Performance-Based Logistics: the Basics and Beyond

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Abstract

Performance-Based Logistics is a common topic at today's aerospace and defense conferences. Jim Hall, the Acting Assistant Deputy Under Secretary of Defense for Logistics Plans and Programs, one of the leaders at the Pentagon charged with driving Performance-Based Logistics, gets directly to the point, saying, "Performance-Based Logistics is proving its ability to provide cost effective readiness."[1]

Instead of paying a supplier to execute individual transactions for things like spare parts, repairs, or hours of technical support, with Performance-Based Logistics (PBL) the DoD pays for weapon system performance over the entire life cycle of the system. According to DoD Guidance, "PBL is the purchase of support as an integrated, affordable, performance package designed to optimize system readiness and meet performance goals for a weapon system through long-term support arrangements with clear lines of authority and responsibility."[2]

The paradigm shift is clear: PBL buys outcomes - not individual parts or services. A simple sentence, perhaps, but this is a seismic shift for very complex, expensive systems. No matter how complicated an acquisition becomes the essential beauty of PBL shines through. PBL contracts fundamentally align the interests of contractors with the Pentagon. If both do the job right, contractors make more money. To do this, they find ways to deliver better system performance at lower total ownership costs, so the Pentagon wins, too.

We have looked into PBL across a number of programs and companies. Though challenges remain, the results delivered by many of these programs are as compelling. In this paper we will explore the fundamentals of PBL, and then explore two case studies. One, the Shadow Tactical Unmanned Aerial Vehicle (TUAV), has received widespread visibility in PBL circles, but what has not received visibility is the long term contracting strategy being deployed, which is in large part the driver for the superb continuing improvements seen in this program. The second, Pratt & Whitney's F117 engine, the propulsion system for the C-17 aircraft is little known but has arrived at the goal all PBL programs aspire to: a firm fixed price contract, delivering demonstrably more cost effective performance for the Air Force.

PBL is not an option to consider. It is a requirement. "PMs shall develop and implement performance-based logistics strategies that optimize total system availability while minimizing cost and logistics footprint."[3] And PBL works; it's a proven concept. The time for debate is over; the time for widespread implementation is here.

The Basics of PBL

The concept driving PBL is simple: the government and contractor form a partnership based upon the particular needs of the warfighter, and align work and incentives to support those needs. The program manager for the government works with the warfighter to determine what the performance outcomes need to be. These performance outcomes then flow to the contractor or Product Support Integrator (PSI). The PSI in turn works with the participating sub-contractors to deliver the product support required to deliver the desired level of performance. If the PSI exceeds expectations, they may be rewarded with financial incentives, gain sharing, or extended contract terms. .

Depending upon the scope of the PBL agreement, some or all of the activities related to product support are transferred from the government to the contractor. At the component level, it may mean responsibility for aircraft tires or sub-systems, and at the total system level it could mean the contractor is responsible and accountable to deliver mission capable system availability.

Collaboration lies at the heart of PBL - both between the PSI and their sub-contractors and between the PSI and the government - with the ultimate goal of cost-effective delivery of weapons systems capability to the warfighter. The PSI is responsible to make sure that information is clearly communicated among the parties and that product support is provided when and where it is are needed. By partnering with private business, the government is able to use the knowledge and experience of the private sector to improve performance, and private business is able to increase revenue by providing improved value.

PBL works because, in part, government logistics support organizations are not designed to optimize for individual weapon systems, but rather to optimize within discrete functions (e.g. supply, maintenance) or commodities (e.g. avionics, tires). Due to these organizational peculiarities at the Department of Defense, many driven by statute and regulation, managing to effectively achieve required warfighter outcomes is difficult, if not impossible. Cost effective supply chain management just isn't a core competency within the DoD. Under PBL, through the careful alignment of performance objectives, accountability, and control, the contractor, while absorbing additional risk, is empowered to pursue improvements that will deliver improved performance, higher profits, and lower total ownership cost. PBL uses the power of free market innovation to improve the delivery of warfighter capability.

When PBL agreements are done right, it assesses product support costs across the life cycle of a system and focuses energy on the necessary outputs, providing both effectiveness and efficiency for the life of the program. For the contractor, PBL is an opportunity to exercise greater flexibility in deciding how support is provided, ensure cash flow stability through long term contracts, and increase revenue by rewarding contractor investment in improving support processes. For the government, it is a chance to obtain guaranteed availability improvements while decreasing costs and logistics footprint through partnering with private business for complete program support.

