



**Balancing Government Risks with Contractor
Incentives in Performance-Based Logistics Contracts**

THESIS

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AFIT/GLM/ENS/08-2

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PERFORMANCE-BASED LOGISTICS CONTRACTS**

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Abstract

The use of Performance-Based Logistics (PBL) as a sustainment strategy for weapon systems has been mandated by the Department of Defense (DoD) and largely embraced by acquisition and contracting professionals in both government and private industry. Despite its apparent success, there is an inherent conflict that DoD implementers of PBL often face: the PBL goal of developing long-term partnerships that encourage investment from commercial partners is best achieved through lengthy, guaranteed contracts—but such contracts increase the DoD’s risk in an environment that is intended to transfer more risk to the contractor. This research examines issues associated with the type and length of PBL contracts between DoD organizations and private industry. The thesis addresses the question of how the DoD can ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors. The results reveal five main areas in which the government should focus its efforts to improve PBL implementation.

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For my son

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Christopher P. Gardner

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BALANCING GOVERNMENT RISKS WITH CONTRACTOR INCENTIVES IN PERFORMANCE-BASED LOGISTICS CONTRACTS

I. INTRODUCTION

Background

The current preferred product sustainment strategy for improving weapon system readiness within the Department of Defense is known as Performance-Based Logistics (PBL) (DAU, 2005). PBL differs from traditional strategies in that contracts between DoD and designated Product Support Integrators (PSI) are based on output measures, such as aircraft availability, instead of input measures, such as parts or technical services. The ultimate goal of this acquisition and sustainment strategy is to reduce total system life cycle costs while simultaneously improving system performance and support. In PBL relationships between DoD and private industry, this is accomplished by offering incentives to support providers to make investments into their logistics structure. Ideally, these investments will enhance the supported weapon system's performance while reducing costs and increasing profitability—essentially a win-win situation for both parties. For example, under the old strategy, a firm contracted to supply parts had incentive to sell as many parts as possible to the government—this resulted in more income for the company, but did not improve system performance for DoD. Under the PBL strategy, that same organization might be responsible for meeting a metric such as logistics response time, and is therefore motivated to make enhancements to its own system that not only improve response time of parts delivery, but increase the amount of return on its own investments. It can be argued that PBL represents the definitive modern

supply chain strategy, because it has, “for the first time in the history of DoD support contracting, aligned the interests of each link in the chain with the end-user — the war fighter (Vitasek et al., 2006).” The same activities that increase profit for the supplier also benefit the customer through better performance.

The PBL concept has been embraced by both the DoD and private industry, and its associated strategies are cause for much discussion amongst acquisition and contracting professionals. Despite its apparent success, however, there is an inherent conflict that DoD implementers of PBL often face: the PBL goal of developing long-term partnerships that encourage investment from commercial partners is best achieved through lengthy, guaranteed contracts—but such contracts increase the DoD’s risk in an environment that is intended to transfer more risk to the contractor. It is not surprising that in most situations, defense contractors consider a longer contract (i.e. multiple years; perhaps 5 or more) to be an enabler for PBL success. At various recent PBL conferences and seminars, private industry representatives have consistently expressed that contracts of shorter term lengths limit defense contractors’ ability to realize worthwhile return on investment (see Appendix F for examples). This thereby reduces the incentive for these companies to make significant up-front investments that would provide long-term benefits for the system in question. The government also sees “long-term support arrangements” as a key element of PBL success (DAU, 2005), but is limited by the uncertainties of future defense requirements. The landscape of the modern combat environment can change rapidly; a weapon system that is vitally important today may be ineffective against tomorrow’s enemy, simply by virtue of design—and congressional funding tends to go where the action is. The potential for financial constraints to occur as

a result of the oft-maligned “must-pay bill” causes timidity amongst decision-makers to enter guaranteed long-term deals with commercial providers.

As a result, the structure and length of PBL contracts sometimes become obstacles to PBL success rather than enablers. There are, of course, certain risk-aversion measures programmed into the contracting system by the Federal Acquisition Regulation (FAR), which limits contracts to an initial period of not more than five years (FAR, 2005). To extend contracts beyond that point, optional years, such as award terms, must be exercised (the FAR permits up to five additional years for a total of ten). Award terms are contract extensions that are exercised based on good performance from the support provider. Even with a five-year limit, though, it is not uncommon for the uniformed services to procure PBL agreements that have only a one- or two-year initial base contract with a just few option years, bringing the total contract length to four or five years. Admittedly, there are many cases in which both DoD and commercial providers agree that a shorter contract length is appropriate. It is widely acknowledged that every PBL agreement must be tailored to fit unique requirements, and because PBL is not a “one size fits all” approach, it is difficult to make generalizations that can apply across the PBL spectrum. But PBL has experienced growing pains in recent history that suggest a lack of consistency and contentment with the way contracts are structured. Many private industry representatives contend that a re-examination of the way the government manages risk in PBL contracts has potential to improve performance, affordability, and profitability.

Problem to be Investigated

In developing PBL contracts, DoD professionals face the difficult challenge of finding a perfect balance: how can the DoD effectively mitigate its own risks while making commitments to commercial contractors that truly encourage affordable, long-term support? As previously mentioned, the detailed answer to that question will be different for each PBL program. But in general terms, no study has yet been undertaken to examine if DoD's current contracting strategies are achieving this balance to the best possible extent. This research seeks to fill that hole by investigating the factors that are most important to decisions of PBL contract type and length, examining contracting trends in past and current PBL programs, and garnering the opinions of subject matter experts in both DoD and private industry. The intention of this research is not to examine whether or not PBL is working as a sustainment technique, but rather to draw conclusions about what steps can be taken in the area of contract structure to make PBL work better. Essentially, the research aims to get the government one step closer to finding the aforementioned perfect balance.

Research Question

The overarching objective of this research is to improve understanding of how the government can ideally balance contract lengths to both encourage commercial investment and mitigate risks at the same time. This objective is supported by other research goals: to identify the factors that have the most influence on contract structure, how they can be used to determine initial PBL contract type and length, as well as to

identify other trends and expert opinions that may be useful to decision-makers in the DoD's acquisition and contracting fields.

In order to address these issues, the following **research question** was investigated:

How can the Department of Defense ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors?

Additionally, several **investigative questions** were established to support the research question and provide a framework for the methodology:

1. What types and lengths of PBL contracts have proven most successful and effective to date?
2. What risks and other criteria most frequently play a role in determining PBL contract type and length?
3. In general, are contracts adequately structured to consistently meet the PBL goal of establishing long-term partnerships?
4. In general, are PBL contracts adequately structured to consistently provide incentives for contractors to make cost-reducing investments in system support?
5. In general, how satisfied are PBL experts in both DoD and private industry with the government's application of risk aversion in PBL contracts?
6. Would any significant benefits be gained if the maximum contract length allowed by the Federal Acquisition Regulation was increased?
7. Are award term and option year contracting strategies being used effectively, and should their use continue in a lesser, similar, or greater capacity?

8. Should Working Capital Funds be used more extensively in PBL programs across DoD?
9. Does a PBL agreement's place among the "four stages" of PBL have any impact on contract length decisions?

These questions are further discussed in Chapter 3.

Scope

Although PBL methods can also be applied to agreements amongst government organizations for "organic" support, this study focused solely on contractual PBL arrangements between DoD and private industry. It should be noted that even in large commercial PBLs, military depots/logistics centers often provide skilled labor for the contracted PSI (the responsible party), partially to ensure compliance with requirements for government depot workloads. In effect, these public/private partnerships create a situation in which the DoD is both a customer and a supplier for the contractor. This research focused on the nature of PBL contracts established between the government and commercial firms, regardless of whether or not the PBLs involve public/private partnerships.

Given this criteria, the research scope also attempted to spotlight large-scale, high-dollar PBL programs. Large-scale PBL programs, particularly those at the "platform" or "system" level, require significant financial and operational risk management during the crafting of contracts. Research efforts were initially aimed at programs known to be either platform-level or high-visibility subsystem-level PBLs. The

study incorporated interviews with personnel from the Navy, Air Force, and Army, as well as multiple defense contractors.

Methodology

PBL program history, current contracting practices, and general satisfaction with PBL methods were examined for trends so that conclusions could be drawn about PBL contract structure issues. This was accomplished through case study research that involved interviews with PBL experts in both DoD and private industry, as well as review of available literature.

Interviews were conducted at two levels: the “program level,” wherein a series of questions was posed to personnel who had significant experience with specific PBL programs, and the “Department of Defense level,” wherein a series of questions was presented to PBL subject matter experts who possessed a wide array of PBL and acquisition/sustainment experiences. At the program level, case studies provided valuable insight into lessons learned by personnel involved with past or current PBL initiatives. At the DoD level, subject matter experts provided a “big picture” view that incorporated lessons learned from multiple programs since the inception of the PBL concept. At both levels, interviews were conducted with personnel in both DoD and private industry.

Implications

PBL is the DoD’s preferred life cycle sustainment strategy; the Office of the Secretary of Defense (OSD) mandates that it be considered for use in acquiring and

sustaining products and services whenever feasible (DoDD 5000.1, 2003). This attention from on-high gives importance to the study of PBL-related topics. This research is significant because it is the first known literary assessment within DoD of whether or not improvements can be made to PBL contract structures that will allow them to more effectively establish long-term partnerships that are equally beneficial for the government and private contractors. A greater understanding of how to ideally balance contract characteristics can potentially enhance the effectiveness of PBL contracts. In situations where there are no clear benefits to changing the contracting strategy, this research may serve to validate that established methods and structures are appropriate. For DoD employees in the acquisition and contracting communities who are responsible for implementing U.S. statutes and DoD policy while dealing directly with private support providers, this is a relevant issue.

II. LITERATURE REVIEW

PBL Partnerships

Throughout the history of the Department of Defense, the processes associated with acquisition and sustainment of weapon systems and commodities have evolved continually. A focus that was once on organic development of technology with emphasis on weapon effectiveness has shifted to make room for commercial technology and sustainment strategies that aim to not only increase performance, but also to reduce costs over the life of weapon systems. Today, the DoD's goals are not only to gain the most efficient and effective performance of systems throughout their entire life cycles, but also to build partnerships and relationships that align the goals of all involved organizations for the duration of the programs (Berkowitz et al., 2005). By mandating implementation of Performance-Based Logistics in the 2001 Quadrennial Defense Review, DoD identified PBL as the ideal strategy for attaining these goals, provided that a thorough business case analysis has been conducted to justify its use. Many definitions of PBL exist. In the Defense Acquisition University's 2005 publication entitled *Performance Based Logistics: A Program Manager's Product Support Guide*, the following definition can be found:

Performance Based Logistics (PBL) is the purchase of support as an integrated, affordable, performance package designed to optimize system readiness and meet performance goals for a weapons system through long-term support arrangements with clear lines of authority and responsibility. Simply put, performance based strategies buy outcomes, not products or services.

Berkowitz et al., (2005) developed this comprehensive definition to capture the essence of this new strategy:

An integrated acquisition and sustainment strategy for enhancing weapon system capability and readiness where the contractual mechanisms will include long-term relationships and appropriately structured incentives with service providers, both organic and non-organic to support the end user's (warfighter's) objectives.

As can be seen in both of these definitions, long-term relationships are integral to the concept of PBL. While many different types of business relationships exist, significant long-term relationships are often referred to as partnerships. As defined by Lambert et al. (1996), "A partnership is a tailored business relationship based on mutual trust, openness, shared risk, and shared rewards that yields a competitive advantage, resulting in business performance greater than would be achieved by the firms individually." The notion of establishing partnerships between DoD and defense contractors, or even between different government organizations is often viewed as centrally important to the success of PBL programs. The core of the PBL strategy involves capitalizing on integrated logistics chains and public/private partnerships (DAU, 2005). Research conducted by DeVries (2005) identified strategic alliances and partnerships as being among the key enablers of PBL implementation.

Lambert et al. (1996), however, are quick to point out that one partnership can differ significantly from another and that not all business relationships are truly partnerships. The same can be said of PBL within the context of DoD contracts. Contractual relationships that are largely transactional, involving very little integration of operations between DoD and smaller support providers, are generally not considered to be performance-based contracts and tend to fit the category of "arm's length relationships" as described by Lambert et al. (1996). In contrast, DoD and major defense

contractors such as Lockheed Martin and Boeing increasingly enter into performance-based accords that display several characteristics of partnerships. Lambert et al. (1996) contend that, in such relationships, “Both parties must believe that they will receive significant benefits in one or more areas and that these benefits would not be possible without a partnership.” The expected benefits form the compelling reasons to partner, described in short by these authors as “drivers.” The four primary drivers are asset/cost efficiencies, customer service, marketing advantage, and profit stability/growth. Although it is unlikely that the drivers will be the same for both parties, a sturdy partnership requires that they be strong for both (Lambert et al., 1996). These drivers can be applied to DoD and commercial organizations in the PBL context.

It can be argued that the DoD’s compelling reasons to partner are to improve service to its customers, the warfighters, and to improve asset performance and cost efficiencies. By employing the PBL strategy, the DoD aims not only to better meet the needs of the operational end-users by improving system performance and readiness (as indicated in the aforementioned definitions of PBL), but also to minimize the total system life cycle costs and logistics footprints associated with those systems (DoDD 5000.1, 2003). On the other hand, private companies are driven to partner with DoD by the prospective benefits of profit stability/growth and marketing advantage. Profit stability is obviously important for any firm that exists to make money, and this is what makes contract duration so important to firms that participate in performance-based partnerships with the government. Profitability is enhanced by long-term volume commitments for products, services, or both (Noordewier et al., 1990). It could also be stated that potential marketing advantage acts as a driver for defense contractors. National defense

requirements have created a market for industrial opportunities that exists nowhere else. Military specifications allow a firm such as Boeing, which develops and produces both commercial and military aircraft, to showcase their most sleek and powerful aircraft designs, enhancing their marketing mix.

Lambert et al. (1996) classify partnerships into three types, each based on the level of commitment and how integrated the relationship between organizations is (with Type I being just above arm's length relationship and Type III being the highest level of partnership). Because PBL programs are tailor-made, meaning that no two are the same (DAU, 2005), it could likely be argued that programs exist at all three levels. However, most PBL contracts between DoD and the major defense contractors seem to fit into the category of Type II partnerships, defined as follows: "The organizations progress beyond coordination of activities to integration of activities involving multiple divisions and functions within the firm. Although not expected to last 'forever,' the partnership has a long-term horizon (Lambert et al., 1996)." Once again, it can be seen that long-term relationships are key to partnerships such as PBL agreements.

It should be noted that, according to Lambert et al. (1996), the most effective partnerships generally have the least specific agreements. This concept separates PBL from traditional contracting strategies because although support providers are expected to meet a clear performance objective, the contract does not specify exactly how they must accomplish it. Breathing room is left for private vendors to make the supply chain for a weapon system as efficient as possible, which enhances its effectiveness while simultaneously improving profitability.

