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Maintaining a Healthy U.S. Defense Industrial Base: Risk Sharing and Contract Design in the Major Defense Acquisition Program Setting

December 2025

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Naval Postgraduate School

Prepared for the Naval Postgraduate School, Monterey, CA 93943

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ABSTRACT

The United States faces an escalating threat from great-power competition, placing new demands on the Defense Industrial Base (DIB). Although the DIB has historically delivered the capabilities needed to deter and defeat adversaries, major defense contractors have recently expressed reluctance to participate in fixed price contracts for Major Defense Acquisition Programs (MDAPs), citing an inequitable allocation of risk. If unresolved, this challenge risks undermining both the health of the DIB and the nation's warfighting readiness. This thesis examines the root causes of misaligned risk-sharing and conflicting incentives between the government and the DIB in MDAPs and evaluates a range of risk-management and incentive-alignment approaches, including enhanced program-management practices and redesigned incentive structures. Drawing on economic theory, particularly agency theory involving information asymmetry and moral hazard, it analyzes current acquisition programs and relevant literature on incentive design and industrial-base resilience. The thesis proposes an alternative profit function and contract-design framework that better aligns firms' profit-maximization incentives with the government's objectives of cost control and truthful cost estimation. The findings suggest that a more balanced approach to risk allocation is essential to sustaining the competitiveness and strategic effectiveness of the U.S. Defense Industrial Base.

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LIST OF ACRONYMS AND ABBREVIATIONS

CPFF	Cost Plus Fixed Fee
CPIF	Cost Plus Incentive Fee
GAO	Government Accountability Office
CPFF	Cost Plus Fixed Fee
CPIF	Cost Plus Incentive Fee
DIB	Defense Industrial Base
FAR	Federal Acquisition Regulations
FFP	Firm Fixed Price
GAO	Government Accountability Office
GPS	Global Positioning System
LRIP	Low Rate Initial Production
MDAP	Major Defense Acquisition Program
RDT&E	Research, Development, Test and Evaluation

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I. INTRODUCTION

The health of the United States defense industrial base (DIB) is central to national security, technological leadership, and maintaining a decisive advantage in the era of renewed great power competition. While the U.S. has faced rivalries before—notably during the Cold War—the current environment presents more immediate, multidimensional, and complex challenges. Unlike the largely bipolar confrontation with the Soviet Union, today the United States confronts near-peer competitors such as China and Russia while also addressing threats from rogue states and non-state actors. China has demonstrated the ability to mobilize state-owned enterprises, subsidize critical technologies, and accelerate defense innovation at a scale that threatens U.S. technological superiority. Russia, despite economic and demographic weaknesses, has shown a capacity for mobilization and adaptation in its defense-industrial system, as evidenced in Ukraine. In this strategic environment, the strength of the DIB is more than an economic concern—it is a decisive factor in whether the United States can deter aggression and prevail in conflict.

For decades, the U.S. defense industrial base has been the backbone of military power and technological innovation. It enabled the arsenal of democracy that defeated fascism in World War II, sustained nuclear deterrence and space dominance during the Cold War, and delivered revolutionary capabilities such as stealth aircraft, precision-guided munitions, and the global positioning system (GPS) that transformed modern warfare. Beyond the battlefield, DIB innovations have spilled over into the civilian economy, generating enormous benefits—from jet engines and the internet to satellite communications and advanced materials. This unique blend of military effectiveness and economic dynamism underscores why the DIB is widely recognized as one of America's greatest strategic assets.

Yet this advantage cannot be taken for granted. Over the past fifty years, the defense industry has undergone significant consolidation, leaving only a handful of prime contractors capable of executing Major Defense Acquisition Programs (MDAPs). In the 1990s alone, a wave of mergers reduced dozens of firms to the "big five" primes—

Lockheed Martin, Boeing, Raytheon, Northrop Grumman, and General Dynamics (Cooper, 1998). While consolidation brought some efficiencies, it also created vulnerabilities: fewer competitors, and greater dependence on single firms for critical capabilities. The COVID-19 pandemic further exposed fragilities in global supply chains, from microelectronics to rare earth elements, reminding policymakers that the DIB is not immune to systemic shocks (Thakker & Rajan, 2020). These structural realities mean that if leading firms decline to participate in major programs, the government may have few viable alternatives—a situation with profound national security implications.