The Navy – which has embraced PBL at the subsystem level for years – has documented irrefutable results across a broad range of programs that shows that PBL works. Some examples of improved performance are highlighted below[4].

Program	Availability		Response Time	
	Pre PBL	Post PBL	Pre-PBL	Post PBL
F-14 Lantern	73%	90%	56.9 days	5 days
ARC-210			22.8 days	5 days
H-60 Avionics	71%	85%	52.7 days	8 days
F/A-18 SMS	65%	98%	42.6 days	2 days CONUS
F/A-18 SMS			42.6 days	7 days OCONUS
Tires	70%	85%	28.9 days	2 days CONUS
Tires			28.9 days	4 days OCONUS
APU	65%	90%	35 days	6.5 days

In practice, PBL has been implemented at the entire weapon system platform level, at the major subsystem level, and at the component level. Documented case studies show success at all levels.[5]

Beyond the Basics: Some Key Tenets of PBL

This portion of this paper reviews some of the more important "tenets" of successful PBL programs as taught in the University of Tennessee's PBL course. These tenets have been identified through research UT performed in developing this course. It is based on UT a review of 17 different PBL programs conducted during the summer and fall of 2005 and is further based on subsequent site visits, interviews, briefings and workshops with organizations such as Lockheed Martin, Raytheon, Pratt & Whitney, Northrop Grumman, Boeing, the Missile Defense Agency, the United States Air Force, the United States Navy, and the Office of the Secretary of Defense.

While not intended as a comprehensive guide to key elements of a PBL implementation, they do serve as important elements observed in highly successful PBL programs.

Metrics, Performance Management, and Continuous Improvement

Metrics lie at the heart of all PBL agreements. The challenge lies in selecting the right metrics that will achieve the desired outcome and warfighter needs. Successful PBL programs tend to have in common is that over time they streamline the number of metrics, as well as the focus, to ensure that the metrics selected are aligned with warfighter needs. Metrics are a performance management tool, evolved and refined over time to deliver increasing levels of performance and cost effectiveness.

One strong example is the GE F404 Engine PBL. GE and NADEP Jacksonville have spent the last 3 years, since the inception of the contract in July of 2003, implementing a formal Six Sigma / Lean program at the Jacksonville depot, eliminating waste and improving the efficiency of the overall process. In short – implementing a formal continuous improvement process program driven by the key performance indicators is a critical success factor.[6]

Contracting

There are many elements of a typical PBL contract. But where should you focus your efforts? The UT researchers all agree, the following are good rules of thumb for developing your PBL program:

Long Term, Life Cycle Strategy

PBL is not a "one and done" approach. It is a journey where all parties want the same thing: cost effective system performance at the tip of the spear. Performance objectives mature as the program matures, and contract structures evolve, becoming more and more sophisticated. PBL relies on collaborative, long-term relationships, utilizing business practices long understood in the commercial space, but on a scope far beyond the typical commercial relationship.

Investment Incentives

Creating a PBL that encourages long term improvements is a key hallmark for a good PBL. The contract should be long enough to inherently provide incentives to all parties to invest capital to improve the overall component, sub-system or platform performance. A good contract will trade the short term benefit of contract flexibility for the stability and improvement potential of a long term award. The Navy, for example, pursues 10 year contracts using the working capital fund to drive a total life cycle view.

On and Off Ramps

Legacy contracting approaches call for extensive documentation of contingencies and associated actions to mitigate risk. Under PBL, contracts are aligned against over-riding objectives, not detailed activities. Thus, there is much uncertainty, particularly under longer term contracts. A typical approach is to "band" around expected operating parameters, with specified actions to allow for contract reset if activities drift outside the range. Similarly, good PBL contracts allow for acceleration, in quantity, timing, or scope, should unexpectedly favorable results indicate that it is appropriate. Rather than focusing on the specific situations and remedies, the agreement should seek to specify a process to select appropriate actions (on-ramps and off-ramps), rather than detailing the universe of all possible outcomes.

Pricing

Cost plus, fixed fix or some mix? Should you have incentives or gain sharing and if so what kind? That is the question that all parties involved in a PBL contract must ask as they get to the detail of pricing. Experience has shown that the typical starting point is a traditional cost plus contract – especially when there is limited or no baseline performance and cost data to support sound fixed prices. As the cost and performance baselines stabilize to the point where performance targets can be set and risk, on both sides, is understood, a transition to a fixed price contract with gain sharing or incentives can take place. Price structure needs to be a clearly thought out strategy, intended to evolve over time.

