on prior programs to ensure successful execution of major engine development programs. The members of the cross-functional IPMT comprised all major functions including engineering, supply chain, manufacturing, partnership, legal, marketing, sales, quality and finance. The team, led by the Vice President of the program, was collectively responsible for executing the program to defined job ticket criteria sponsored by Pratt & Whitney’s President and Executive committee, under authorization from the United Technologies Board of Directors.

Pratt & Whitney’s IPD process has been constructed to ensure that products are developed and integrated to fully meet customer contractual requirements according to defined standard work processes with defined metrics. In the IPD phase of the program, customer and certification requirements of the propulsion system were validated by the execution of a multi-engine validation program, in addition to hundreds of individual component validation tests. The coordination of these efforts was established by the Engine Validation Plan (EVP), which was the central drumbeat of the program, defining the configuration and scope of engine and component testing to be performed.

Hardware delivery requirements for all components were linked to the EVP as defined by the System Engine Validation (SEV) team. The EVP was initially baselined and then modified as development learning was established throughout the course of the engine development program. All configuration changes were approved by the System Integration Product Team (SIPT) – core members of the IPMT, charged with evaluating the impact of changes, communicating approval or disapproval, and leading efforts to define any modifications to the EVP. The EVP consisted of two major elements, accumulation of key learning points during the initial development phase that defined the engine certification configuration standard, followed by a certification phase where all major engine tests defined by the TCCA approved Means of Compliance were executed.

The key challenge managed during this phase of the program was execution and communication of a disciplined change management process to enable required modifications to propulsion system hardware within the required schedule for on-time certification. One of the key elements of risk reduction successfully used in the course of the development program was the use of “3D printing” or additive manufacturing. This technology was used to significantly reduce the lead
time required for the design and delivery of required hardware modifications. Additive manufacturing was also used for the design and development of assembly tooling and instrumentation. The capabilities of this new technology were used to take more than six months of schedule risk out of the program during execution of the initial validation phase.

After the completion of the initial phase of engine validation, the certification build standard was defined, hardware delivered and engine certification testing initiated. Concurrent with this, a plan was established for engine certification. A decision was made to certify the engine through TCCA to gain synergies with the aircraft certification. As this was the first program executed by P&W certified by TCCA, the best practices and standard templates of Pratt & Whitney Canada were employed. The Pratt & Whitney Canada Delegated Airworthiness Office (DAO) established requirements for certification and assigned highly experienced Delegated Airworthiness Representatives (DARs) to support training of P&W certification specialists. Standard work certification documentation requirements were transferred, including standard certification reports that defined the format and content from prior Pratt & Whitney Canada TCCA certification programs. A baseline certification plan was developed for the engine and components, which was tracked and managed on a daily basis by the team and communicated to the IPMT on a weekly basis to ensure on-time completion and rapid escalation of issues as they occurred. Frequent communication also occurred between the DAO, DARs and P&W certification specialists, as well as between the DARs and TCCA to ensure that certification requirements were being achieved to the satisfaction of all key stakeholders. Certification of the engine to the requirements of CH533 was accomplished with the final type review board meeting, and the Type Certificate for the PW1500G engine was issued on February 12, 2013.

A primary benefit of the decision to certify the engine through TCCA was the synergy obtained with the aircraft certification program. P&W was responsible for development and delivery of an integrated propulsion system inclusive of the engine (CH533 engine scope) and the nacelle, mounts, EBU, and exhaust (all CH525 Aircraft scope). As a result, significant effort during this period was associated with finalizing and releasing the design of the aircraft components and completing all required testing and documentation required to declare safety of flight. P&W contracted its supplier UTAS (former Goodrich) as the responsible supplier for the nacelle, mounts, EBU and exhaust. Customer requirements for the design were provided in a Technical Requirements Document (TRD), which in addition to a Statement of Work (SOW), were the key governing documents of the Preferred Supplier Agreement (PSA). The design of the aircraft nacelle components was closely managed by Bombardier, and the 3D configuration was uploaded to the Bombardier Configuration Management System. A process was subsequently established to enable close coordination of configuration changes between the three companies prior to and during the flight test program with full oversight by the Bombardier Design Airworthiness Designees (DADs). A detailed plan was base-lined for the engine and nacelle components (including EBU, Mounts, and exhaust) to achieve a Safety of Flight (SoF) declaration to support the first flight of the aircraft. Execution of this plan was monitored daily by the team to ensure schedule adherence and to identify any issues requiring resolution with weekly reporting to the IPMT.
The team successfully completed the SoF plan in August 2013, with subsequent full approval by the DARs, Bombardier DADs and Transport Canada. This approval subsequently enabled the first flight of the CSeries aircraft powered by the PW1500G engine and nacelles on September 16, 2013.

Throughout the period of performance of this international program, export control requirements were continuously evaluated to ensure full compliance to evolving standards. Examples of key initiatives included the establishment of an automated IT infrastructure where technical data required by foreign partners, suppliers and customers could be stored and exchanged in full compliance with export requirements. Supporting this infrastructure was the requirement to identify Jurisdiction and Classification (J&C) for export of all technical data generated during the execution of the program within a centralized database. All technical data generated was marked with this information and subsequently reviewed by a Business Area Export Representative (BAER) prior to transmission into the database.

P&W created a program in which several hundred BAERs were identified and trained to the latest export requirements. The trained BAERs are deployed within all functional areas of the business (engineering, partnership office, manufacturing, supply chain, legal, finance). Additional duties of the BAER include review and release of all information transmitted to a foreign entity to ensure it can be released to the intended recipient (including verification of MK denial) and contains appropriate export marking. P&W continues to review its export policy, including annual review of all functional areas for potential export escape risks, which are prioritized and addressed by improvements to the export process.

In conclusion, the past three years of effort by the PW1500G engine extended program team have resulted in one of the most significant achievements in aviation history. Bringing to reality the design of a new generation of propulsion systems offering the benefits outlined in the table below:

<table>
<thead>
<tr>
<th>GTF Objectives</th>
<th>Key Performance Factors</th>
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<tbody>
<tr>
<td>Fuel efficiency</td>
<td>~16% reduction in fuel consumption</td>
</tr>
<tr>
<td>Noise reduction</td>
<td>~75% reduction in noise footprint</td>
</tr>
<tr>
<td>Emissions reduction</td>
<td>~50% reduction in regulated emissions</td>
</tr>
<tr>
<td>Reduced complexity</td>
<td>46% reduction in number of airfoils</td>
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<tr>
<td>Technology maturation</td>
<td>Over 7,500 hours of engine testing</td>
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<td></td>
<td>Over 100,000 takeoff cycles on FDGS</td>
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<tr>
<td></td>
<td>25 years, four demonstrator engines</td>
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</tbody>
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The execution of the program from the start of validation testing, through certification and initiation of the flight test program required the coordinated efforts of thousands of members of a globally deployed team. Accomplishing this task in full compliance with customer and business requirements was made possible by rigorous application of a world-class system of program management processes established by P&W coupled with the company’s fundamental tenets, a unique certification approach, and a solid commitment to export compliance excellence.