Ensuring the continued vitality of the DIB requires balancing multiple objectives. Firms must be able to earn sustainable, though not excessive, profits to remain viable and attractive to shareholders. At the same time, the risks associated with developing next-generation systems must not be so great that firms are deterred from bidding. Finally, contractor incentives must align with government objectives: minimizing costs, ensuring timely delivery, and advancing cutting-edge capabilities. Achieving this balance requires addressing two enduring economic challenges. The first is moral hazard: contractors may have incentives to under-invest in cost-saving efforts or to inflate costs if they believe the government will bear the risk. The second is information asymmetry: firms often possess private information about true costs and technical risks, which can distort contract negotiations and execution. Contract design, therefore, plays a central role in shaping industry behavior and outcomes.

The economic literature provides important insights into these problems. Principal–agent theory emphasizes that when one party (the government, as principal) delegates work to another (the contractor, as agent) information problems and risk allocation become central concerns (Laffont & Tirole, 1993). If contracts do not align incentives properly, the agent may shirk, misreport costs, or take actions contrary to the principal's goals. Similarly, transaction cost economics stresses that in complex, uncertain environments like MDAPs, contracts are necessarily incomplete: no contract can specify every future contingency. As a result, governance mechanisms must be designed to manage adaptation, share risks appropriately, and minimize opportunistic behavior. Together, these frameworks highlight why risk-sharing is not a narrow accounting issue but a foundational problem in sustaining a healthy DIB.

Recent industry developments illustrate these theoretical concerns in practice. Several leading defense firms have publicly resisted fixed-price development contracts (Boeing, 2023), which shift disproportionate risk onto contractors during the most uncertain phases of a program. Boeing, for example, has absorbed billions of dollars in losses on fixed-price programs such as the KC-46 tanker and the Air Force One replacement, leading its Chief Financial Officer to declare that the company does not intend to sign new fixed-price development contracts (Boeing, 2023). Similarly, L3 Harris's leadership stated that the industry is increasingly unwilling to bid on such contracts, citing unacceptable risks when program specifications remain unsettled. Northrop Grumman, too, has reported billion-dollar losses on a fixed-price low-rate initial production (LRIP) contract (Kubasik, 2023). These examples underscore a basic principle from contract theory: when agents perceive risks as prohibitively high relative to expected returns, they will exit the market. For the government, this outcome translates into reduced competition, fewer bidders, and ultimately less leverage in negotiating future programs.

At the same time, cost-plus contracts—the traditional alternative to fixed-price agreements—face intense criticism from policymakers. Labeled "blank checks," cost-plus arrangements are often blamed for cost overruns, inefficiencies, and lack of contractor accountability. The Obama Administration explicitly called for reducing reliance on such contracts, arguing that they encourage waste and shield industry from performance pressures (Office of the Press Secretary, 2009). Here, too, economic theory is instructive. Cost-plus contracts expose the government to risks of moral hazard, as contractors may not exert sufficient effort to control costs when they are reimbursed for expenditures. They also exacerbate information asymmetry, since contractors have incentives to overstate costs or understate risks to secure favorable terms. The tension between these two contracting models raises fundamental questions for policymakers: How can risk be allocated in a way that sustains industry participation while protecting taxpayers? Can cost-plus contracts be modified to limit moral hazard and information rents without driving firms out of the market? And, more broadly, what contract design techniques can reconcile the government's need for efficiency with industry's need for sustainable risk-sharing?