Risk

Inherent in any discussion of partnership contracts is the idea of risk. In PBL arrangements, both parties assume a certain amount of risk that is different in nature for each. The biggest concern for most private sector firms is financial risk; that is, firms want to ensure that the government will give them enough business to allow them to realize adequate (and ideally profitable) return on their investments. One of the best ways for vendors to ensure profitability and reduce financial risk is to secure longer contracts, but they must also carefully weigh their risks in determining the level of service they are willing/able to provide. The government's concern rests primarily with operational risk, or the ability to meet mission objectives (Doerr et al., 2005). By contracting out weapon system support, the DoD is putting certain aspects of its mission in the hands of another organization. The length of a contract that the DoD is willing to grant is often directly related to the amount of risk assumed by the commercial support provider. Doerr et al. (2005) propose that "when commercial sector vendors assume less (measurable) operational risk under a PBL contract, the term of that contract should be less." In the opposite sense, this implies that when vendors take on greater risk, the government should offer a long-term contract. The DoD also concerns itself with financial risk, however. Affordability and cost reduction are important aspects of true PBL, and the fear of being unable to divert funds when sudden changes to the mission require increased use of different weapon systems often drives DoD contracting behavior. Times of economic uncertainty and potential price adjustments are to be taken into consideration by contracting officers who craft long-term deals (FAR, 2005).

It is important to understand the impact that financial and operational risk have on PBL contract decisions. “The tradeoff of these two kinds of risk is central to the logic of PBL outsourcing. PBL contracts are almost always offered across multiple years (lowering financial risk for the vendor), with the expectation that the vendor will assume some degree of operational risk (Doerr et al., 2005).” As discussed previously, long-term relationships are at the core of a successful PBL strategy. To take this further, contracts offered across multiple years may be the best existing incentive for vendors to provide the best weapon system support possible. “Rewarding contractors with long-term relationships may provide a more powerful incentive than extra profit. Surely, extra profit is important to a business in reaching short-term goals. Profit earned over an extended period, however, is better aligned with the longer strategic goals of a firm, and therefore exerts greater influence on shaping contractor performance (Stevens and Yoder, 2005).”

Advantages & Disadvantages of Long-term Contracts

There are, of course, intrinsic advantages and disadvantages that accompany long-term contracts; this is recognized in both the public and private sectors. Table 1 below, adapted from Monczka et al. (2005), lists some rewards and drawbacks that organizations can experience when executing long-term contracts.

Table 1. Advantages and Disadvantages of Long-Term Contracts

Potential Advantages:

Assurance of supply
Access to supplier technology
Access to cost/price information
Volume leveraging
Supplier receives better information for planning

Potential Disadvantages:

Supplier opportunism
Selecting the wrong supplier
Supplier volume uncertainty
Supplier foregoes other business
Buyer is unreasonable

Several of these factors have already been discussed to some extent in the preceding paragraphs of this chapter. While they are all applicable to PBL in one way or another, those most pertinent to PBL are expanded upon below.

Advantages:

Assurance of supply. Using long-term PBL contracts, the government can be assured that commercial vendors will provide weapon system performance for a known period of time.

Access to cost/price information. “Longer term contracts create greater incentives for suppliers to improve or expand their processes through capital improvements because they are able to spread their fixed costs over a larger volume (Monczka et al., 2005).” Suppliers in PBL relationships can improve their profitability by making the system more efficient, from which the DoD benefits directly.

Volume leveraging. A multi-year contract with the supplier gives the government leverage to require the vendor to gradually increase performance as the relationship progresses.

Supplier Receives better information for planning. This is perhaps where the commercial support provider benefits the most in a long-term PBL deal, and is similar to the *access to cost/price information* advantage. Suppliers who are better able to plan production and support over a long period will be more efficient, more profitable, and more willing to make large up-front investments.

Disadvantages:

Supplier opportunism. “From the buyer’s perspective, there is a major risk that the supplier will become too complacent and lose motivation to maintain or improve performance as the contract progresses (Monczka et al., 2005).” A case could be made that this is the impetus for the implementation of award-term contracts in PBL, which is explained later in this chapter.

Selecting the wrong supplier. If a thorough and informative business case analysis is not conducted prior to establishing a performance-based contract, an agreement could be reached with a sub-optimal supplier.

Supplier foregoes other business. When a company agrees to provide support to the government, that support often uses up a large amount of the company’s business capacity. This is especially true in PBL. Therefore, commercial organizations that engage in long-term PBL contracts are taking the risk of possibly having to turn down other profitable business opportunities that arise due to a lack of capacity.

All of the characteristics listed in Table 1 represent potential issues that contracting officials must take into consideration when establishing any type of long-term contract, and PBL contracts are certainly no exception. These potential upsides and

pitfalls make clear why decisions associated with long-term contracts are typically not made in haste.

Contract Structure and Incentives

Contract duration is not the only major decision that must be made when developing a PBL contract; consideration must also be given to how the vendor will be paid, and which tools will be employed to incentivize performance. DoD support contracts typically fall into one of two broad categories: Cost-Reimbursable or Fixed Price (FAR, 2005). Table 2 describes how these contract types pertain to PBL.

Table 2. DoD Contract Types Most Frequently Applied to PBL

	Fixed Price	Cost-Reimbursable	
	Firm-Fixed Price (FFP)	Cost-Plus Incentive Fee (CPIF)	Cost-Plus Award Fee (CPAF)
Description	♦Price not subject to any adjustment ♦Specifies a target cost, a price ceiling and a profit adjustment formula ♦Maximum risk on Contractor ♦Minimum administrative burden on parties ♦Preferred contract type	♦Government pays allowable cost and incentive fee ♦Incentive fee based on contractor achievement of objective metric targets ♦Can also include cost gainsharing; comparing actual cost to target cost and sharing of savings	♦Government pays allowable cost, base fee and award fee ♦Base fee does not vary with performance ♦Award fee is based on a subjective evaluation of performance ♦Amount of award fee is unilateral
PBL Application	♦Requirement is well defined ♦Able to establish fair and reasonable pricing	♦A relationship can be established between the fee and the performance measures	♦Subjective evaluation is desired (i.e. customer satisfaction)

Adapted from DAU (2007)

In essence, while a Fixed Price contract guarantees that a vendor will be paid a set price regardless of the costs incurred, a Cost-Plus contract is expense-based: when the contractor completes the agreed-upon work, the compensation he receives is equal to his costs plus a bonus, provided that the expenses were determined to be allowable and reasonable. The major determinant in choosing whether to go with a Cost-Plus or Fixed Price contract is the degree of pricing risk present in the support cost (DAU, 2007). This risk is higher during the early phases of program development and deployment, when costs are less certain, hence Cost-Plus contracts are more appropriate in the beginning stages. In general, however, the contracting objective is to eventually achieve a Fixed Price contract, in conformance with the PBL concept of buying defined outcomes at a defined price (DAU, 2007).

Consideration must also be given to the types of incentives that will be utilized in a PBL contract. For vendors to earn the rewards associated with PBL incentives, they must meet or exceed the contractual metrics for performance and/or support (DAU, 2007), depending on specific contract requirements. The most common PBL incentives are summarized in Table 3.

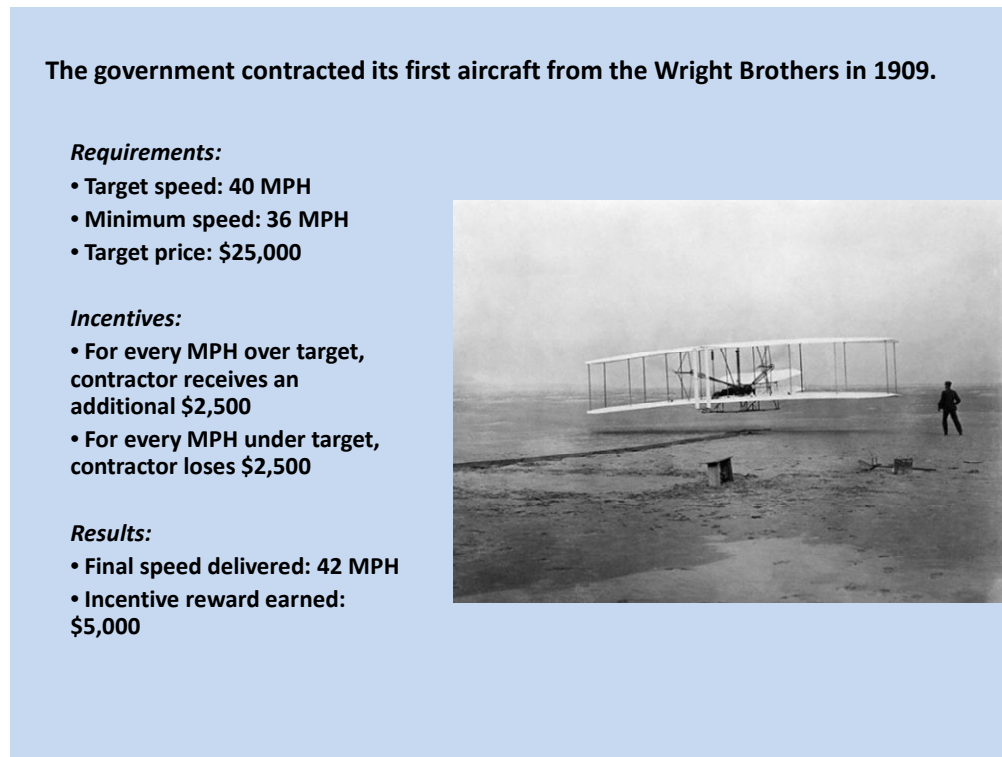
Table 3. PBL Contract Incentives

Incentive	Characteristics
Incentive Fee	♦Most incentive contracts are primarily oriented toward cost incentives, which take the form of a profit or fee adjustment formula and are intended to motivate the contractor to effectively manage costs. No incentive contract may provide for other incentives without also providing a cost incentive (or constraint). ♦Incentive contracts may include a target cost, a target profit or fee, and a profit or fee adjustment formula that (within the constraints of a price ceiling or minimum and maximum fee) provides that: 1) Actual cost that meets the target will result in the target profit or fee; 2) Actual cost that exceeds the target will result in downward adjustment of target profit or fee; and 3) Actual cost that is below the target will result in upward adjustment of target profit or fee.
Award Fee	♦An Award Fee plan is established (timeline for award) ♦Can be a combination of Objective and Subjective assessments ♦Award fee (or portion thereof) is earned by meeting Award Fee plan performance goals
Award Term	♦Additional years are added to the original contract based on satisfactory contractor performance
Shared Savings (Gain Sharing)	♦Fixed Price > Contractor Costs = Contractor Profit ♦When a pre-negotiated maximum contractor profit increases (meaning costs decrease due to contractor achieved savings), DoD and contractor share the savings based on a percentage formula (e.g. 50/50). NOTE: The contractor must share in any cost <i>over-runs</i> as well.

Adapted from DAU (2007)

Incentives such as award fees often form the backbone of a PBL contract; they provide the opportunity for profit that motivates contractors to perform well. The government’s contract with the Wright brothers for the first aircraft in 1909 is an oft-cited illustration of how incentives can influence performance in contracts, and could arguably be called the first performance-based contract in the DoD. The government set a target speed that was desired for the aircraft’s capability, and the contractors were awarded a fee for each MPH over the target that was delivered. This incentive resulted in aircraft performance that exceeded the target, as well as extra pay for the contractors—a prime

example of the “win-win” atmosphere that PBL strives to create. Figure 1 expands on the details of this contract.



Adapted from DAU, 2007

Figure 1. Performance-Based Contract Incentives for the First Military Aircraft

Performance bonuses are a crucial part of contract structure in many PBL constructs. Nevertheless, the government sometimes struggles to find the right incentives to match operational and financial risks, even when the risks are apparent. In many cases, it is a greater struggle to identify an adequate fixed price for a contract, even when the contract has been in a Cost-Plus status for several years. Why is this so? Unlike the private sector, the government has considerable difficulty placing specific dollar values on logistical support. Because private sector firms exist to make money, they invest in

process capabilities and logistics services that are relatively easy to relate to profitability (Doerr et al., 2005). Process improvements are typically undertaken in the commercial realm to improve the bottom line. Conversely, the DoD exists not to make a profit, but to provide military defense of the United States and its interests. Although the DoD is often cost-driven, its objectives are sometimes difficult to label with monetary value. What exactly is the worth of having a particular weapon system perform better? As Doerr et al. (2005) point out, “while the cost of making a weapon system fully mission capable may be estimable, the benefit...is far more difficult to assess in dollar terms.” Corporate views of readiness are based on equipment costs that affect profitability: “when will it become so expensive to maintain that I will have to replace it (Doerr et al., 2005)?” DoD views of readiness focus on war fighting capability, and are often balanced against budget constraints. While funding constraints may reveal the value of one program in relation to another, they don’t necessarily define true individual values of capabilities.

Even assessing what it really costs the government to perform logistical support for a weapon system is often a hugely daunting task. It typically requires analysis of years of data, and to be realistic, must analyze a myriad of costs that are hidden throughout an enormous bureaucratic system. When a contractor offers a price for the same work, that price usually includes all overhead costs associated with the work, and it is difficult for the government to make a close comparison to its own costs. Hence, although achieving a Firm-Fixed Price is supposedly the end goal, there are challenges in getting it right.

Award Terms and Option Years

Two common and very similar methods the government uses to mitigate risks while implementing PBL deals across multiple years are known as *option years* and *award term* incentives. Option years refer simply to non-guaranteed contract years that provide the government with “off ramps” if a need develops to end the contract prematurely. For example, a five-year contract may consist of two guaranteed years with three subsequent option years. It is generally assumed by both parties in a PBL contract that the option years will be exercised, barring significant unforeseen limitations.

Award term years operate in much the same manner as option years, but are earned by contractors through good performance, and introduce more legal obligation on the government’s part. Modeled after the cost-plus-award-fee incentive contract described in section 16.405-2 of the Federal Acquisition Regulation, award-term contracts reward commercial vendors for good performance during the original contract by adding additional years without undergoing contract competition (Edwards, 2001). This naturally requires the government to monitor the contractor’s performance for an initial period that is long enough to get an adequate picture of performance but brief enough to minimize the government’s share of risk. As a result, PBL contracts that use award terms often have an initial base period of only one year, with several award term years attached as incentive for performance. Once the government has recognized that that the contractor’s performance has met or exceeded the pre-set standards that warrant extension, the length of extension is based on the government’s continuing need for the service and the availability of funds (Edwards, 2001).

Because they are similar in nature, and tend to motivate the same behavior, it is often difficult to distinguish between option years and award terms. The only truly notable difference between the two in the PBL context is the notion of legal obligation that award terms bring:

“A true award term incentive rewards the contractor with legal entitlement to a contract extension, not an additional option. An option is a unilateral right of the Government; a contractor is not entitled to the exercise of an option. But under a true award term incentive, if the contractor’s performance meets the award term criteria stipulated in the contract and if any stipulated conditions such as continuing need and availability of funds are met, then the government must either extend the contract or terminate it for convenience or default. (Edwards, 2001).”