Alignment

One area that few PBL agreements leverage is depth of performance alignment with the various product support providers. Top level alignment among the warfighter, the Product Manager, the Force Provider, and the Product Support Integrator is the foundation, but it is not the complete structure. To the extent possible, the PSI should endeavor to extend PBL's across the Product Support Providers. Failure to do so leaves risk in the hands of the PSI, when properly structured contracts with the sub-contractors can serve to reduce risk by aligning activities across the end-to-end chain, while at the same time pooling risk across participating organizations.

Workscope

Flexibility

Traditional government contracts are very rigid, having formal Statement of Work documents that virtually spell out every single aspect of the contract and suppliers should perform every detail of the work to be done. Best practice PBL agreements move away from the constraining "Statement of Work" and adopt a more flexible "Statement of Objectives" and alpha contracting as the guiding force. A PBL agreement – especially one that involves a non-organic entity such as a contractor – should allow the product support provider enough flexibility to be able shift work activities and workflow so that they can achieve the most effective support structure. If the method of work is specified – as is the case in traditional SOWs - the PSP will be required to perform the work exactly as stated, and as such will not have the flexibility they need to capitalize on opportunities.

Workload Allocation & Unity of Effort

Another best practice being deployed under PBL is to ensure the "best use" with regard to where the work gets done. This is not just a good practice, but is DoD policy. DoD Policy states "Sustainment strategies shall include the best use of public and private sector capabilities through government/industry partnering initiatives, in accordance with statutory requirements."[7] One of the challenges of making this a

reality is in how the various organic and contractor providers work together. Best practice PBLs tended to use a true "partner" mentality. In some instances contactors and organic providers even had co-located facilities to help facilitate a better interchange of work and ideas. This helped to foster teamwork and almost gave a sense of transparency between government and contractor personnel – with all parties having a common goal of improving performance and cost of the program.

Leadership Support and Involvement

The best PBL results occur where senior leaders from both the government and the contractor are fully aligned and visibly leading the vision of how their programs will evolve and implement PBL philosophies. These senior leaders go beyond simple support – they are actively engaged to help drive their respective organizations toward an effective PBL arrangement.

Shadow Case Study: the Shadow Knows

Background

Who knows what power lurks in the heart of PBL? The Shadow knows.

The Shadow 200 is Army's Tactical Unmanned Aerial Vehicle (TUAV) deployed to provide near real time support to tactical commanders in the battlespace. Product Support is provided under a PBL contract, and the Shadow's performance, in both cost and performance, has been outstanding.

In November of 2005 the Shadow received special recognition from the Department of Defense for its role in the Global War on Terror. The success of the vehicle was demonstrated in the significant number of successful sorties flown, while meeting or exceeding all operational readiness/availability, weapon system availability, and mission success requirements.

The Shadow uses video and infrared sensors and is the airborne "eyes" of many ground commanders. "From that expanded view of the battleground, a commander can decide if he needs to call in" artillery or attack helicopters, said Chief Warrant Officer James Harris, an 82nd Airborne Division soldier who worked with the Shadow in Iraq.[8] In many cases, the Shadow fulfills missions once tasked to helicopters.

Flying multiple observation and command helicopters is expensive. One hour of flight in an AH-64 Apache costs more than $2,500; a UH-60 Black Hawk, $1,800 per hour; and the OH-58D Kiowa, more than $800 per hour, according to Army estimates. Lieutenant Colonel Keith Hirschman, the Program Manager for the Shadow System, has publicly stated that a Shadow costs $366 per hour[9] to fly. [10]

Facts about the Shadow

- In October 2002 the Shadow 200 was approved for full-rate production.
- Since 1999, 43 Shadow systems have been delivered to the Army.
- In May of 2006, the US Army contracted for an additional 9 systems, bringing the total to 73 systems and extending the program through December 2009.
- Since being deployed to Iraq at the outset of military operations in 2003, Shadow systems have flown more than 19,000 sorties.
- In a June 2006 combat mission Shadow surpassed 100,000 flight hours.
- The units currently operating the TUAV in Iraq include the 4th Infantry, 1st Cavalry and 82nd Airborne and 2nd Infantry divisions and the Stryker brigades.
- In May of 2006 AAI was awarded a $65.6 million, the Phase II contract for performance-based logistics product support for the Shadow through FY07. Army Aviation and Missile Command, Redstone Arsenal, AL Contract W31P4Q-06-C-0256.