This study addresses these questions directly. Building on a substantial body of economic literature and analyzing the incentives of DIB firms through the lens of the principal–agent framework, it reaches two main conclusions. First, cost-plus contracts should remain the primary contracting mechanism for MDAPs, especially in their early developmental stages, where uncertainty is highest and technical risk cannot be reasonably priced. Second, cost-plus incentive contracts can be designed to induce voluntary "truth-telling" by contractors regarding expected costs, thereby mitigating information asymmetry and reducing moral hazard. Such contract modifications offer a promising path forward—balancing risk-sharing in a way that preserves industry participation while safeguarding government interests.

The urgency of these issues cannot be overstated. MDAPs are long-term undertakings, often spanning decades, and problems in their design and execution may take years to surface. A failure to address contracting challenges today risks eroding U.S. capabilities tomorrow, precisely when they may be most needed in a conflict with a near-peer adversary. While the underlying economic theories of risk allocation, incentives, and contract design have existed for decades, their systematic application to defense acquisition policy remains limited. Bridging this gap is essential if the United States is to sustain its technological and strategic advantage.

The remainder of this thesis is organized as follows. Chapter II reviews the relevant literature, including agency theory, information asymmetry, moral hazard, contract types in defense procurement, and risk-sharing frameworks. Chapter III examines risk-sharing in the MDAP context, highlighting the unique features of these programs and the challenges they pose. Chapter IV develops an optimal contract design framework for MDAPs, proposing specific mechanisms for improving risk-sharing and incentive alignment. Chapter V presents policy recommendations and key findings, and Chapter VI concludes with a summary and suggestions for future research.

II. LITERATURE REVIEW

A. BACKGROUND OF CONTRACT TYPES

Government contracting in the United States has long revolved around two broad categories of contract types: cost-reimbursement contracts and fixed-price contracts. Both forms date back to the nation's earliest wartime procurement practices. For example, during the U.S. Civil War, the Confederacy initially relied on cost-plus arrangements but later experimented with fixed-price contracts with arbitration options to manage disputes (Nagle, 2012). Since then, the federal government has codified both types in the Federal Acquisition Regulation (FAR), which provides the legal and administrative foundation for procurement. FAR 16.301-1 defines cost-reimbursement contracts as those that "provide for payment of allowable incurred costs, to the extent prescribed in the contract" while establishing an estimated total cost and often a ceiling price that the contractor may not exceed (FAR 16.301, 2025).

Cost-reimbursement contracts are generally employed in high-risk or developmental programs where cost, schedule, and performance outcomes are highly uncertain. By reimbursing contractors for all allowable, allocable and reasonable costs, the government assumes the bulk of the financial risk associated with unforeseen technical challenges. This structure lowers barriers to participation for firms because they are guaranteed coverage of their costs, provided they comply with government-approved cost accounting standards and maintain accountability systems (FAR 16.301, 2025). In return, contractors accept a relatively modest and predetermined profit, typically in the form of a fixed fee.

The underlying rationale for cost-reimbursement contracts rests on risk allocation and market participation. In environments such as Major Defense Acquisition Programs (MDAPs), which frequently involve cutting-edge technologies, decade-long timelines, and significant engineering uncertainty, contractors would likely demand prohibitively high-risk premiums if required to operate under a purely fixed-price arrangement (McNicol et al., 2004). Cost-reimbursement agreements mitigate this problem by

spreading risk between the government and industry, thereby maintaining competition among a broader set of defense industrial base (DIB) firms.

Within this category, Cost-Plus-Fixed-Fee (CPFF) and Cost-Plus-Incentive-Fee (CPIF) contracts are the most widely used. CPFF contracts reimburse all allowable costs and provide contractors with a fixed fee that does not vary with actual performance (Berends, 2000). CPIF contracts, by contrast, include provisions to adjust profit levels depending on cost performance, thereby introducing limited incentives for efficiency (Berends, 2000). Despite their differences, both share the core advantage of attracting firms to high-risk programs that they might otherwise refuse.