A 2004 memo from the OSD mandated that award-term contracts should be used wherever possible as part of the PBL acquisition strategy (OSD-ATL, 2004). This is the result of a growing perception within DoD that award terms are the most powerful of the available PBL incentives, and a less risky way of crafting long-term contracts; award-term incentives provide advantages such as an environment conducive to capital investment and process improvement (Stevens and Yoder, 2005). But while award-term contracts appear to minimize risk for DoD and represent the interests of the taxpayer by ensuring that outsourcing money is well spent, the method is not universally acclaimed. Stevens and Yoder (2005) claim that this strategy caters only to a small number of businesses who are fortunate enough to win contracts with the government and hold onto them, which causes the government marketplace to “appear less and less attractive to those firms considering doing business with the government until finally, these firms may be forced to leave this marketplace altogether.” These authors believe that such conditions are the very same that induced passage of the Competition in Contracting Act

of 1984, which was enacted to increase competition for government contracts. Another danger of award-term contracts is that they create an entitlement for the contractor before funds are made available, because “award-term contracts actually convey the right of a contractor to continue work, provided certain performance criteria are met (Stevens and Yoder, 2005).” And while award terms are generally viewed as a cost-saving strategy, there are administrative costs associated with contract extensions that may go overlooked; annual revisions and extensions of contracts can be cumbersome and consume significant manpower.

Financial Limitations and Enablers

Current DoD budget allocation processes were not designed with PBL in mind. Funds are separated into various appropriation accounts (e.g. Procurement, Operations & Maintenance, etc.), and rarely are any of these categories inclusive enough to provide a single line of accounting for large PBL arrangements (DAU, 2007). This problem is further compounded by the fact that the different “colors” of money also have different time limits affecting their use. For example, O&M funds are budgeted annually, while Procurement funds are projected for three years. Because financial appropriation in government was not created with PBL in mind, these factors can be challenging to deal with when attempting to construct a long-term PBL contract.

Working Capital Funds (WCF) provide one tool that the services can use to get around these funding issues, given certain circumstances. In general terms, WCF can be used at any level of PBL, but can only be used to fund supply support (i.e. repair, purchase, and transportation of spare parts). Because of this limitation, WCF are most

effectively utilized at the subsystem or component level. WCF can still be quite advantageous, however, because supply support is such a huge portion of weapon system sustainment over time. Depot-level organizations can use WCF to operate, then replenish the money by charging their customers. The Navy has used WCF most extensively; PBL contracts citing the NWCF have been executed with five-year initial contract periods followed by five-year option periods. “The NWCF is a non-expiring, revolving fund that finances the repair and procurement of Navy Depot Level Reparables, and select consumables at the wholesale level (DAU, 2007).” Although the Navy has used WCF to its advantage, the strategy has been less prevalent in the other services and cannot be employed in many platform-level PBL situations.

The Four Stages of PBL

The most well-known method of classifying PBL arrangements according to their “level” of strategy implementation is shown in Figure 2. While the Four Stages are not universally accepted as a clear-cut way of labeling all PBL programs—as stated previously, all PBL programs are unique—they are frequently used to describe the wide range of PBL possibilities and the potential evolution of such programs.

Four Stages of PBL

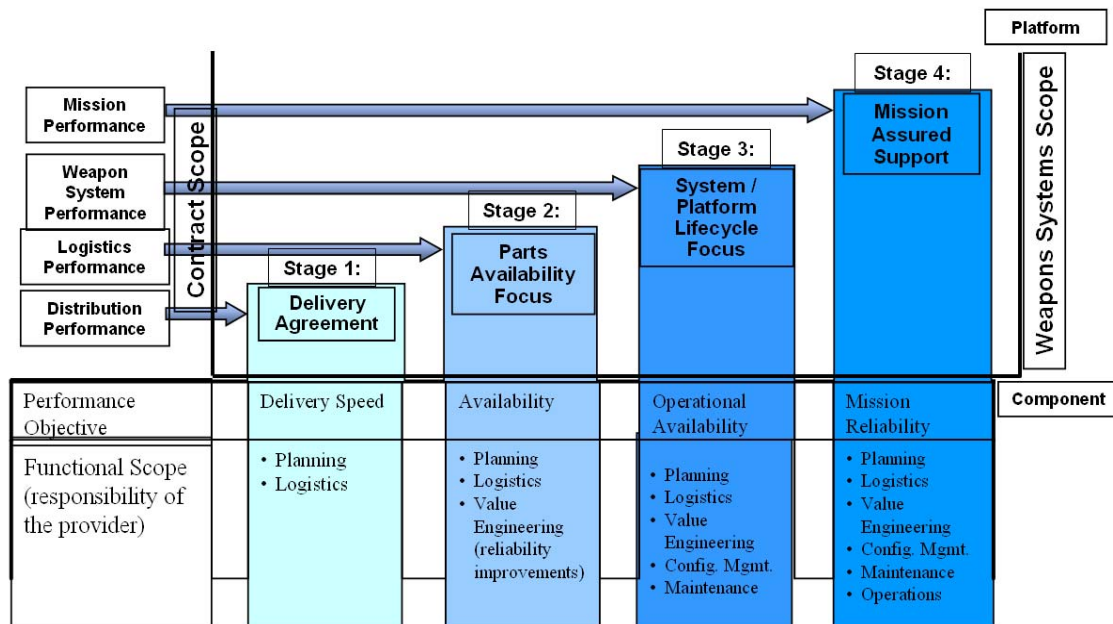


Figure 2. The Four Stages of PBL

In short, Stage 1 describes support at the component level, Stage 2 describes support at the major subsystem level, Stage 3 deals with the weapon system platform level, and Stage 4 assures mission availability/support at the system level (Vitasek et al., 2006). While the Four Stages do not exist to provide any sort of prescription for PBL contract structure, the possibility of conceptual correlations between the different stages and varying types and lengths of contracts warrants investigation.

Interestingly, as the PBL concept has evolved over the past decade, some have begun to challenge whether it can effectively be applied at all four levels. After conducting a case study of multiple private industry organizations that have implemented PBL concepts, the Government Accounting Office recommended that PBL be used as “a tool to achieve economies at the subsystem or component level, rather than as a preferred practice at the platform level (GAO, 2004).” In response to the report, the DoD acknowledged the need to re-emphasize the use of PBL for subsystems and components, but also noted its belief that “it is still prudent to pursue performance-based logistics strategies at the platform level where supported by a business case analysis (GAO, 2004).”

Conclusion

Regardless of the level or stage at which PBL is implemented, it is clear that strong partnerships and long-term contracts are keys to success (Kratz, 2007). At one June 2007 “think tank” meeting on PBL in Washington, D.C., industry representatives suggested that the government could do a better job of risk analysis and that what private industry wants out of PBL agreements is not necessarily higher award fees but longer contracts (Lexington Institute, 2007). It can be seen that there has been a fair amount of discussion in the literature concerning the importance of long-term relationships, the acknowledgment of inherent risks and rewards, and the currently accepted methods for structuring PBL contracts. But how might these methods and strategies be improved? Finding the answer to this question will aid efforts to continuously improve PBL implementation in government. Using the investigative questions presented in Chapter 1

as a lens, this research takes a close look at the issues that appear to have the most influence on contract length and structure in order to shed light on where improvements can be made.

III. METHODOLOGY

Overview

This chapter discusses the research methodology, including research design, units of analysis, and data collection. Case studies of existing PBL programs and interviews with PBL “Subject Matter Experts” (SME) were used to gain a greater understanding of which factors have a significant impact on PBL contract type and length, to what degree contract length has been an issue during PBL implementation, and how this information can be used in future decision making. Case studies primarily took the form of interviews with personnel who had intimate experience with the PBL programs selected.

Case studies and SME interviews were appropriate methods for this research because the study asked several “how” and “what” questions that required exploratory investigation to answer (Yin, 1994). Choosing the best contracting methods for PBL programs is largely a matter of opinion and difficult to support with empirical data. Case studies provided valuable insight into lessons learned by personnel involved with past or current high-profile PBL initiatives. SME interviews added to this knowledge base by providing a “big picture” view that incorporated lessons learned from multiple programs since the inception of the PBL concept.

Research Questions

In order to establish a clear direction for the research and a framework for data analysis, several research questions were developed. As explained in Chapter 1, this study was guided by the following overarching research question:

How can the Department of Defense ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors?

The following investigative questions were established to provide a means for answering the research question. They served as a guide for the development of the interview questions in that they motivated the nature of the inquiries. These questions also guided the study of published PBL historical information when applicable.

Investigative Questions:

1. What types and lengths of PBL contracts have proven most successful and effective to date?
2. What risks and other criteria most frequently play a role in determining PBL contract type and length?
3. In general, are contracts adequately structured to consistently meet the PBL goal of establishing long-term partnerships?
4. In general, are PBL contracts adequately structured to consistently provide incentives for contractors to make cost-reducing investments in system support?
5. In general, how satisfied are PBL experts in both DoD and private industry with the government's application of risk aversion in PBL contracts?
6. Would any significant benefits be gained if the maximum contract length allowed by the Federal Acquisition Regulation was increased?
7. Are award term and option year contracting strategies being used effectively, and should their use continue in a lesser, similar, or greater capacity?

8. Should Working Capital Funds be used more extensively in PBL programs across DoD?
9. Does a PBL agreement's place among the "four stages" of PBL have any impact on contract length decisions?

Research Design

In order to gain an adequate perspective on PBL contract length issues throughout DoD, this study included interviews with knowledgeable personnel associated with a variety of organizations and programs. Based on recommendations from the thesis sponsor, representatives of PBL programs incorporating commercial support, primarily at the system or platform level (Stage 3), were solicited for study amongst the Army, Air Force, and Navy (these programs are listed in Table 5 later in this chapter). When initial contact was made with PBL experts, certain criteria were suggested as guidelines for program selection, in order to solicit the appropriate case study participation. Included in this criteria were:

- Weapon or materiel systems (vice IT programs or services)
- Major Defense Acquisition Programs; ACAT 1 and some 2 programs
- Platform or system-level contracts
- Only commercial programs
- Accessible personnel in both the DoD and private industry

As stated above, these criteria were intended to serve as guidelines for case study selection, not as strict boundaries. The last criterion listed above, "accessible personnel," ultimately proved to be the most decisive factor in selecting programs, as responsiveness of personnel contacted is obviously critical in an interview process. As a result, some of

the programs that were chosen for this study qualify as subsystem-level PBLs. However, all personnel interviewed for the case studies had experience and perspective that were based on PBL activity that concerned the entire weapon system in question. For example, the PBL arrangement for the Navy's F/A-18 E/F Super Hornet is generally considered to be a conglomeration of subsystem and component PBL contracts. While this is true, the F/A-18 Integrated Readiness Support Teaming (FIRST) contract that was examined in this study is a single contract that essentially gives the PSI responsibility for managing the supply chain for the entire weapon system. The objective of conducting research that was inclusive of programs across multiple military branches also influenced the levels of programs selected; i.e. while the Air Force is known to have a penchant for platform-level programs, the Navy has shown more of a tendency toward subsystem and component-level programs.

The research was focused on large-scale PBL programs for two reasons. First, contract length issues appeared to be more prevalent amongst this type of PBL program, especially those in which a contractor is held responsible for the performance and/or integration of support for an entire weapon system platform instead of merely a component of a weapon system. Because these platform-level PBL agreements typically involve enormous amounts of funding and operational risk on the part of the government and considerable investment and financial risk on the part of the contractor, guaranteed contract length becomes very important to financial management on both sides. The second motive for focusing on a few large-scale PBL programs was to limit the scope of this research to a size that was achievable in the allowed time frame.

The research also excluded PBL programs in which system support was primarily organic (i.e. an agreement in which support is provided almost exclusively by a DoD organization such as a logistics depot instead of a commercial contractor). Organic PBL agreements are inherently different from agreements between public and private entities; memorandums of agreement are typically used in lieu of contracts, and risk is less prevalent. Hence, long-term partnerships in this context involve less conflict of interests and objectives. It is worth noting, however, that several of the contracts studied for this research incorporate public/private partnerships between commercial firms and DoD depots, in which the depots are responsible to the commercial PSI for certain core requirements.

Whenever possible, personnel from both the DoD and commercial contractor sides of the selected programs were interviewed, in an attempt to gain an unbiased and balanced perspective on the programs' issues. Unfortunately, this was not possible in every situation due to a lack of timely responses or willingness to participate from personnel contacted.

In addition to case studies, interviews were also conducted with PBL "Subject Matter Experts" not associated with specific programs. A SME was defined as *any government or private sector representative who has had significant experience (preferably at least 5 years) working closely with, overseeing, or evaluating multiple PBL programs from the perspective of either a government organization or a commercial firm*. The goal of gathering input from SMEs was to attempt to broaden the perspectives on PBL contract length issues outside the bounds of specific programs. Most SMEs offered opinions based on conclusions they had drawn as a result of working

many PBL issues over a significant period of time. This added a degree of “veteran” opinion that was often encountered, but not guaranteed to be found in the case study interviews. As with the case studies, an adequate balance between DoD and private industry sources was sought for interviews with SMEs. Again, however, the well-timed availability of sources was a primary factor in determining who was interviewed.

Although not every subject interviewed worked at the most senior levels of his/her organization, all personnel had a respectable amount of experience with PBL and acquisition logistics-related career fields. Altogether, the interviewees possessed an average of about 9 years of experience with PBL, and 27 years of experience in fields such as program management, maintenance, and logistics in both DoD and private industry. Military experience was common amongst commercial personnel interviewed.

Units of Analysis

Prior to beginning the data collection process, the type and scope of information to be gathered had to be determined, as well as the sources. The perspectives of interviewees and applicable level of their response data were central in defining two units of analysis.

The first unit of analysis was the specific “program level,” wherein a representative collection of PBL programs was examined as case studies, as explained in the previous section. Analysis conducted at this level sought to reap historical information and expert opinions associated with PBL programs at their points of execution, not the top-level view of PBL implementation in DoD overall. Given the time and resources allowed for this research, it was not feasible to conduct an in-depth

study of every PBL program throughout the DoD. Therefore, this unit of analysis included a subset of programs selected from the various branches of DoD.

The second, contrasting unit of analysis was the “DoD level,” which incorporated the “10,000-foot view” of PBL implementation in government. Analysis at this level sought to reap expert opinions and lessons learned from a representative sample of PBL Subject Matter Experts, as explained above. As with the case studies, it was not reasonable to attempt to interview every person in DoD and the commercial sector who qualified as a SME. Therefore, this unit of analysis included a collection of professionals with many years of acquisition and contracting experience in DoD and private industry.

Data was collected from personnel in the public and private sectors at both levels of analysis, which essentially resulted in four categories of data, as illustrated in Table 4.