This hourly cost includes the cost of all elements in the system, not just the air vehicles. The basic Shadow platoon consists of four air vehicles, six High Mobility Multi-purpose Wheeled Vehicles (HMMWV), two Ground Control Stations (GCS), four Remote Video Terminals (RVTs) and antennas, one Portable Ground Control Station and Data Terminal. One HMMWV of the platoon transports the air vehicles and launcher trailer. Two more HMMWVs each transport one mounted GCS. Two HMMWVs are personnel and equipment transports. The sixth HMMWV carries associated maintenance equipment.

Photo 1: A Shadow TUAV launches from its catapult just prior to an intelligence-gathering mission for 2nd Brigade Combat Team in Baqubah, Iraq. Photo by Sgt. Troy Chatwin. Photo courtesy of ARCENT Public Affairs Office, used with permission.

This success is no accident, and there are clear lessons available for other programs involved in PBL initiatives.

The PBL Acquisition & Implementation Strategy

Performance-based logistics is one of the most successful product support acquisition strategies in today's defense contracting environment. "[PBL] process gives the contractor both the responsibility and the incentive to meet defense readiness goals," according to Suzanne Schwitalla, director of performance-based logistics at AAI, the Prime Contractor for the Shadow.[11] Under Shadow's PBL agreement, the contractor is responsible for providing total product support for the Shadow system using a performance-based, contractor-managed supply and maintenance system that imposes performance metrics designed to support the system operational requirements. Performance is measured on a recurring basis, and the contract provides incentives to AAI to meet and exceed defined performance targets.

In addition to overall responsibility for delivering the performance outcomes, the Product Support Integrator provides Contractor Managed Supply Support, Contractor Managed Maintenance Support, Field Support Representatives in the deployed environment, Sustainment Engineering Brigade Integration Team (BIT) Training RESET/PRE-SET Efforts, and Deployment Support (CONUS/OCONUS Training Exercises, OIF/OEF, etc).

The Program Management Office has been pursuing a Performance-Based Logistics approach to product support from Day 1, relying on a deliberate and phased acquisition and implementation strategy.

Phase I (2003 – 2006)

Initially relying on a cost plus contract with fixed fees, and then easing into cost plus with incentive fees, the Shadow team selected what they viewed as the critical parameters for driving total life cycle system cost and performance.[12] The team used this phase to evaluate true cost and to determine the right incentives to support the ultimate fixed price objective. During this phase, the government made a go no-go decision on their acquisition strategy.

Key lessons: allow time to validate and verify the metrics and data collection processes; proper data collection and analysis are vital.

Phase II (2006 – 2008?)
At the end of Phase I, the team executed a review of PBL results and system performance. Based on this review, the decision was made to revise the performance metrics, placing a greater emphasis on objective data and system reliability[13], while also introducing gain sharing on cost reductions to drive even more cost effective system performance. In addition, the contractor was provided with an investment pool, and the discretion to utilize these funds in the best way to achieve performance improvements.
Key lessons: Evolve metrics as necessary, but remain aligned toward the award of a Fixed Priced Contract.

Phase III (2008? - ????)
It is anticipated that the Phase III Award will either be a long-term, fixed price award term contract, or a life cycle contractor support warranty contract. Both approaches can be appropriate for delivering total system performance, lower costs, and continuous improvement.
Key lessons: remember that the warfighter requires readiness, not transactions.

Beginning with a well articulated CONOPS, and flowing through the acquisition strategy and into the implementation strategy, the Shadow team has done an admirable job of balancing near term operational requirements with the long term total lifecycle performance of the system by adhering to a structured and iterative approach.

Observations
Shadow has effectively deployed a comprehensive program addressing the breadth of the tenets of success identified by the University of Tennessee. Metrics, Performance Management, and Continuous Improvement are blended into a balanced and evolving process aligned to the needs of the warfighter. The Contracting Strategy incorporates a phased, long term, Life Cycle Strategy, with appropriate investment incentives and a defined schedule to move from cost plus all the way to firm fixed price, with gain sharing opportunities. Alignment and appropriate workscope structures are achieved by the reliance on the PSI for the lion's share of support activities. And, throughout the life of the program, leadership commitment from both the government and the contractor has been evident.

While it is too soon to claim ultimate victory for the Shadow PBL program, it is clearly on a path to success. Beyond the points already explored, the Shadow is also another example that can be used to refute common objections to PBL.