While cost-reimbursement contracts are indispensable for technologically complex projects, they have drawn persistent criticism for their susceptibility to inefficiencies, particularly moral hazard and cost growth. Because contractors know that allowable costs will be reimbursed, they face weaker incentives to aggressively control expenditures, sometimes resulting in "gold-plating" or scope expansion (Wang & San Miguel, 2013). Moreover, the informational advantage contractors hold over the government enables them to shape cost estimates in ways that secure favorable funding while limiting their accountability for overruns (Laffont & Tirole, 1993).

These dynamics have fueled political and public scrutiny. Wang and San Miguel (2013) note that cost-plus contracts have been increasingly criticized in MDAPs for frequent cost overruns, with critics arguing that taxpayers bear an undue share of project risk without commensurate benefits. The backlash reached a peak during the Obama administration. In Executive Order 13576 on government efficiency, President Obama pledged to "end cost-plus contracts that run up a bill that is paid by the American people" (Obama, 2011, p. 1). This declaration reflected mounting frustration with high-profile acquisition failures and the perception that cost-plus arrangements enabled poor management discipline.

However, a critical distinction must be made between symptoms and root causes. Cost overruns under cost-reimbursement contracts are not solely the product of contract type but also stem from deeper structural challenges. One such challenge is the government's inherent disadvantage in technical expertise relative to contractors, which

makes accurate cost estimation especially difficult in early program stages (Arena et al., 2006). Another is the high level of uncertainty that accompanies research, development, test, and evaluation (RDT&E) activities, where design modifications and unforeseen technological hurdles are the norm. Seen from this perspective, cost growth may reflect the fundamental realities of complex defense procurement rather than flaws inherent to the cost-reimbursement form.

Scholars and practitioners have therefore urged caution against wholesale abandonment of cost-plus contracts. Instead, reforms should focus on improving incentive alignment and strengthening oversight mechanisms (Wang & San Miguel, 2013). For example, enhanced milestone reviews, profit adjustment formulas, and budget-based incentive schemes can encourage more truthful reporting of cost expectations and greater cost discipline (Wang & San Miguel, 2013). In sum, while cost-reimbursement contracts undeniably pose challenges, they remain indispensable for early-stage MDAPs, where the uncertainty is too great for firms to accept fixed-price risk without jeopardizing participation in the defense industrial base.

B. FIRM-FIXED-PRICE CONTRACTS AND UNDERLYING ISSUES

In contrast to cost-reimbursement agreements, Firm-Fixed-Price (FFP) contracts obligate the contractor to deliver a specified product or service at an agreed-upon price. The key feature of this structure is that the contractor bears the majority, if not all, of the cost risk. If actual expenditures exceed the negotiated price, the contractor absorbs the loss; conversely, if costs fall below expectations, the contractor retains the savings as profit. FAR Part 16 describes FFP as "providing for a price that is not subject to adjustment on the basis of the contractor's cost experience in performing the contract" (FAR 16.202-1, 2025).

FFP contracts offer powerful incentives for efficiency. Contractors, knowing that any cost overrun directly reduces their profit margin, are motivated to implement cost-control measures, streamline production processes, and avoid unnecessary expenditures. For the government, FFP arrangements reduce exposure to cost escalation, simplify administrative oversight, and provide predictability in budgeting.

However, these advantages are counterbalanced by significant limitations. In technologically uncertain or developmental programs, the risk imposed on contractors may be excessive. In such contexts, contractors often respond by demanding risk premiums, that is, inflating their bid prices to hedge against the possibility of overruns (Aniol, 2017). These premiums can offset the government's anticipated savings from fixed pricing, leading to inefficiencies (Aniol, 2017). Moreover, when risks are judged to be incalculable, firms may decline to bid altogether, creating the "no-deal" problem (McNicol et al., 2004).

The presence of risk premiums highlights a paradox in defense procurement. FFP contracts are often viewed as tools to discipline contractors and reduce government exposure, yet when applied to MDAPs (i.e., programs characterized by long timelines, immature technologies, and unforeseeable integration challenges), they may result in higher upfront costs or a diminished pool of competitors. Aniol (2017) explains that contractors often shield themselves from uncertain costs by embedding larger margins into their bids. While this ensures financial viability for the firm, the government ultimately pays the premium whether or not the risk materializes. In cases where costs do not escalate, contractors may reap disproportionately high profits, undermining the principle of equitable risk-sharing.