Table 4. Units of Analysis & Number of Interviews Conducted

Sector Represented		Unit of Analysis	
		Program Level (Case Studies of PBL programs)	Department of Defense Level (PBL Subject Matter Experts)
	Public	4	3
	Private	6	2

Data Collection and Analysis

With assistance from the thesis sponsor at Defense Acquisition University, an initial distribution list of approximately 40 names was created. This list included

electronic mail addresses of points of contact throughout DoD and several defense contractors, and the e-mail message that was sent to them served as a starting point for establishing contact with PBL experts who were qualified and willing to assist with the research. The message listed the criteria for potential case studies and SMEs as explained in the previous section, and requested guidance in identifying the right personnel to speak with about the subject matter. As responses to the initial contact were received, they were organized into four categories:

- 1) DoD personnel associated with specific PBL programs
- 2) Private industry personnel associated with specific PBL programs
- 3) DoD personnel qualified as PBL Subject Matter Experts
- 4) Private Industry personnel qualified as PBL Subject Matter Experts

The process of choosing PBL programs for case studies and establishing contact with the right personnel for interviews was drawn out over several months. Ultimately, 7 PBL programs were studied, which entailed interviews with a total of 12 personnel. In addition, interviews were conducted with 6 SMEs, bringing the total number of sources to 18 individuals (15 total interviews; multiple people were interviewed simultaneously in some cases). The specific programs studied and affiliations of personnel who contributed data to this research are listed in the following tables:

Table 5. Case Study Programs Selected and Associated Personnel Interviewed

PBL Program	Organizations Represented by Personnel Interviewed	Type of Contract¹	Length of Contract²
C-17 Globemaster III Sustainment Partnership (GSP)	♦ U.S. Air Force Acquisition Program Office, Logistics Management ♦ Boeing Company, Business Development Dept.	♦ Combination of Firm Fixed Price Award Fee and Cost Plus Incentive Fee	♦ PBL contract began in 1998 ♦ Current contract period: 2004-2008 ♦ 5-year base with 3 option years ♦ Current J&A lasts until 2011³
T-45 Goshawk Contractor Logistics Support	♦ U.S. Navy, NAVAIR Logistics Management Integration Dept. ♦ L-3 Communications Corp., Program Management	♦ Firm Fixed Price with Over & Above Contract Line Item Numbers & performance bonuses	♦ Current contract period: 2004-2008 ♦ 1-year base with 4 option years
High Mobility Artillery Rocket System (HIMARS) Life Cycle Contract Support (LCCS) I/II	♦ Lockheed Martin Corp., Missiles & Fire Control (section that provides post-production support for product line) ♦ U.S. Army, LCCS Team, Precision Fires Rocket & Missile Systems Project Office	♦ Firm Fixed Price with Incentive Fee ♦ Cost-Plus Fixed Fee for contingency deployments	♦ LCCS I covered 2004-2007 ♦ LCCS II will cover 2008-2010 ♦ 1-year base plus option years (both contracts)
E-8 Joint Surveillance & Target Attack Radar System (JSTARS) Total System Support Responsibility (TSSR)	♦ Northrop Grumman Corp., Aerospace Prime Contractor (3 personnel)	♦ Cost Plus Award Fee and Award Term	♦ PBL contract began in 2000 as 1-year base with 5 option years ♦ J&A period of 22 years³ ♦ Contract years have been negotiated up to 2010 (award term)
F/A-18 Hornet F/A-18 Integrated Readiness Support Teaming (FIRST)	♦ U.S. Navy, F/A-18 and EA-18G Program Office, Office of the Director of Logistics and Naval Inventory Control Point	♦ Firm Fixed Price ♦ Current contract combines 2 former separate contracts for NAVAIR & NAVICP	♦ Current contract period: 2006-2015 ♦ 5-year base with single 5-year option
F-117 Nighthawk Total System Performance Responsibility (TSPR) & Total System Support Partnership (TSSP)	♦ Lockheed Martin Corp., Strategic Plans & Sustainment Integration	♦ Cost Plus Incentive Fee ♦ “Stabilized Funding” for first 8 years	♦ TSPR period: 1999-2006 (5-year base with 3 option years) ♦ TSSP period: 2007-2008
F-35 Joint Strike Fighter ⁴	♦ Lockheed Martin Corp., Global Sustainment Business Integration IPT	No official PBL contract yet in place	

¹Refers to the contract’s present or last documented form

²Dates refer to fiscal years

³J&A = Justification and Authorization from Congress for sole source

⁴Sustainment of the JSF is anticipated to become one of the largest PBL agreements ever established around the year 2013. Because the contract was merely in planning stages at the time this research was conducted, information was obtained on this program for purposes of comparing the results of the study with current plans for a future large-scale PBL program. The JSF program is primarily addressed in Chapter 5, however the results of this interview also contributed to the data presented in Chapter 4

Table 6. PBL Subject Matter Experts Interviewed

	Department of Defense	Private Industry
Organizational Affiliations of Participants	♦ Directorate of Innovation & Transformation, Headquarters United States Air Force	♦ Booz Allen Hamilton, Inc. – Senior Associate
	♦ Naval Air Systems Command (NAVAIR) – Logistics Integration, ♦ Naval Inventory Control Point (NAVICP) – Supply Chain Solutions Division *	♦ Lockheed Martin Corp. – Corporate Focused Logistics
	♦ Air Force Materiel Command (AFMC) – Acquisition Logistics	

*One interview conducted with two personnel

The interview questions were devised to provide a framework for the research and guide conversations with personnel, but not necessarily to limit the scope of conversations. In terms of data-gathering, they were intended to accomplish several goals:

- Answer the investigative questions
- Obtain a clear picture of where contract length issues exist within the PBL spectrum
- Get to the heart of what is believed to cause the issues
- Garner suggestions for improvement in future PBL contracting endeavors

Participants were given the option to either answer questions over the telephone (or in person if possible) or to provide written responses. Interview questions were developed into four separate sets, corresponding with the four categories of respondents mentioned previously:

- 1) Questions for DoD Personnel associated with Case Study Programs
- 2) Questions for Private Industry Personnel associated with Case Study Programs
- 3) Questions for PBL Subject Matter Experts in DoD
- 4) Questions for PBL Subject Matter Experts in Private Industry

These question sets can be found in their entirety in Appendices A-D.

Throughout the interviewing process, the question sets underwent several iterations as it became apparent that adjustments, additions, and deletions were required. As a result, not every interviewee was asked every question in the exact same manner. The central themes of the discussions remained consistent with each other and with the investigative questions, however.

Each interview that was conducted verbally was recorded with the permission of the participant. These recordings were then transcribed into notes outlining the pertinent points presented by the person interviewed. The notes were combined with the written responses received and organized in accordance with the interview questions asked. In many instances, participants were asked follow-up questions in order to clarify earlier statements, validate implications of their statements, or to provide further information.

The analysis process was accomplished by organizing the data into the four categories explained above, based on the participants' affiliations. For each interview question, the responses were consolidated, arranged according to the investigative

questions they helped to answer, and then examined for similarities and differences. This was achieved by searching for key words, themes, and implications communicated by the interview participants. Wherever possible, conclusions were drawn based on these apparent themes, common views, and majority opinions of the interviewees.

IV. DATA ANALYSIS AND FINDINGS

Overview

This chapter details the results of the interviews and analysis of the data that was gathered. Content was examined with the aim of answering the investigative questions—responses to interview questions were combined, analyzed, and organized according to which investigative questions they helped to answer. Therefore, the investigative questions provide the framework for the presentation of information in this chapter. Other research findings that were outside the scope of the investigative questions are also discussed.

Investigative Questions

1. What types and lengths of PBL contracts have proven most successful and effective to date?

Interview participants at the program level were asked to express their (or their organizations') degree of satisfaction with the type and length of the PBL contract in question, and to assess the contract's effectiveness in the context of type and length. Comments from Subject Matter Experts that related to this topic at the DoD level were also examined. Interestingly, in all three cases where both public and private sector representatives were interviewed for the same program, both sides were in agreement on the suitability of the type and length of the contract, whether good or bad.

Results for Contract Length

A consistently high level of satisfaction with contract length was found amongst programs that had contracts with a 5-year base, followed by option years or award terms. Respondents in these cases expressed that the contract length allowed for an appropriate amount of risk sharing and return on investment. The DoD interviewee for the C-17 program conveyed that the option years strengthened the arrangement by allowing flexibility for contract changes while extending the agreement into the future. This was a recurring finding throughout the research.

The one case in which both the government and the contractor expressed a high level of satisfaction with a short contract was that of HIMARS. The contracts for LCCS I and II consisted of four and three years respectively, comprised mostly of option years. The shorter contract for LCCS II was designed to reduce a significant risk associated with unknown launcher production quantities and price fluctuations for component spares that affected both parties. Although Lockheed-Martin recognized that three years was too short to encourage significant investment in the program that could be paid back during the length of the contract, the length was acknowledged as an effective compromise with the Army.

The most notable case of dissatisfaction with contract length was that of the T-45 program. Representatives of both the Navy and L-3 Communications agreed that the contract (one-year base with four option years) was too short, because it was limited to five years by the FAR regulations for service contracts. A ten-year contract consisting of a five-year base with five option years was preferred. A similar structure incorporating a single five-year option was employed for the F/A-18 FIRST contract, and this “5+5”

construct appears to be the Navy's preferred PBL contract length when circumstances permit. The Navy interviewee argued that the benefits would outweigh the costs of a longer contract and the contractor agreed, contending that a longer agreement would allow for more creativity in managing spares.

Results for Contract Type

A consistently high level of satisfaction with contract type was found amongst programs with Firm-Fixed Price contracts, which supports the idea that FFP is the desired end-state for PBL contracts.

The contractor for the JSTARS program expressed some dissatisfaction with the current CPAF contract structure of the Total System Support Responsibility, citing that while the Cost-Plus style of contract was appropriate in earlier years, the contract is now in its eighth year and the Air Force is still unwilling to agree on a fixed price.

Government JSTARS personnel were unavailable to provide a DoD perspective on this issue, but the finding once again demonstrates an expectation that PBL should ideally transition from Cost-Plus to Fixed Price. The contractor also indicated that the "year-to-year" nature of contract negotiations had been cumbersome (each ongoing year is an award term) until the government recently negotiated the award terms in a three-year chunk, out to fiscal year 2010.

Ironically, although the PBL contracts for the F-117 have always been CPIF, the well-known criticism of the Total System Performance Responsibility contract from the Air Force's perspective was "fixed price" in nature. A special clause written into the TSPR contract called for "stabilized funding" that required the government to obligate

the funds for the program up-front each year. While this was obviously beneficial to Lockheed-Martin, many bill-payers within Air Combat Command (ACC) considered it a mistake—the clause essentially created a bill for the government that had to be paid in full even if operational requirements changed the use and/or amount of funding directed towards the F-117. However, Lockheed-Martin used this stabilized funding to successfully reduce costs over the long run, and when the follow-on TSSP contract was created, ACC verbally agreed to continue funding the program in the same manner and has followed through. The “must-pay bill” issue is still prominent in PBL contract structure discussions, and the arguments and suggested solutions concerning this issue are further discussed in the results for investigative question #4.

The Firm-Fixed Price Goal

SMEs interviewed were asked to express the degree to which they agreed with the notion that the contracting objective in any long-term PBL partnership between DoD and a commercial entity is to work towards a FFP contract, even though a Cost Plus-style contract may be more appropriate in early stages of the agreement. Some personnel interviewed for case studies also offered comments on the FFP topic.

Of the six interviewees who were directly asked about FFP, four explicitly agreed that it should be the ultimate goal in a PBL contract (in the context of structure), and one implied agreement. Some of the reasons provided were:

- FFP transfers more risk to the contractor, but also provides the most incentive for the contractor to make investments
- “It’s the way PBLs evolve.”

- It is “the only arrangement that will effectively motivate industry to continuously reduce costs through management of the engineering trade space.”
- FFP has inherent incentives—there is no need to continually examine subjective reasons why contractor is doing well (a hassle associated with most Cost-Plus contracts is that they take time and manpower every year to figure out what fee the contractor is going to receive)

One DoD respondent felt that there was too much variation in requirements and funding to ever truly stabilize towards FFP, and that developing a strong partnership between the government and the key supplier was more important than the contract type. He argued that the Planning, Programming, Budgeting, & Execution System generates too many changes to support fixed prices and what is needed, in the end, is flexibility to deal with the trade-offs between performance and cost.

Most respondents also acknowledged that while a fixed price is the goal, it can be very difficult to arrive at and should usually be preceded by a cost reimbursable period. Because it is hard to know early in a program if the price is right, a Cost-Plus contract provides the opportunity to collect data that will later form the basis for a FFP contract. But such data can be difficult to gather, integrate, and comprehend. The following paraphrased analogy provided by one SME illustrates this challenge: “If I’m going to offer a kid a fixed price to cut my lawn, I have a pretty good idea of how much work it takes to cut my lawn; it’s not hard to agree on a price. But when you’re talking about supporting sixteen aircraft, what is a reasonable price to do that?” All involved parties must agree that the historical data provides a credible basis for a fixed price.

A participant at the program level made a case that the government's difficulty in valuing sustainment is an underlying reason for some to challenge PBL as a cost-saving strategy. Platform-level PBL support is often wrapped up in one huge bill to the government, while the costs of logistical support for non-PBL weapon systems are broken up and spread across DoD; there is not one known value associated with overhead costs (e.g. health care for personnel). Thus, PBL may appear to be more expensive when it is not. This concept is consistent with the government's challenges discussed in Chapter 2.

It is interesting to note that while most participants in this study believed that FFP contracts are the exception and not the rule in today's PBL environment, four of the six existing PBL contracts studied have achieved some level of FFP. The prevalence of FFP contracts encountered in the research could be due to the possibility that these programs were suggested for study because they had been recognized as successful programs. If this is true, it is one more reason to associate FFP with PBL program success.

Synopsis of Findings for Investigative Question #1

- Of the PBL contracts studied, the most satisfactory incorporated base periods of five years, with option years or award terms extending beyond five years. The much shorter HIMARS contracts also proved effective, and were based on risk mitigation measures that were in the interest of both parties. The research suggests that, where possible, the "5+5" contract structure is likely to be beneficial for both the government and commercial contractors.

- A consistently high level of satisfaction was found amongst programs with Firm-Fixed Price contracts.
- The majority of Subject Matter Experts agreed that the contracting objective in any long-term PBL partnership between DoD and a commercial entity should be to work towards a Firm-Fixed Price contract, even though a Cost Plus-style contract may be more appropriate in early stages of the agreement. Most also agreed that a FFP is difficult to achieve, and thought that it has been rarely achieved in PBL.

2. What risks and other criteria most frequently play a role in determining PBL contract type and length?

Interview participants at the program level were asked to describe what risks and other factors had the greatest impact on contract structure and future decisions to extend or re-compete the contract as a PBL. Responses pertaining to this investigative question varied greatly, which created difficulties in conclusively identifying which criteria have the greatest influence. Table 7 lists all of the issues that interviewees cited as either having influenced contract structure or having the potential to influence contract structure. The subsequent paragraphs discuss the issues that were most frequently raised by interview participants in the context of this question.

Table 7. Factors that Influence PBL Contract Type and Length

Factors for Government	Factors for Contractors	Factors for Both
♦ DoD budgeting process—significant changes in operations may need to be addressed annually ♦ Precedents set by past PBL programs ♦ May need to rely on OEM because there are no organic support options ♦ Best value of cost vs. performance	♦ Risk of underbidding and getting stuck with an unprofitable contract ♦ Reputations at stake—performance may be more important than short-term profitability in order to earn future business ♦ Setting up a support infrastructure (personnel & installations) requires significant investment ♦ General risks: - System reliability trends - Obsolescence - Program stability - Profit margins - Inflation - Overall relationship with customer	♦ Newness of program/contract (are requirements/costs clear?) ♦ Lack of historical data for system ♦ Risks associated with rapid changes in environment and material costs ♦ Risks associated with accuracy of demand forecast ♦ Contract length can be an enabler for affordability improvements ♦ Cash-rich contractors can afford to take risks when government funding doesn't come through as expected

The DoD budgeting process was mentioned on more than one occasion by both public and private representatives as having considerable influence on contract structure. Funding streams are annual to allow for adjustments to changing requirements. As a result, contractors sometimes “float” cash for the government for upkeep such as aircraft modifications when funds have not yet been obligated or disbursed. The problem, of course, from the contractor’s view is that the government does not pay interest.