- PBL works in the deployed, tactical environment, including over-the-shoulder support from the private sector product support integrator.
- PBL is not a zero sum game between the government and the Product Support Integrator. Properly structured and implemented, it can yield more cost effective performance.
- It is possible to manage a comprehensive system level PBL program with just a handful of metrics. Shadow runs with four, explicitly linked to the ORD, constrained by a cost reduction incentive.

Who knows what power lurks in the heart of PBL? The Shadow knows.

F117 Propulsion System Case Study

Background

The C-17 Globemaster III is a four engine turbofan aircraft capable of airlifting large payloads over intercontinental ranges without refueling. The C-17 is capable of rapid strategic delivery of troops and all types of cargo to main operating bases or directly to forward bases in the deployment area. The aircraft is also able to perform theater airlift missions when required. [14]

The C-17 aircraft is the focus of a Boeing – Air Force PBL partnership. They do joint off sites and work specifically on their "relationship." They regularly scheduled joint reviews. Every employee who works on the C-17 wears a plastic card the size of their badge, imprinted with partnership agreement signed by Boeing and Air Force leaders.[15]

Photo 1: Boeing C17 courtesy of Boeing - negative no. DVD-32-05

Pratt & Whitney's F117 engine, the military variant of the commercial engine used on the Boeing 757, is the propulsion system on the C-17. A Product Support Provider to Boeing, P&W has been engaged in support since the development of the C-17 under the F117 Globemaster III Sustainment Partnership. P&W has won competitive bids for Propulsion Support in 1997 and 2000. In 2005, P&W won a competitive extension to provide product support until 2009.

Photo 3: Boeing C17 courtesy of Boeing. Negative no. T95-1859

The product support bundle provided under the PBL contract includes:

- Maintenance Event Logistics and Tracking
- Maintenance Management
- Repair Execution (Labor & Material)
- On-Wing Monitoring & Tech Support
- Spare engine availability (rotable pool)
- Reliability Centered Maintenance (RCM) Analysis & Maintenance Optimization

Photo 4: PW F117 engine courtesy of Pratt and Whitney

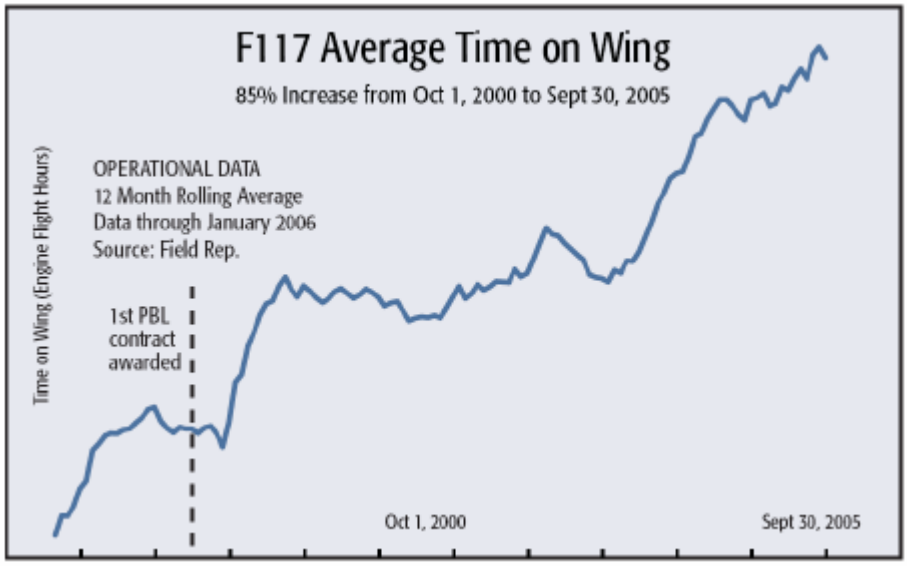
The success of P&W F117 PBL is due in large part to the ability to leverage commercial commonality and goal aligned contracting structure, with the freedom to pursue improved performance under a firm-fixed price contract structure.

Real-time Information Makes the Difference

Under traditional contracts material orders are placed in the form of batch and queue mass production[16], which simply drops an order for parts in queue and the hardware is produced to specifications with little to no incentive to reduce cost or improve

reliability over the long life of the program. Under P&W's PBL contract for the F117, the contractor is paid a flat rate per engine cycle[17], and must meet specified engine availability targets. This arrangement moves P&W away from "batch and queue," and drives the PSP to connect and align to the warfighter, and behave in a way impossible under legacy support arrangements.