These dynamics are not theoretical. Recent examples illustrate the danger of excessive reliance on FFP contracts in developmental contexts. Northrop Grumman, for instance, reported multi-billion-dollar losses in 2024 and 2025 on fixed-price programs, citing inflationary pressures and supply chain disruptions as the primary causes (Defense News, 2025). Because the contracts were fixed-price, these cost increases could not be passed along to the government, leaving the contractor solely responsible to absorb substantial financial losses. While such arrangements may appear favorable to taxpayers in the short term, they risk discouraging industry participation in future competitions, especially for projects with high technological uncertainty.

1. Communication and Performance Risks

Another limitation of FFP contracts lies in their effect on communication and oversight. Under cost-reimbursement arrangements, frequent interaction between

government and contractors is required to validate incurred costs and assess program progress. This continuous engagement provides the government with visibility into performance challenges and opportunities for mid-course correction. FFP contracts, however, encourage a more "hands-off" posture. Because the contractor bears the primary risk, it may choose to limit communication, thereby reducing the government's situational awareness.

Mossadeghian Golestani and Zwanenberg (1996) found in a comparative study that teams working under cost-plus contracts reported higher levels of collaboration, participation, and overall performance quality than those operating under fixed-price contracts. Their findings suggest that while FFP contracts may provide stronger cost discipline, they may inadvertently weaken the collaborative environment needed for innovation and complex systems integration. For MDAPs, where unforeseen design challenges often emerge during development, this lack of communication can result in late detection of problems, delayed deliveries, or degraded capability outcomes.

2. Underlying Issues: Asymmetric Information and Moral Hazard

While debates over FFP versus cost-reimbursement contracts often emphasize structural differences, many of the problems encountered under either type reflect deeper underlying issues of agency theory: asymmetric information and moral hazard.

Asymmetric information arises because contractors generally possess more detailed knowledge about production processes, cost structures, and technological risks than the government. This advantage allows contractors to strategically shape proposals and cost estimates, sometimes inflating uncertainty to justify higher bids or risk premiums (Laffont & Tirole, 1993). The government, even with robust cost-estimating tools and historical data, remains at an informational disadvantage.

Moral hazard, by contrast, manifests after contract award. In cost-plus environments, contractors may have little incentive to aggressively manage costs, knowing that overruns will largely be reimbursed. In FFP environments, the opposite problem can occur: contractors may cut corners, reduce effort, or prioritize cost control at

the expense of performance quality to protect their profit margins. Both dynamics demonstrate that contract type alone cannot fully resolve incentive misalignment.

Contract design solutions such as incentive schemes and profit-adjustment formulas have therefore become central to modern acquisition reform. These mechanisms seek to balance risk allocation with incentives for efficiency and truthful reporting. As Schmitz (2023) argues, when contracts are designed with proper incentive structures, both parties can achieve more efficient outcomes despite the inherent presence of asymmetric information.

C. AGENCY THEORY AND ITS APPLICATION TO DEFENSE PROCUREMENT

Agency theory provides a foundational framework for analyzing the challenges inherent in defense acquisition. At its core, agency theory addresses situations where a principal (the government) delegates work to an agent (the contractor), who possesses specialized knowledge, resources, and capabilities (Panda & Leepsa, 2017). The relationship is inherently fraught with challenges because the agent generally has more information about the costs, risks, and technical feasibility of a project than the principal. Furthermore, the agent's profit-maximizing incentives may diverge from the principal's goals, which emphasize national security, fiscal discipline, and timely delivery.

In the Major Defense Acquisition Program (MDAP) setting, the stakes are particularly high. These programs involve cutting-edge technologies, extended development timelines, and multi-billion-dollar commitments. The complexity of such undertakings magnifies the risks of misaligned incentives and information asymmetries. As Laffont and Tirole (1993) observe, government acquisition officials cannot fully observe contractors' internal cost structures or effort levels, nor can they disentangle the various factors that drive project outcomes. This creates fertile ground for inefficiencies, cost overruns, and performance shortfalls.