Several commercial respondents noted that firms are motivated to perform well as a means of earning additional contracts, therefore the short-term profitability of a contract isn’t the only consideration. Firms often feel pressure to prove to the government that they can provide better support than an organic source that has/could have the same

capability. This suggests that many contractors are willing to accept a less-than-optimal contract structure simply for the opportunity to demonstrate their logistical prowess.

Several individuals also iterated the point that early program risks can be mitigated with a CP contract, and that historical data and lessons learned from the CP phase can provide a foundation for a later FFP contract. FFP contracts were described by one commercial respondent as being an “opportunity to either make significant profits or suffer significant losses.”

Multiple case study participants indicated that in almost all cases, PBL contract structure is determined by the government; that is, vendor input is considered, but decisions are ultimately made by the customer. Vendor behavior suggests that obtaining the desired contract structure is somewhat subordinate to the priority of simply procuring business. As one Boeing representative explained regarding the C-17 program, “Boeing wants what the government wants”—award terms may not be ideal from Boeing’s perspective, but if the DoD perceives award terms as the best way to go, Boeing will work with them to keep the business. It was also acknowledged that risk sharing is an important part of PBL and that both parties must be prepared to assume some risk to assure success.

Synopsis of Findings for Investigative Question #2

- When constructing a PBL contract, the government must consider the limitations of its annual budgeting process and the value of commercial support vs. organic support.
- Private industry must consider issues such as profitability and maintaining a reputation that will help to earn future business.

- Both the government and commercial vendors must consider various risks such as changes in costs and operational environments, unknown costs associated with infant programs, and accuracy of future demand based on historical data. Contract length should be considered as a possible enabler for affordability improvements.
- In most cases, PBL contract structure is ultimately determined by the government.
- Risk sharing is important to the process of agreeing on a PBL contract.

3. In general, are contracts adequately structured to consistently meet the PBL goal of establishing long-term partnerships?

Interview participants at the program level were asked to comment on the extent to which their organizations viewed the PBL contract as a long-term partnership with the other party.

Case Study Results

All but one respondent viewed their PBL contracts as true long-term partnerships. The lone exception was a Navy representative who did not necessarily deny that the T-45 contract was a partnership, but expressed that the length of the contract fell short of his expectations for what truly “maximizes” the PBL concept. The T-45 contractor agreed that the contract was too short, but stated that the company viewed it as a long-term partnership and would not have entered the deal otherwise.

By and large, case study interview participants classified their associated programs as long-term partnerships and had positive views of the programs in this regard. Participants from both sides acknowledged the need to make commitments and share

both risks and rewards. From the DoD perspective, a C-17 authority pointed out that the government wants the flexibility to make changes to a contract annually, but must surrender some of this flexibility to be a good partner. From the commercial perspective, a Lockheed-Martin spokesperson cited examples of steps his company had taken to show it was a good partner in the HIMARS program, such as sharing repair work with the Army depot and adjusting spares purchasing to maximize performance over profit. “We believe that it is necessary to be a ‘good partner’ that is willing to help our customer in some instances, even when it will reduce our revenue stream,” he said. For JSTARS, a close working relationship between Warner Robins Air Logistics Center personnel and Northrop Grumman Corporation’s embedded team was mentioned, where supply chain personnel work closely together to solve parts problems.

A challenge of some long-term PBL relationships that was pointed out by several respondents is that of the paradigm shift created by the public/private partnerships between private vendors and military depots. In many cases, depots have become suppliers to the contractors who do maintenance and modifications, causing a complete reversal of traditional roles. One commercial interviewee expressed that in the recent past, this created difficulties in making PBL work at its full potential when depots resisted being held to performance standards and were less fiscally responsible, causing costs to rise. Additions to U.S. Code Title 10 in 2005 require that military logistics centers be held responsible for quality, schedule, and cost performance requirements (GPO, 2005). The practice of this accountability, though, may not yet be readily apparent to all who interact with the depots.

Synopsis of Findings for Investigative Question #3

- There is a consistent perception in the PBL community that long-term partnerships are being achieved, though exceptions exist.
- Both DoD and private industry have taken steps to strengthen partnerships, and are learning how to be good partners with each other.
- In some instances, the role reversal brought about by public/private partnerships between depots and vendors has created new challenges in implementing PBL effectively.

4. In general, are PBL contracts adequately structured to consistently provide incentives for contractors to make cost-reducing investments in system support?

Interview participants at the program level were asked questions about how the type and length of the contract influenced the quality of system support as well as encouragement for investment and return on investment (ROI) for the contractor.

Responses to these questions varied significantly, and are highlighted in Table 8.

Table 8. Case Study Findings for Investigative Question #4

Program	Contract Structure*	Comments on incentives for improvement and ROI
C-17	FFP/AF & CPIF 5+3	♦ Option years strengthened the arrangement by increasing contract length while providing flexibility ♦ Boeing spends a lot on the program, but turns a respectable profit from it as well
T-45	FFP 1+4	♦ The addition of more option years would have provided more incentive for investment from contractor without added risk to government (5+5 structure would have been better) ♦ L-3 Communications viewed the opportunity for ROI and incentive for investment as adequate, but believed a longer contract would have allowed the firm to better manage spares
F/A-18	FFP 5+5	♦ The Navy is happy with the current contract structure, but does not want it to be longer; 5+5 is just right
HIMARS	FFP/IF (CP Fixed Fee for contingency deployments) LCCS I: 1+3 LCCS II: 1+2	♦ For LCCS I, incentive for investment was good—Lockheed Martin was able to make up-front investment in spares that resulted in greater ROI ♦ For LCCS II, incentives are too small to encourage Lockheed Martin to invest in cost reduction, and there is not much room for improvement. FFP does provide some incentive, since money saved is profit.
JSTARS	CPAF Award Term	♦ Length of J&A was enough to encourage some investment from Northrop Grumman, but year-to-year nature of contract discouraged long-term investment—therefore, the company is not making large investments in the program ♦ Negotiating the contract in 3-year portions instead of annually has improved incentives for investment ♦ TSSR trails other Northrop Grumman sustainment programs in terms of revenue stream; more contract guarantees would change the company's approach in achieving cost savings
F-117	CPIF (with “Stabilized Funding” for TSPR) TSPR: 5+3	♦ In comparison to other Lockheed Martin programs, the stabilized funding in the TSPR contract definitely provided greater incentive for investment ♦ In contrast, the F/A-22 contract is similar in length but Lockheed Martin is not making long-term investments in the program because contract years and funding are not guaranteed

* Length denoted as # of base years + # of option/award term years

As can be gleaned from the table, it is challenging to summarize the various views that respondents had about their contracts' levels of effectiveness in meeting these PBL goals. Not surprisingly, the satisfaction with investment incentives was highest amongst programs that had multiple guaranteed contract years or guaranteed funding. Equally unsurprising was the tendency for vendors to express that investment incentives were lacking somewhat in programs with shorter or less guaranteed contracts. In most cases, ROI did not seem to be a significant issue, because defense contractors will rarely enter into contracts with the government that are unprofitable, even if they are not as lucrative as would be preferred.

Interviewees offered many other thoughts on PBL investment incentives that can be generalized across DoD. The limitations associated with the government's annual funding procedures and lack of stable budgeting were repeatedly recognized as roadblocks to the creation of truly effective PBL contracts, and are discussed thoroughly in other segments of this chapter. It was conveyed that long periods of Justification and Authorization for weapon system support do provide some comfort and motivation for investment to contractors, but still involve risk on their part because J&A is not a contract. Several respondents acknowledged that optional contract years have the power to encourage investment despite their non-guaranteed nature, because contractors generally assume that option years will be exercised by the government unless the vendor seriously underperforms. This topic is also explored in greater detail later in this chapter.

Of perhaps the greatest interest to this investigative question were comments offered by a Lockheed Martin representative for the Joint Strike Fighter program, who suggested that the two biggest enablers for vendors to accomplish weapon system

affordability improvements are long-term contracts and price-based (vs. cost-based) contracts. This would suggest that it is in the government's best interest to work towards long-term, fixed price PBL contracts whenever possible. Another contract incentive that has not been traditionally implemented but has potential to result in greater affordability improvements is the concept of *profit sharing*. Historically, the government has seen efficiencies achieved by contractors as opportunities to lower costs; DoD contracting officers are directed to attempt to get a lower price whenever possible. This tends to limit creativity and incentive for investment on the contractor's part because the government is the only party who enjoys the return on improvements made. If provisions for sharing these returns between vendors and DoD became more common in PBL contracts, bigger cost reductions and benefits for both parties may be realized. This idea was echoed by the commercial authority for the T-45 program, who articulated that if PBL contracts were worded in such a way that allowed profit sharing, shorter contract length would be less of a problem. One SME expressed his belief that while the government has done a good job of incentivizing performance in the short term, it has not found a way to truly incentivize cost reduction over time. Profit sharing may be the key to solving this problem.

Synopsis of Findings for Investigative Question #4

- While the levels of satisfaction with investment incentives have varied greatly in PBL contracts, the longer contracts with more guaranteed years appear to have been more successful in this regard.

- Congressional funding methods, stable budgeting, J&A periods, and option years all have some influence on vendors' motivation to invest in PBL programs.
- Long-term contracts and price-based contracts are enablers for affordability improvements.
- Both the government and private industry could benefit from an increased use of profit sharing incentives in PBL contracts.

5. In general, how satisfied are PBL experts in both DoD and private industry with the government's application of risk aversion in PBL contracts?

Interview participants at the DoD level were asked to assess the appropriateness of the government's risk aversion in PBL contracts and the government's degree of success in balancing risks between itself and commercial contractors. Comments from other interviewees that related to this topic at the program level were also examined.

SME Opinions

Assessments of the government's risk aversion in PBL varied significantly amongst interview participants at the DoD level; while some Navy personnel thought risks had been appropriately addressed on both sides (government and industry), some Air Force and private industry personnel indicated that the government was too risk averse and that risk sharing had been ineffective. The majority of participants expressed dissatisfaction with the government's risk aversion in PBL contracts. A Lockheed Martin executive claimed that "virtually all PBLs are successfully achieving their objectives and saving life cycle costs for the government, and the process for performing business case

analysis as a precursor for award is torturous.” He suggested that the DoD’s risk aversion has kept PBL from becoming a more prevalent contracting strategy. A Booz Allen Hamilton senior associate suggested that there is not enough due diligence in government to fully understand the risk profiles that contractors are taking on, pointing out that it is worth understanding because sometimes the contractor isn’t actually taking on very much risk.

Applicable Results from Case Studies

Several results from interviews conducted at the program level were applicable to the topic of risk aversion. There was considerable acknowledgment from both DoD and private industry that risks must be shared for PBL contracts to be effective. Notably, this was mentioned repeatedly as a success factor for two of the “high satisfaction” programs, C-17 and HIMARS. In contrast, a commercial JSTARS authority expressed that while risk sharing was sufficient in the early years of the TSSR contract, the government was now showing a little too much risk aversion in its reluctance to give serious consideration to a fixed price contract. Multiple interviewees touched on the fact that big defense contractors can usually afford to take risks for the government; that is, operate using their own capital when government funds have not yet come through. As mentioned earlier, however, the government does not pay interest when it pays these bills, and therefore creates a minor risk for the contractor. In summation, as a Boeing representative quipped, crafting a PBL contract is “really all about risk sharing.”

The F-117 TSPR “Must-Pay Bill” Argument

Recent PBL history can shed some light on the government’s current risk aversion tendencies in some corners of DoD. The somewhat controversial F-117 TSPR contract initiated in FY99 has been heralded as a PBL contracting triumph by many in the private sector, while some USAF contracting officials have cautioned it as a mistake not to be made again. This dichotomy of opinion arose from the aftermath of the aforementioned stabilized funding clause that required the government to obligate \$200 million for the program up-front each year and pay in monthly installments. As discussed previously, this created what many dubbed a must-pay bill for the F-117, meaning that the government must fund the program the same amount each year regardless of changes in operational or budgetary requirements. In return for five guaranteed years, Lockheed Martin agreed to make certain cost reductions that would benefit the government. Since the inception of TSPR, opinions of its success have been split between DoD and commercial professionals: while many DoD personnel view the contract as too risky to replicate in future deals and a black mark on the PBL concept, many private industry persons believe that avoiding the must-pay bill contract shows too much risk aversion on the government’s part.

It should be noted that ACC appeared to have had no real hindrances in paying this bill throughout the duration of the TSPR contract, and has followed through with its verbal agreement to continue the same level of funding during the subsequent TSSP contract. In addition, Lockheed Martin was able to hedge against inflation so that the cost per flying hour never went above 1998 dollars, and returned roughly a 5% cost under-run during several years of the contract. That being said, it is still reasonable for

the government to be hesitant to commit to such a deal again for fear of fluctuating requirements, regardless of the fact that the feared problems never actually materialized during the F-117 contract.

However, a Lockheed Martin interviewee who had experience with both the F-117 and F/A-22 programs offered that contract solutions exist that could potentially answer the problems of the must-pay bill. There is a perception that if the government breaks a contract, it has to pay a penalty, he argued, but a contract can be written so that there is no penalty. The key is a concept known as flexible performance. When a contract has provisions for flexible performance, metrics are designed to accommodate unexpected fluctuations in operational requirements and funding. For example, flexible metrics were developed for the F/A-22 so that if DoD needs to pay Lockheed Martin less money for whatever reason, then Lockheed Martin will deliver less performance. This decrease is measurable; if funding is projected to decrease by a specific amount, then the F/A-22 program can indicate almost exactly how performance will decline as a result. Non-PBL programs with less flexible contracts could provide no such indications in the face of a sudden loss of funds. Therefore, properly building flexible performance into PBL contracts could enable long-term deals with assured funding levels, such as the TSPR contract, to become prevalent and effective. As stated by the professional who was interviewed, “the problems with having a must-pay bill do not constitute an argument against doing PBL; it’s about contracting for flexible performance.”

Synopsis of Findings for Investigative Question #5

- Most interview participants believed that the government has shown too much risk aversion or lack of good risk management in PBL contracts.
- Balanced risk sharing is a crucial part of successful PBL contracts.
- The greatest risk to the government in PBL contracts seems to be changing operational requirements that result in budget fluctuations, not contractor performance. In other words, there isn't much fear that contractors won't come through, but rather there is trepidation about having to pay a contractor a fixed price after Congress has cut funding. This issue has been at the heart of the "must-pay bill" argument, and has implications for award terms and option years, discussed further under investigative question #7.
- The inclusion of flexible performance provisions in PBL contracts could potentially open doors for more effective contracts by alleviating DoD's budgetary concerns.