Under the firm fixed price PBL, it is in Pratt & Whitney's best interest to strive to improve reliability, because this behavior drives down support costs incurred to earn the fixed price. And, it is in the Air Force's interest, because they obtain improved performance over time, while their operating costs remain flat. Under this PBL structure, the supply chain is closely aligned from the PSP through the PSI to the performance requirements of the warfighter.



Source: DC Velocity Magazine, July 2006. Used with Permission.

At Pratt, an integrated IT system provides an integrated data environment for analyzing, understanding, and preventing failures. Knowing exactly where inventory is located, hardware status at a specific point in time, knowing how much is in stock, and optimizing the movement of material to the proper locations in order to optimize maintenance and overhaul schedules reduces cost to the overall program. However, for the F117 P&W takes it a step further.

The configuration, use, and condition of each engine are monitored in near real-time. Using sophisticated models and analytic techniques, P&W develops optimal strategies based on the unique identities of each engine, developing a detailed forecast. This forecast, driven by a comprehensive data set, allows P&W to trade-off shop schedules, failure forecasts, engine condition, component availability, engine availability, scheduled upgrades, and other identified variables of significance to drive cost-effective time-on-wing.

This fundamental integration of the support services activities with "focused logistics"[18] enables an accurate, evolving, and comprehensive understanding of the customers' requirements, anchored against the constraints and reality of the operating environment.

For the F117, real-time feedback from the customer in the operating environment is critical factor for the contractor, enabling continuous adjustments to better adapt to actual performance. One of the more important elements comes in the form of parametric data received from the end-user. This information defines how the fleet is operating in reference to established performance, durability, and reliability standards. In a Reliability Centered Maintenance (RCM) system, the contractor uses this data to identify and introduce financially prudent enhancements to extend the performance of the hardware. Performance-based logistics contracts provide the incentives and alignment to prioritize and select the appropriate improvements and recurring maintenance requirements.

Standard work is applied throughout the entire product support value stream, including the supply chain, standardizing all processes. "Business Process standard work is a consistent approach to activities. The objective is to ensure that everyone who performs a repeatable process has consistent, waste-free, best practices available to do his or her work."[19] This standardization, among other things, allows P&W to rely on consistent behaviors throughout the value stream, and interpret data accordingly, around the world.

Pratt & Whitney closes the loop with a robust Continuous Improvement Program. Incorporating benchmarking techniques, defining root cause to an issue and instituting mistake-proofing methods into existing processes develops a vigorous system designed to improve "the way things are done." Reducing cost and improving the throughput of the processes reduces the response time to the customer needs, as well as the cost of doing business. Reducing variability equates to the better management and a consequent reduction of the risk incurred by the program, a major consideration to a for-profit enterprise fulfilling a firm fixed price contract.

Observations

There is no "one size fits all" approach to Performance-Based Logistics. Every organization must tailor their approach, based on the characteristics of the system and their own unique capabilities. At Pratt & Whitney, their program has been configured to make the tenets of Metrics, Performance Management, and Continuous Improvement the core. The sophistication of their data-driven approach sets the F117 apart from the typical PBL program.

Other key tenets are also present in their PBL implementation. In the area of contracting, appropriate strategies exist to drive a long term, life cycle strategy inherently incorporating appropriate investment incentives. As a PSP providing support to the end customer through a third party PSI (Boeing), P&W's PBL program is a strong example of top-to-bottom alignment, driving alignment deeply into the supply chain hierarch. Leadership support and involvement is evident, resulting in clear unity of effort.

The F117 engine PBL program is a mature PBL implementation, over a decade old. Beyond the points already explored, the F117 is also another example that can be used to refute common objections to PBL.

- PBL can work at the Product Support Provider level.
- With diligence, an integrated data environment, including near real-time data from the point of the spear, can be constructed.

- Commercial support capabilities (support infrastructure and approaches used on the engine from the 757 system) can deliver value in the military environment.

Work is currently underway by Pratt and Whitney, in close collaboration with the Air Force, to develop and deploy a comparable program for the F119 engine, the propulsion system for the F22 Raptor, leveraging many of the lessons learned on the F117.

Summary

By aligning performance against a set of end-to-end performance measures, PBL reduces risk across the supply chain. By understanding the implications of PBL, the A&D industry is beginning to see that PBL presents an entirely new business model, with growth opportunities clearly tied to their core competencies and achieving results that are tied to the warfighter needs. Implementation of PBL by the DoD is ambitious and far-reaching, but founded on sound precedents in the commercial marketplace. And there is one thing that leading practitioners, academics and government personnel all agree on – PBL is here to stay.

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