1. Information Asymmetry

One of the most persistent challenges in defense procurement is information asymmetry. Contractors invariably know more about their internal cost structures,

technical challenges, and organizational capabilities than the government. This imbalance has two major consequences:

Adverse Selection (Pre-Contract). Before a contract is signed, contractors may strategically withhold or distort information about their capabilities and risks. For example, a firm might understate expected costs to win a competition, anticipating that overruns will later be renegotiated. Alternatively, firms might overstate risks to justify inflated bids, particularly under FFP arrangements where risk is priced into the contract.

Moral Hazard (Post-Contract). After contract award, the government cannot perfectly observe the contractor's level of effort or efficiency. Under cost-reimbursement contracts, this creates incentives for waste or inefficiency, since additional costs are reimbursable. Under fixed-price contracts, moral hazard manifests differently: contractors may reduce effort or sacrifice quality to protect profit margins when unexpected costs arise.

Laffont and Tirole (1993) describe these dynamics succinctly: regulation is "subject to adverse selection and moral hazard" because firms hold private information about their technologies and cost-reducing behavior, while regulators cannot disentangle cost components or directly observe effort.

The implications for MDAPs are profound. Programs such as the F-35 Joint Strike Fighter or the KC-46A Pegasus tanker illustrate the challenges of managing asymmetric information. Both programs suffered major cost overruns and delays despite extensive oversight, underscoring the difficulty of aligning contractor incentives with government objectives in highly uncertain technological environments (Government Accountability Office [GAO], 2023).

2. Information Rents

Information asymmetry also gives rise to information rents—excess profits contractors earn by exploiting their informational advantage. For instance, when a contractor knows the true cost of production but the government does not, it can inflate its cost estimates without detection. Even when competitive pressures exist, specialized defense markets often lack sufficient bidders to discipline pricing. The result is that

contractors may secure higher profits than would occur under conditions of full information (Laffont & Tirole, 1993).

For policymakers, the existence of information rents presents a dilemma. While it may be impossible to eliminate them entirely, contract design can aim to minimize rents by creating mechanisms that reward accurate cost reporting and penalize opportunistic behavior. One such approach, discussed later, is the use of budget-based incentive schemes that link profits more closely to performance and cost accuracy (Wang & San Miguel, 2013).

3. Moral Hazard in MDAPs

Moral hazard, as distinct from adverse selection, arises after contract award. In defense procurement, this often manifests in two forms:

Under Cost-Reimbursement Contracts: Contractors may exert less effort to control costs, knowing that overruns will be reimbursed. In extreme cases, contractors may even benefit from inefficiency, as larger program budgets can provide opportunities for organizational expansion or additional overhead recovery (McNicol et al., 2004).

Under Fixed-Price Contracts: Contractors may cut corners in production, reduce quality assurance, or delay investments in innovation to protect margins when facing unexpected cost increases. This dynamic is especially concerning in MDAPs, where cutting corners can degrade mission-critical capabilities and jeopardize national security.

Schmitz (2023) emphasizes that even well-designed contracts cannot fully eliminate inefficiencies when asymmetric information is present. Instead, contracts must be structured to induce truthful revelation of information and to align incentives as closely as possible with desired outcomes. For example, incentive-fee structures that reward cost savings and penalize overruns can mitigate some of the risks associated with moral hazard, though they must be carefully calibrated to avoid encouraging opportunistic behavior.

4. Monitoring Challenges in MDAPs

The long development timelines and technical complexity of MDAPs exacerbate both information asymmetry and moral hazard. Programs often span decades, making it difficult for government officials to maintain consistent oversight. Personnel turnover within acquisition offices can further erode institutional knowledge, leaving contractors with enduring informational advantages. Additionally, the sheer complexity of technologies ranging from stealth aircraft to integrated missile defense systems makes it nearly impossible for government monitors to fully verify cost estimates or assess contractor effort in real time (GAO, 2023).