6. Would any significant benefits be gained if the maximum contract length allowed by the Federal Acquisition Regulation was increased?

Interview participants at the program level were asked to discuss whether or not FAR limitations had significantly impacted the structure of the PBL contracts. At the DoD level, participants were asked if they believed FAR limitations had significantly influenced the lengths of PBL contracts, and if they believed there were any benefits to be gained if the maximum initial contract length allowed by the FAR was increased to a period beyond five years.

Case Study Results

Of the eight individuals who were asked whether or not FAR limitations had affected program contract lengths, five indicated that the FAR was irrelevant. Two of the respondents who believed the FAR had limited contract length were associated with the T-45 program, not surprisingly. This program was the most notable instance of the FAR having an impact on contract length, because its classification as a service contract prevented program officials from attaining the “5+5” structure that was desired.

The only conflicting answer between DoD and commercial representatives for the same program came from the C-17 interviews: the Boeing representative thought the contract length had been limited by “programmed risk aversion measures” such as the FAR, while the Air Force representative surmised that the government would not have pursued a base contract beyond five years regardless of FAR limitations.

SME Opinions

Several SMEs asserted that there was little evidence to suggest any real need to change the contract length limitations in the FAR; PBL goals can and are being accomplished using initial base contracts of five years or less. One private industry authority expressed that the FAR limitations are indeed relevant, but not as important as the funding limitations associated with the “one-year” Operations and Maintenance money that is used to fund major PBL efforts.

The Emerging Problem

A recurring finding throughout the research was that the real issue was not the limitation on the number of base years for a PBL contract, but a lack of guaranteed funding during those years. This seems to represent what industry wants most out of PBL deals, but is something the government can't truly provide using current practices. The concept of PBL says that a longer contract is better, but reality dictates that funding will only be approved annually, and this limits implementers' ability to get the full potential out of PBL. This seemed to be an important issue among interview participants and inspired them to discuss past issues associated with the F-117 program on multiple occasions. It is clear that most defense contractors seek to achieve FFP contracts that are guaranteed over several years. The government also benefits from FFP contracts, but struggles to guarantee them for longer than a year at a time because military requirements can change rapidly, and Congress reacts with annual changes to the defense budget.

Unfortunately, Congress is not likely to change its funding methods in the near future, so PBL contract builders can expect to continue to face the challenge of creating long-term deals without knowing when monetary lifelines will be snipped or shortened. This has not stopped PBL proponents from searching for solutions, though. One SME discussed a recent PBL funding proposal that has drawn divisive attention within the Air Force. Some have lobbied for a separate governance process for PBL, in which a certain amount of funds are fenced off specifically for PBL contracts. The advantage of this "fenced funding" would be that implementers would have assurance that the money is there to support long-term contracts. This could create a perceived lack of fairness in the budgeting process, however, if money apportioned to PBL contracts is immune to budget

cuts that affect non-PBL programs. In the end, the Air Force will need to divert money to the capabilities it needs the most, regardless of whether or not it involves PBL. At this writing, Air Force Materiel Command had formed teams to examine funding possibilities such as this for PBL.

Synopsis of Findings for Investigative Question #6

- There don't appear to be any clear potential benefits to changing the FAR contract length limitations. Instances of the FAR having an impact on contract structure were found to be in the minority.
- Funding limitations have proven more notorious than length limitations in PBL contracts; in fact, funding constraints are a cause of shorter contract lengths. Consideration needs to be given to the fact that Congressional funding methods are not congruent with PBL, especially at the platform/system level.
- Since the government is not likely to change its funding process in the foreseeable future, this issue will continue to limit PBL success until fair alternatives can be established. Alternative funding methods for PBL are being examined.

7. Are award term and option year contracting strategies being used effectively, and should their use continue in a lesser, similar, or greater capacity?

SMEs interviewed were asked to share their thoughts on the use of award terms in PBL contracting (i.e. assess their effectiveness and frequency of use). This frequently led to discussion of option years as well, since the two concepts are closely tied. Late in the data collection phase, a follow-on question was posed to all interview participants at both

levels, asking if anyone was aware of any instance of a PBL contract in which the option years or award terms were not exercised by DoD.

Findings

This study found that award terms have been utilized successfully in Air Force contracts, but there is little knowledge of award terms outside of the Air Force. Several participants had difficulty discerning a clear difference between award terms and option years. As explained in Chapter 2, award terms create an obligation for the government to extend a contract if the specified conditions are met, whereas option years give the government the choice to extend regardless of performance. Nevertheless, option years are not much different from award terms in actual practice. One industry SME pointed out that contractors are just as motivated to perform well for option years as they are for award term years because it is up to the government to exercise them, and good performance is likely to sway such a decision.

Despite the fact that award terms are not guaranteed, it was found that they do provide incentives to contractors to perform well in the long run, as opposed to the more short-term motivation that comes from award fees. Another SME asserted that award terms can be effective because keeping business is a very strong incentive in the commercial world; once a company has a revenue stream established, they really don't want to lose it. One DoD SME believed that while the award term can be an effective tool, it "needs to be tied to better cost reduction incentives."

How are award terms and option years really being used?

Throughout this research, it was pointed out repeatedly that award terms and option years are typically employed to provide “off ramps” for the government in big PBL contracts; that is, they give the government a way out of the deal if the contractor is not performing up to the desired standards or at the desired price. Obviously, contractor performance is central to the decision to continue a PBL contract. But this research found that the academic perceptions and definitions of award terms/option years do not seem to accurately represent the way they are truly being utilized.

All interviewees were asked if they were aware of, or had any experience with, a PBL contract in which the award term or option years were not exercised by DoD. While respondents were able to think of several examples of past contracts that were either non-PBL deals terminated early or PBL contracts that were not extended after the final year, no examples were given of PBL contracts in which optional years were not exercised. Therefore, this research uncovered no instances in which award terms/option years were needed to provide the government with a way out of a PBL deal gone bad. Interestingly, even amongst the examples given, the reasons for contract termination did not include bad performance on the part of the contractor. Among the reasons given were the realization that performance-based contracts were not needed and the realization of cost savings from dealing directly with an Original Equipment Manufacturer (OEM) for a sub-system. When the extensive history of DoD’s relationships with major U.S. defense contractors is also factored in, this information suggests that the risk of a contractor seriously underperforming in a PBL arrangement is actually quite minimal. But if the risk is small, why are option years and award terms so prevalent?

The research revealed that the answer can be found, once again, in the way DoD is funded by Congress. The majority of DoD contracting officials have no trouble seeing the value of long-term contracts for PBL agreements, but are limited by the uncertainty of funds over periods that would generally be considered long-term (e.g. eight years). Does the government truly fear that a company like Boeing is not going to deliver the level of performance it promises in a PBL contract? Probably not. But there is little flexibility to deal with changes that affect a must-pay bill in a lengthy guaranteed contract. Optional years provide an opportunity to make adjustments to a contract in the process of extending it. Hence, award terms and option years often provide the DoD with the flexibility it supposedly needs to maintain a long-term contract while dealing with budget fluctuations.

There are other aspects to consider as well, as pointed out by the interviewees. Acting on the decision to not exercise an option takes considerable planning, and in the case of the award term, sufficient evidence of non-performance on the part of the contractor. If a provider is cut loose, another must be found to take its place, meaning that when an option year is not exercised, a new contract with a new provider must be created so that operations are not disrupted. Because new contracts typically take 18-24 months to put in place, the decision to not exercise an option must be made very early—so early, in fact, that in most cases, the DoD would likely be forced to award the next option year to the underperforming contractor, simply because an alternative source cannot be procured on such “short” notice.

A previously mentioned government SME believed that most PBLs have been awarded in what is effectively a “sole source environment,” expressing that in reality, no

firm other than the prime contractor or OEM has the knowledge and ability to provide PBL support for a weapon system, so “OSD’s notions of competition are really not operable.” It was suggested that because of this, it is highly likely that any PBL agreement that DoD enters into on the platform-level will last for a long time. This issue warrants consideration when contract type and length are being structured for major PBL programs.

Synopsis of Findings for Investigative Question #7

- Award terms and option years have been effective in PBL contracts, and their use should continue in a similar capacity.
- In a perfect PBL world, long-term agreements with guaranteed years and guaranteed funding throughout the duration of contracts would be ideal. But since this is not reality, it appears that award terms and option years essentially serve as the “happy medium” that enables PBL contracts to be long-term while effectively sharing risks at the same time.
- Due to the natural reliance on OEMs, it is likely that DoD will continue to enter platform-level PBL agreements for the long haul, so long-term contracts should be as stable as possible.

8. Should Working Capital Funds be used more extensively in PBL programs across DoD?

DoD interview participants at the program level were asked if the PBL programs had been able to use WCF to their advantage in any way. Likewise, DoD SMEs were

asked to provide their views on whether or not WCF are being used to their full potential in PBL contracts across DoD.

Case Study Results

Working capital funds have been used to fund supply support for PBL programs in various parts of DoD. The Navy has used WCF most extensively; for example, NWCF finances 65% of the F/A-18 FIRST contract. When applied, WCF have successfully allowed longer PBL contracts; however, they have restrictions on where they can be used and therefore do not seem to be recognized as a widespread strategy for lengthening contracts.

SME Opinions

Most respondents agreed that WCF are best suited for employment at the subsystem or component level. An Air Force interview participant assessed that the Navy has made the use of PBL more straightforward by cordoning off some WCF money to be used on PBLs classified as supply contracts. He maintained that the Air Force is slowly but surely learning how to use these funds more effectively and that AFWCF will have a role in more PBL deals in the near future, especially if anything like the ‘fenced funding’ proposal described under investigative question #6 comes to fruition. Most experts expressed a belief that there is room for improvement in the Air Force and Army in the use of WCF for PBL, and that the Air Force has taken steps in that direction (no assessment of the Army was provided). The research did not reveal the utilization of WCF to be at the heart of PBL contract structure issues, however. Bigger-picture

questions about what is achievable and affordable and which contracting approach is best suited to the task were found to be of greater importance.

Synopsis of Findings for Investigative Question #8

- When used, WCF have successfully enabled longer contracts, but the use of WCF does not seem to be of great significance to PBL contract structure issues.
- WCF are best suited for application at the subsystem or component level.
- WCF could be used more frequently to the advantage of the Army and Air Force, so there is room for improvement, but limitations on the use of WCF suggest that they are unlikely to have a great impact on PBL contracting strategy.

9. Does a PBL agreement's place among the "four stages" of PBL have any impact on contract length decisions?

Interview participants at the DoD level were asked if they believed a contract's place among the four stages of PBL had any significant impact on contract length decisions.

Findings

There was little evidence to suggest that there is any direct link between contract length and where a PBL fits within the four stages. DoD SMEs interviewed did not believe that the four stages had much impact on contract decisions. One stated that the "four stages don't properly express what's being done" in PBL, and another pointed out

that, because “there is little real benefit from PBL in the short term,” PBL should address long-term sharing of risks and costs regardless of the level at which it is implemented.

One industry SME believed that programs at higher levels and maturity, such as platform-level responsibility, require more long-term commitment, while material management support contracts that require little to no investment do not need to be long term. He believed “it would be difficult to implement a stage 3 PBL with a one-year contract that gets renewed every year.” This suggests that the length of commitment from both parties in a PBL agreement should increase in proportion with the stages of implementation. While this is a logical assumption, PBL contracting behavior does not necessarily support it. Supply support contracts enacted at the stage one or two level are not only typically less risky than stage 3 contracts, but can also usually draw income from working capital funds, which allows for longer contracts. There was also a general consensus that no stage 4 PBL has ever truly been implemented. It was suggested that the upcoming Joint Strike Fighter contract (an anticipated PBL program) may be the closest yet.

The most interesting finding was agreed upon by multiple interview participants: that the four stages concept is misperceived in the acquisition and contracting communities, and that contrary to popular belief, all PBLs should not strive to move up to the next stage in this supposed “PBL evolution.” Stage 4 is often presented as a goal for all PBL programs to strive for—Vitasek et al. (2006) describe the four stages model as “a tool for program managers in charting a path to extend their PBL strategies to higher levels and broader scope”—but as several interviewees agreed, there is nothing wrong with an effective stage 1 PBL that is static in this regard. Higher-stage PBLs are difficult

to implement, and when a lower-stage PBL has been fittingly implemented, the war fighter is better off as a result. Oftentimes, attempting to move such a program to the next level is not necessary or achievable.

Synopsis of Findings for Investigative Question #9

- A PBL agreement's place among the "four stages" of PBL appears to have little, if any, impact on contract length decisions.
- Not all PBL programs should strive to move higher in the four stages model—effective stage 1 and 2 PBLs accomplish good things for the war fighter and there is often no need to expand the scope of such programs.

Other Findings from Research

The research uncovered several other intriguing findings that were not directly related to the investigative questions:

PBL a Good Fit for Programs Studied

All case study participants were asked whether or not they believed that their program was a good fit for PBL methods. The unanimous answer was a resounding "yes." All programs were viewed by DoD and private industry personnel as having had success due to the PBL construct.

Relationships More Important than Contracts?

In answering a question about whether PBL contracts define the partnership between organizations or if contracts are merely a necessary evil, many respondents acknowledged that relationship management is vital to a successful PBL and perhaps more important than the contract itself. While the contract lays some important groundwork and is helpful in dealing with personnel turnover, a true long-term partnership is between people who can successfully align attitudes and overcome adversarial tendencies.

Conflicting Views Abound

It was mentioned in Chapter 2 that a 2004 GAO report recommended that PBL be focused on the subsystem level. Views about what level PBL is best suited for and where it is most used seem to vary greatly. One interviewee remarked that the Air Force tended to enact PBL at the system level, while another remarked that the Air Force tended to focus on the subsystem level. In stark contrast to the GAO report, many commercial participants seemed to view PBL as the premier strategy for platform-level sustainment. Still, others believed that long-term success of PBL will occur in subsystem-level contracts.

Cost-Based Logistics?

PBL programs have been widely viewed as being very successful in providing improved weapon system performance. Because improved performance has become an expectation and a given, the other major PBL goal of cost reduction seems to have

jumped in the driver's seat. As a Boeing representative stated, "performance just isn't cutting it anymore; now it's about affordability." Contractors' efforts in remaining competitive now focus greatly on ways to best improve affordability, because performance is assumed and cost savings drive many government contracting decisions.

Killing the Roots of the Plant

In discussing the dangers of the must-pay bill issue, an industry representative highlighted the importance of the government providing business for large OEMs. He generalized that when the government doesn't have the money to fully fund depots for repairs, it doesn't typically reduce personnel strength at the depots—instead, DoD tends to stop buying materiel, paying a vendor, or funding a Contracted Logistics Support program. Contending that this damages industry by denying nourishment to the few OEMs who remain to build DoD its next airplane, he articulated that "if you look at the big picture, we are killing the roots of the plant." Military depots are not likely to lose their workload, but they may turn to an OEM one day for support only to find that the company is building hybrid cars instead of military aircraft. This scenario emphasizes the importance of continuing to find ways to partner that keep contractors in the defense business. It is a debatable topic to be sure, but one that provokes thought.

Summary

This chapter discussed the research results within the framework of the investigative questions. The next chapter examines what conclusions can be drawn from

these findings in order to answer the overarching research question, and discusses implications of the conclusions.

V. CONCLUSIONS AND RECOMMENDATIONS

Overview

This chapter is organized into four sections. The first section brings together the research findings discussed in the previous chapter and examines how they can be used to answer the overall research question that was put forth in Chapter 1. The second section draws a comparison between the conclusions of this study and the plans for implementation of a future major PBL effort for the F-35 Joint Strike Fighter. The third section discusses limitations that were encountered in this research, and the final section puts forward some recommendations for future research on this topic.

Answering the Research Question

How can the Department of Defense ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors?

As discussed in Chapter 1, this research sought to draw conclusions about what steps can be taken in the area of contract structure to make PBL work better and help DoD to achieve the ideal balance depicted in the research question above. The findings in Chapter 4 revealed five main areas where efforts for improvement should be concentrated.

1) Congressional Funding Methods are Not Compatible with PBL

As discussed thoroughly in the previous chapters of this research, the annual allocation of funds (primarily O&M) creates difficulties for implementers of PBL. In

fact, the findings of this research suggest that it is the single biggest challenge facing those who seek to craft PBL contracts consisting of multiple guaranteed contract years. DoD simply cannot always guarantee the funding levels that would allow it to commit to contract periods that are truly long-term. Other methods are being explored for funding PBL in such a way that mitigates the risk of budget fluctuations, such as “fencing off” money within the services to be used for PBL programs. If significant changes in PBL funding methods were to take place, they could eventually force changes to contract length limitations in the FAR, which currently do not appear to have a widespread impact on PBL contracts. Alternate funding methods for PBL are controversial, however, and it is not reasonable to expect that Congress will alter its O&M funding methods in the near future. Therefore, for now, PBL officials must use other methods to build funding flexibility into contracts, such as option years, award terms, and flexible performance metrics.

2) Optional Years Provide Flexibility Today; Flexible Performance May Be the Solution for Tomorrow

Option years and award terms are typically described as serving the purpose of providing the government with “off ramps” in a PBL contract, that is, they give the government a way out of the deal if the contractor is not performing up to the desired standards or at the desired price. While contractor performance is obviously important to decisions to extend PBL contracts, this description does not seem to accurately reflect what option years and award terms are truly being used for. This research did not uncover a single instance of a PBL program in which option years or award terms were

not exercised because DoD needed a way out of a deal gone awry. This finding, combined with the extensive history of DoD's relationships with major U.S. defense contractors, suggests that the risk of a contractor seriously underperforming in a PBL arrangement is actually rather small. Why, then, is the use of option years/award terms so prevalent? The answer is that these optional contract years provide the government with the flexibility it needs to make adjustments based on budget fluctuations. When option years and award terms are negotiated, the government has the opportunity to make changes to the contract as a response to changes in funding. Therefore, option years/award terms provide one method of building flexibility into PBL contracts.

Considering that the option year and award term concepts were devised with intentions other than what they are primarily being employed for, it would be wise to explore other options for making PBL contracts financially flexible over the long run. One suggested alternative is the concept of flexible performance. Utilizing flexible performance metrics, PBL contracts can be written to accommodate unexpected fluctuations in operational requirements and funding, eliminating the government's fear of being penalized for funding reductions that affect a long-term contract. Put simply, flexible performance provisions allow contractors to deliver less performance when the DoD needs to pay them less money. Changes in performance delivered are measurable, meaning that they are directly proportional to changes in funding, and allow program managers in both the public and private sectors to predict how much performance will decline as a result of an anticipated reduction in funds. This is an advantage that typically cannot be found in non-PBL programs, and should be leveraged as a means of allowing longer contracts where they are needed.

3) Improve Incentives with Increased Use of Profit Sharing

As discussed in Chapter 2, effective partnerships require the sharing of both risks and rewards. While risk sharing is understood to be at the core of PBL relationships, reward sharing seems to have received less attention. Because the government has historically seen efficiencies achieved by contractors as opportunities to lower costs (primarily in Cost-Plus situations), contractors have often had little incentive to make creative improvements and investments in sustainment because only the government enjoys the return. In contrast, when contractors improve efficiencies that result in profits in some Fixed Price situations, the government may see performance improvements but not cost reductions. If PBL contracts more frequently included provisions for profit sharing between DoD and private vendors, benefits may be realized by both parties. Because profit sharing benefits everyone and is conceptually well-suited to the “win-win” partnerships that PBL agreements claim to be, it would seem that financial returns on improvements should be shared whenever feasible.

4) Long-Term Contracts Aren’t Always the Answer...But They Usually Are

Because PBLs are tailor-made to fit requirements of numerous different types of programs, it is difficult to make generalizations about ideal contract length that are applicable across the board. Nonetheless, it cannot be denied that long-term contracts are at the heart of PBL strategy. While there is no universally agreed-upon definition of “long-term” in the PBL context, this researcher generally found the term to refer to agreements of five years or more. PBL programs in DoD have seen substantial success in the execution of contracts that consist of five base years plus three to five option years or

award terms. There are many benefits that come with this type of contract length, such as:

- The long-term nature of the agreement strengthens the partnership between DoD and private industry.
- When combined with the right contract type, there is more incentive for contractors to invest in logistics support for systems, enabling affordability improvements.
- Contractors see opportunity for greater return on investment.
- Labor is not expended to continually rewrite the contract from year to year.

There are, of course, some drawbacks associated with this contract structure as well, the most prominent of which is the loss of flexibility during the initial guaranteed years to deal with fluctuating budgetary requirements (ways of dealing with this problem are discussed later in this section). There are also instances in which a shorter contract is actually ideal for both parties due to unique circumstances (e.g. HIMARS). But in general, history has demonstrated that commitment to long-term contracts produces effective performance-based partnerships, and that the government's reliance on OEMs for weapon system sustainment tends to be drawn out over many years. Therefore, whenever possible, PBL implementers should strive for something that resembles a "5+5" contract structure.

5) Keep Working Towards Fixed Price/Price-Based Contracts

The findings of this research supported the notion that, whenever possible, PBL implementers should strive to achieve a Fixed Price contract for their programs. The

success of programs that have achieved some form of FP demonstrates that this is a meaningful goal. FP contracts align with the PBL goal of purchasing a defined outcome at a defined price; they stabilize prices for the government while guaranteeing a specific level of revenue for vendors. In turn, this provides incentive for contractors to make affordability improvements to systems they support because money saved can be turned into profit (ways to make these improvements beneficial to both parties are discussed in the following section). A long-term contract alone does not encourage a supplier to make investments; the contract must also have provisions that reward such behavior. As one commercial SME put it, “without a fixed price, a long contract only serves to reduce the contracting burden,” meaning that less frequent contract revisions are the only notable benefit.

Fixed Price contracts can be difficult to accomplish; data that supports a stable price is often difficult to gather and comprehend. If not properly planned for during cost-reimbursable stages of a contract, a fixed price may never be attained. Therefore, PBL implementers should keep the FP goal in mind from the inception of a PBL contract, and work towards it over time. It should also be noted that some elements of a PBL contract may never be suited for FP, therefore the effort to reach a FP should not preclude the necessity to keep some elements of a contract in a CP state (for example, the C-17 GSP contract consists of 65% FFP/AF and 35% CPIF).

Summary and Implications

Performance-Based Logistics is a relatively young concept, and a complex beast. Because it has been embraced by the DoD as a preferred strategy for weapon system

sustainment, much is accomplished today in the name of PBL. Therefore, improvements made to the way PBL contracts are structured can have far-reaching effects. There is an inherent conflict that DoD implementers of PBL often face: the goal of developing long-term partnerships that encourage investment from commercial partners is best achieved through lengthy, guaranteed contracts, but such contracts increase the DoD's risk due to unpredictable fluctuations in operational and financial requirements. This thesis addressed the question of how the DoD can ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors. Findings from the research suggested that improvements can be made in PBL by focusing (when applicable) on the five areas described in the previous paragraphs and summarized in Table 9 below.

Table 9. Summary of Findings and Recommendations that Address the Research Question

Research Question: How can the Department of Defense ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors?	
Finding	Recommendation/Comments
<i>(1) The fact that existing Congressional funding methods do not fit well with PBL may be the biggest challenge that PBL implementers currently face.</i>	This is a hindrance to effective long-term contracts. DoD should continue to explore alternative PBL funding methods that reduce the risks associated with budget fluctuations.
<i>(2) Flexible performance metrics, option years, and award terms provide opportunities to build flexibility into long-term PBL contracts.</i>	Because annual funding methods are not likely to change in the near future, these tools can be used to provide flexibility for the government in PBL contracts. Because option years and award terms are designed to provide off-ramps and incentives, flexible performance should be utilized more frequently as a means of enabling long, guaranteed contracts while mitigating the risk of variable funding.
<i>(3) Profit Sharing improves PBL incentives.</i>	Profit sharing provides greater incentives for contractors to make long-term investments and affordability improvements, and is endemic to effective partnerships. Financial returns from improved efficiencies should be shared whenever possible.
<i>(4) Long-term contracts of five years or more, with multiple guaranteed years, make PBL agreements more effective in most cases.</i>	When possible and appropriate, PBL implementers should strive to create contracts with a multi-year base and multiple option years (e.g. “5+5”).
<i>(5) Fixed Price/price-based PBL contracts are typically more effective in the long run than cost-based contracts.</i>	PBL implementers should work towards the goal of a FP contract from the inception of a program. This can require considerable effort, so whenever possible, data should be gathered in the early CP phase to support the later transition to FP. Certain elements of a contract may be better suited for FP and may drive a mix of FP and CP over the long run.

Comparison of Results with F-35 Joint Strike Fighter (JSF) Program

An interview with a Lockheed Martin Corp. representative who possessed substantial knowledge of the F-35 Joint Strike Fighter program was conducted for the purposes of comparing the findings of this study with a potential future PBL contract. Sustainment of the JSF is anticipated to become one of the largest PBL agreements ever

established when the aircraft enters full rate production in roughly 2013. The potential scope of the contract is massive, as it is expected to include customers not only across the U.S. DoD but across the globe. The highlights of the contract proposal that Lockheed Martin initially offered to the U.S. government for sustainment of the weapon system and the counter-proposal from the government are listed in Table 10 below.

Table 10. Notable Aspects of PBL Contract Proposals for F-35 JSF

Initial Lockheed Martin Corp. Contract Proposal	JSF Program Office Counter-Proposal (differences only)
♦ 8-year initial contract ♦ After 3 years, government will issue a 3-year extension added onto the end of the initial contract ♦ One large contract with CLINs for each customer¹ ♦ Cost-based contract during LRIP phase² ♦ Move to a price-based contract when steady-state PBL is achieved ♦ If fixed price is achieved, incorporate “dollar per flying hour” approach ♦ Sharing of profits from affordability improvements (ratio under investigation; possibly 50/50) ♦ High-level objectives: 1) surpass performance requirements, 2) reduce costs over time ♦ Global spares pool in which parts are owned by suppliers/manufacturers	♦ Initial 5-year Award Term contract ♦ Possible extensions added onto end of contract after each year in which contractor performs according to award term provisions ♦ Eventual Fixed Price contract with “dollar per flying hour” approach that is divided into a fixed part and a variable part to provide flexibility (variable portion is directly related to hours flown)

¹CLIN = Contract Line Item Number

²LRIP = Low Rate Initial Production

While there are many interesting aspects of the program and its proposals that merit discussion, the following paragraphs focus on proposed contract structure in relation to the conclusions of this thesis.

Lockheed Martin’s proposed initial contract length of eight years certainly qualifies as a long-term contract, and recognizes the need from industry’s perspective to provide adequate time to make substantial improvements and ensure sufficient ROI. The eight-year figure was derived using input from Lockheed Martin’s suppliers for the JSF,

who communicated the desired contract lengths that would ensure ROI for them. The government sees problems with Lockheed Martin's suggested approach, however, because an initial contract of eight guaranteed years would require special approval from Congress to put in place; the contractor's proposal did not incorporate any restraints imposed by the FAR. In the context of this research, the government's proposal of five award term years is merely on the cusp of what should be considered long-term. It is reasonable to expect that the government would seek to mitigate the risks of such a huge contract, and the five-year total with opportunities for extension is not unusually short for a large-scale program. However, the year-to-year award term structure, which lacks any contiguous portion of guaranteed years, reflects lingering trepidation resulting from past experiences with "must-pay bill" risks. Given the other contractual provisions discussed below, a case could be made that the government should show less timidity and more commitment in the contract length. JSF is an enormous program with expectations of being the next best PBL—to be a true partnership, there should be no question that the contract is long-term.

The government sees eye-to-eye with Lockheed Martin on the need to begin with a cost-based contract and work towards a price-based contract, which is supported by the findings. It is the contractor's desire to eventually transition from a "FAR Part 15" type of contract to a "FAR Part 12" type of contract. Contracts created under the guidelines of Part 15 of the FAR require that contractor teams supply the data that substantiates their costs and proposals (FAR, 2005). Part 12 requirements are less stringent—the government only knows the price, not the costs, like a consumer who agrees to pay a price for a product based on its affordability and not how much it cost to produce.

Because Fixed Price contracts can be created under either set of guidelines, it remains to be seen whether the government will agree on a FAR Part 12-type contract when the time is appropriate. In the meantime, the biggest challenge in the context of contract type is to gather enough reliable data during the LRIP phase to support a fixed price when the program matures.

Lockheed Martin's proposal for sharing of profits from affordability improvements should be embraced by DoD, provided that the ratio is somewhat equal. As the study found, profit sharing is a strong motivator for contractors to make cost-reducing improvements to system support and is well-aligned with the PBL goal of producing a "win-win" situation. Forfeiting some financial benefits of cost reductions in early stages has potential to pay off well over the life of the contract.

The notion of paying a per-flying-hour, or "power by the hour" price that is apportioned in both fixed and variable elements is intelligent and enables some risk mitigation for the government. The fixed portion would essentially be the equivalent of a zero flying hour program; infrastructure must be paid for even when aircraft are not flying. The variable portion would be directly correlated to actual hours flown, so that the government does not lose flying hour money on aircraft that aren't actually flying. This is evocative of the flexible performance concept, wherein the government has the flexibility to reduce the size of the bill when the operations tempo gives cause to do so.

In summary, there are several provisions of the JSF PBL contract proposals that show promise of PBL progressing in a positive direction. Its profit sharing elements, flexible performance, and eventual fixed price objectives are congruent with the findings of this research, and should enable a long-term contract. The contract length itself might

be improved if more concessions were made in both parties' proposals—the results of this research suggest that the ideal contract length lies somewhere in between. Because, as this thesis has shown, the contract length will probably be ultimately decided by the government, the onus is on DoD to agree to a contract length that is worthy of the “long-term partnership” label.

Assumptions and Limitations

This research was constrained by certain limitations and assumptions. The time allowed for research completion and the accessibility of personnel and information limited the number of cases studied and personnel interviewed. Because the PBL programs studied and the number of experts interviewed were greatly dependent upon the responsiveness of personnel contacted and their willingness to participate, the population in this study is represented by more of a “convenience” sample than a random sample. Given more time and/or resources, a broader, more balanced study might provide a greater understanding of the issues, further substantiate the findings of this study, or suggest alternative conclusions not discussed in this study.

The very nature of Performance-Based Logistics made it difficult to generalize results across the entire PBL spectrum. As discussed repeatedly, every PBL agreement is tailored to fit unique requirements, and because PBL is not a “one size fits all” approach, it is difficult to make generalizations that can be applied to all programs. In addition, the different military services seem to have differing philosophies about how PBL should be approached, and these differences become more complex when the different system levels (i.e. platform, subsystem, etc.) are factored in.

Lastly, the possibility of bias must be assumed: while interview participants attempted to give unbiased assessments of PBL issues, it is possible that in some cases their opinions may have been skewed by the perspectives of their organizations; that is to say they may have highlighted what was in their organizations' best interest.

Recommendations for Future Research

A study of effective PBL contract structures and incentives that more clearly delineates between practices at the subsystem/component levels and practices at the platform-level could prove beneficial. A comparison of best practices at the different levels could serve to identify if the recommendations presented in this research should be generalized across all PBLs or if they are appropriate only at certain levels of system support.

Similarly, a comparison of PBL contracting approaches amongst the Air Force, Army, and Navy may help to determine whether some contract-building strategies are best suited to specific branches of the military. Such a study could clarify the degree to which the generalizations presented in this research are applicable in each of the armed forces, or perhaps identify areas where the different services should better align their methods.

In the specific case of the F-35 JSF program, it may be beneficial to further study the evolution of PBL concepts in a manner that incorporates perspectives of both the government's JSF Program Office and Lockheed Martin Corporation. Time constraints prevented the gathering of data from the JSFPO for this study.

Future research may also investigate how the recommendations presented in this study might best be carried out. Of particular interest would be an exploration of potential alternatives for PBL funding methods, or new ways to overcome the barriers that the current budgetary process creates.

APPENDIX A

Interview Questions for DoD Personnel (Case Studies)

1. How would you describe the suitability of the type and length of the PBL contract for this program (*e.g. appropriate, good fit, effective, inadequate, too short, too long*)? Please explain why.
2. What were the primary factors (i.e. risks) that influenced or determined the length of this contract?
3. Did contract length limitations posed by the Federal Acquisition Regulation play any role in limiting the length of this contract, or were they irrelevant?
4. Do you believe there could be significant improvements in system support if this PBL contract was crafted differently or if the duration was longer, or would such changes make little/no difference? Please explain.
5. Do you (or does DoD) view this PBL agreement as a “long-term partnership” with the contractor? Why or why not?
6. Do you think the contract is central to defining this relationship with the support provider, or just a “necessary evil?” Please explain.
7. If applicable: What factors and operational/financial risks are likely to be important to future decisions of whether or not to extend this PBL contract?
8. Has this program been able to utilize Working Capital Funds to its advantage in any way? Has this issue had any effect on contract length?
9. Do you think this program has been a good fit for PBL methods? Why or why not?

APPENDIX B

Interview Questions for Private Industry Personnel (Case Studies)

1. How would you describe the suitability of the type and length of the PBL contract for this program (*e.g. appropriate, good fit, effective, inadequate, too short, too long*)? Please explain why.
2. What business risks did your company take/consider when forming this PBL contract and to what extent did those risks influence the length of the contract?
3. Did contract length limitations posed by the Federal Acquisition Regulation play any role in limiting the length of this contract, or were they irrelevant?
4. Has the duration and style of this PBL contract:
 - a. adequately encouraged your company to invest in significant long-term improvements to the support infrastructure for the system in question?
 - b. enabled the company to meet its goals for return on investment for this program?Why or why not?
5. Do you believe there could be significant improvements in system support if this PBL contract was crafted differently or if the initial term length was extended, or would such changes make little/no difference? Please explain.
6. Do you (or your firm) view this PBL agreement as a “long-term partnership” with DoD? Why or why not?
7. Do you think the contract is central to defining this relationship with DoD, or just a “necessary evil?” Please explain.
8. If applicable: What factors and business risks are likely to be important to future decisions of whether or not to extend/recompete this PBL contract?
9. Do you think this program has been a good fit for PBL methods? Why or why not?

APPENDIX C

Interview Questions for Subject Matter Experts (DoD)

1. Understanding that every Performance Based Logistics arrangement is unique, do you think that DoD contracting strategies for Performance Based Logistics have, in general, adequately addressed risks taken by both the government and private industry contractors while encouraging long-term investments in system support? Please explain.

Alternate question: Do you think the government has shown an appropriate amount of risk aversion in crafting PBL contracts, or too much/too little?

2. In your experience, have contract length limitations posed by the Federal Acquisition Regulation played a significant role in crafting PBL contracts, or do you think those limitations have been largely irrelevant?

a. Do you believe there would be any significant benefits to be gained (or costs) if maximum contract length allowed by the FAR was increased to a period beyond five years?

3. PBL contracts citing the Navy Working Capital Fund have been executed with 5-year initial performance (base) periods and multiple option periods that extend the total possible contract period up to ten years. Do you think Working Capital Funds are utilized to their full potential in PBL contracts across DoD?

4. To what extent have you found PBL contracting methods to vary across different DoD service branches? Has one area/branch of DoD stood out to you as being the best at implementing PBL contracts? Please elaborate if possible.

5. Please explain why you agree or disagree with the following statement:

The contracting objective in any long-term PBL partnership with a commercial entity is to work towards a Firm Fixed Price contract, even though a Cost Plus-style contract may be more appropriate in early stages of the agreement.

6. Please share your thoughts on the Award Term contracting strategy for PBL, to include contrasting it with the use of Award Fees. Is it effective? Is it overused? Not utilized enough?

a. Are you aware of, or have you ever had experience with a PBL contract in which the option years were *not* exercised by DoD?

7. In your experience, does a PBL agreement's place among the "four stages" of PBL (see attachment) have any significant impact on contract length decisions?

8. PBL contracts are often referred to as *partnerships* built on long-term relationships between DoD and private firms. Do you see contracts as central to defining these PBL partnerships, or more of a "necessary evil?" Please explain.

APPENDIX D

Interview Questions for Subject Matter Experts (Private Industry)

1. Understanding that every Performance Based Logistics arrangement is unique, do you think that DoD contracting strategies for Performance Based Logistics have, in general, adequately addressed risks taken by commercial contractors while encouraging long-term investments in system support? Please explain.

Alternate question: Do you think the government has shown an appropriate amount of risk aversion in crafting PBL contracts, or too much/too little?

2. In your experience, have contract length limitations posed by the Federal Acquisition Regulation played a significant role in crafting PBL contracts, or do you think those limitations have been largely irrelevant?

a. Do you believe there would be any significant impact (positive or negative) on PBL contracting strategies if maximum contract length allowed by the FAR was increased to a period beyond five years?

3. To what extent have you found PBL contracting methods to vary across different DoD service branches? Has one area/branch of DoD stood out to you as being the best at implementing PBL contracts? Please elaborate if possible.

4. Please explain why you agree or disagree with the following statement:

The contracting objective in any long-term PBL partnership is to work towards a Firm Fixed Price contract, even though a Cost Plus-style contract may be more appropriate in early stages of the agreement.

5. Please share your thoughts on the Award Term contracting strategy for PBL, to include contrasting it with the use of Award Fees. Is it effective? Is it overused? Not utilized enough?

a. Are you aware of, or have you ever had experience with a PBL contract in which the option years were *not* exercised by DoD?

6. In your experience, does a PBL agreement's place among the "four stages" of PBL (see attachment) have significant impact on contract length decisions?

7. PBL contracts are often referred to as *partnerships* built on long-term relationships between DoD and private firms. Do you see contracts as central to defining these PBL partnerships, or more of a "necessary evil?" Please explain.

APPENDIX E

Other/Miscellaneous Interview Questions

PBL Program Background Data Gathering Questions:

1. What is the type and length of this PBL contract?
2. Who is the Product Support Integrator or TSSR for this program? Who are the important parties? (Please describe the basic reporting hierarchy of this PBL in terms of organizations, not specific names.)
3. What are the primary performance requirements/objectives for this PBL program?
4. How long has the PBL been in existence (contract start date)?

Experience/Biographical Info for Personnel Interviewed:

1. How many years of experience do you have working with PBL programs?
2. How many years of experience do you have in your current specialty / career field / area of expertise?
3. What organization and department/level do you represent?

Questions Specific to F-117 Program:

- 1) Have both sides been good on their word?
 - Did Lockheed-Martin successfully reduce the bill?
 - Despite complaints, did the gov't have actual problems paying LM?
- 2) How do you think the amount of long-term investment put into the F-117 program compared with investment LM has put into other PBLs? In other words, did the way this contract was constructed encourage more investment from LM than it might have otherwise?
- 3) This program seems to have been heralded as sort of a victory in the commercial sector while being considered a bad idea in the public sector. Would you agree?

Questions Specific to JSF Program:

Discussion of the future PBL contract for the F-35 was steered by the industry professional who was interviewed, with questions concerning the proposed contract structure asked as needed.

APPENDIX F

Examples of PBL Conferences/Seminars in 2007

Return on investment, among many other issues associated with government-contractor relations in PBL arrangements, was a topic of discussion at these events:

- 23rd Annual National Defense Industrial Association (NDIA) National Logistics Conference & Exhibition, March 2007
- Semi-annual Aerospace Industries Association (AIA) Product Support Conference, May 2007
- Lexington Institute Logistics Working Group Meeting on Performance Based Agreements, June 2007
- The International Society of Logistics (SOLE) Annual Conference Aug 2007

BIBLIOGRAPHY

- Berkowitz, D., Gupta, J.N.D., Simpson, J.T., and McWilliams, J. "Defining and Implementing Performance Based Logistics in Government," *Defense Acquisition Review Journal* (December 2004 – March 2005)
- Defense Acquisition University (DAU), *Performance Based Logistics: A Program Manager's Product Support Guide*. Ft. Belvoir, VA: Defense Acquisition University Press, (March 2005)
- Defense Acquisition University (DAU), "Award Contracts," and "Financial Enablers." DAU Acquisition Community Connection website (PBL Toolkit), Retrieved from <https://acc.dau.mil/CommunityBrowser.aspx?id=22482&lang=en-US> on 13 December 2007.
- Department of Defense Directive (DoDD) 5000.1, "The Defense Acquisition System," para. E1.16-E1.17 (May, 2003)
- Devries, Hank J. "Performance Based Logistics—Barriers and Enablers to Effective Implementation." *Defense Acquisition Review Journal*, 11(3), 243-254 (December 2004 – March 2005)
- Doerr, K., Lewis, I., and Eaton, D.R. "Measurement Issues in Performance-Based Logistics," *Journal of Public Procurement*, 5 (2), 164-186 (2005)
- Edwards, Vernon J. "Award Term: The Newest Incentive," *Contract Management*, 44-45 (February 2001) Can also be found at <http://www.wifcon.com/anal/analaterm.htm>, 30 Oct, 2000.
- Edwards, Vernon J. "The Five-Year Limit on Government Contracts: Reality or Myth?" (March, 2003) Retrieved from <http://www.wifcon.com/anal/analfiveyear.htm> on 28 November, 2007.
- General Services Administration, Department Of Defense, and National Aeronautics & Space Administration. *Federal Acquisition Regulation (FAR)*. Vol. 1 (March, 2005)
- Government Accounting Office (GAO). "Defense Management: Opportunities to Enhance the Implementation of Performance-Based Logistics." Report to the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate (August, 2004)
- Kratz, Lou. "Achieving Actionable Logistics," Presentation delivered at 23rd Annual National Logistics Conference and Exhibition, 21 March 2007 (retrieved 6 Dec 07 from <http://www.dtic.mil/ndia/2007logistics/2007logistics.html>)

- Lambert, Douglas M, Emmelhainz, Margaret A, and Gardner, John T. "Developing and Implementing Supply Chain Partnerships." *The International Journal of Logistics Management*, 7(2), 1-17 (1996)
- Lexington Institute. *Performance Based Agreements Working Group* meeting notes, Ritz Carlton Hotel, Pentagon City, Arlington, VA (8 June, 2007)
- Monczka, R., Trent, R., Handfield, R. *Purchasing and Supply Chain Management*. Thomson/South-Western, 2005.
- Noordewier, Thomas G., John, George, and Nevin, John R. "Performance Outcomes of Purchasing Arrangements in Industrial Buyer-Vendor Relationships." *Journal of Marketing*, 54(4), 80 (1990)
- Office of the Secretary of Defense, Undersecretary for Acquisition, Technology & Logistics [OSD-ATL]. *Performance Based Logistics: Purchasing Using Performance Based Criteria* (2004)
- Stevens, B. and Yoder, C. "Award-Term Contracts: Good for Business?" *Contract Management*, 30-35 (September 2005)
- U.S. Government Printing Office (GPO). *U.S. Code, Title 10 – Armed Forces*. Subtitle A, Part IV, Chapter 152 (2005). Retrieved on 28 Feb 2008 from http://www.access.gpo.gov/uscode/title10/subtitlea_partiv_chapter152_.html.
- Vitasek, K., Geary, S., Cothran, J., and Rutner, S. "Keep Your End Customer in Sight." *MIT Supply Chain Strategy*, 7-9 (June 2006)
- Yin, R.K. *Case Study Research: Design and Methods*. Thousand Oaks: Sage Publications, 1994.

Vita

Captain Christopher P. Gardner graduated from William Mason High School in Mason, Ohio, in 1995. He then entered undergraduate studies at Miami University in Oxford, Ohio, and graduated with a Bachelor of Arts degree in Creative Writing in 2000. Upon graduation, he was commissioned as a second lieutenant through Miami University's Air Force Reserve Officer Training program, and entered service as a munitions maintenance officer.

His first assignment was at Eglin Air Force Base, Florida, where he served in multiple aircraft and munitions maintenance flight commander positions within the 33rd Fighter Wing. In 2003, then-First Lieutenant Gardner was assigned to Kirtland Air Force Base, New Mexico. While assigned to the 898th Munitions Squadron at Kirtland, he was promoted to the rank of captain and served as the Maintenance Operations Officer for the Kirtland Underground Munitions Maintenance and Storage Complex. In August 2006, he entered the Graduate School of Engineering and Management at the Air Force Institute of Technology. Upon graduation, Captain Gardner will be assigned to the 576th Flight Test Squadron at Vandenberg Air Force Base, California.

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14. ABSTRACT The use of Performance-Based Logistics (PBL) as a sustainment strategy for weapon systems has been mandated by the Department of Defense (DoD) and largely embraced by acquisition and contracting professionals in both government and private industry. Despite its apparent success, there is an inherent conflict that DoD implementers of PBL often face: the PBL goal of developing long-term partnerships that encourage investment from commercial partners is best achieved through lengthy, guaranteed contracts—but such contracts increase the DoD's risk in an environment that is intended to transfer more risk to the contractor. This research examines issues associated with the type and length of PBL contracts between DoD organizations and private industry. The thesis addresses the question of how the DoD can ideally balance PBL contracts to mitigate operational and financial risks while simultaneously building long-term partnerships that encourage investment from commercial contractors. The results reveal five main areas in which the government should focus its efforts to improve PBL implementation.					
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