These challenges underscore the importance of contract design as a tool for managing uncertainty. Rather than relying exclusively on one contract type, acquisition professionals must tailor arrangements to the stage of the acquisition life cycle, the maturity of the technology, and the relative risk-bearing capacities of the government and contractors.

5. Implications for Risk-Sharing and Contract Design

Agency theory suggests that no single contract type can fully resolve the problems of information asymmetry and moral hazard. Instead, the goal should be to balance risk allocation in a way that incentivizes efficiency without discouraging participation. For MDAPs in early development phases, where uncertainty is highest, cost-reimbursement contracts may be more appropriate, provided they incorporate incentive mechanisms to mitigate moral hazard. As programs mature and risks become more predictable, transitioning to fixed-price arrangements may become viable.

Ultimately, the insights of agency theory reinforce the need for adaptive contracting strategies. Policymakers must recognize that rigid adherence to FFP contracts that were promoted during the Obama administration to curb “blank checks” may unintentionally discourage industry participation and undermine the health of the defense industrial base (Obama, 2011). Likewise, uncritical reliance on cost-plus contracts can foster inefficiency and erode public trust. Only through thoughtful application of

incentive-compatible contract design can the government hope to reconcile these competing pressures.

D. RISK ATTITUDES, RISK SHARING, AND INCENTIVE DESIGN

Understanding risk preferences is essential for analyzing how contracts should allocate risk between the government and defense contractors. In economic theory, parties may be risk-neutral (concerned only with expected returns) or risk-averse (placing additional value on certainty and disfavoring variance in outcomes). In the MDAP setting, the U.S. government is often modeled as relatively risk-neutral because it can diversify risks across multiple programs and has deep financial resources. Contractors, by contrast, are generally considered risk-averse, as their survival depends on the financial outcomes of a limited portfolio of projects (Schmitz, 2023; Laffont & Tirole, 1993).

The difference in risk preferences shapes how contracts are designed. A risk-neutral government can theoretically bear more risk at a lower "cost" than contractors, who will demand risk premiums to accept greater uncertainty. This insight has critical implications for defense contracting: shifting excessive risk to contractors through firm-fixed-price (FFP) arrangements often leads to inflated bids, reduced competition, or outright refusal to participate (Wang & San Miguel, 2013).

1. The Cost of Risk Premiums

When contractors are required to absorb high levels of uncertainty, they incorporate risk premiums into their bids. These premiums compensate for the possibility of unexpected cost overruns, technological setbacks, or schedule delays. In competitive markets, risk premiums may be disciplined by rival bids. However, the defense industrial base is heavily consolidated, with only a handful of firms capable of undertaking MDAPs (Gholz & Sapolsky, 2000). As a result, inflated bids are not easily countered by competitive pressures, leading to higher overall government costs.

Even with risk premiums being priced in the contract, FFP could still be problematic in early development phases of MDAPs, when uncertainty about technological feasibility and production costs is greatest. For example, the Air Force's KC-46A tanker program illustrates the hazards of placing too much risk on contractors

under an FFP framework. Boeing absorbed billions of dollars in unexpected losses after underestimating development challenges, an outcome that has since made contractors more reluctant to accept fixed-price terms on complex programs (GAO, 2023).

a. The "No-Deal" Problem

When risk premiums rise too high, contractors may decline to bid altogether, creating a "no-deal" problem. This is especially concerning in the defense sector, where only a small number of firms have the capability to produce major platforms such as submarines, aircraft carriers, or next-generation fighter aircraft. If those firms walk away from competitions because the contractual terms are too risky, the government may face reduced competition, higher long-term costs, and increased dependence on single suppliers.

The no-deal problem is not merely theoretical. Industry resistance to fixed-price contracts has been evident in recent years, with several leading contractors signaling reluctance to bid on programs that impose excessive risk without adequate compensation (GAO, 2023). From a policy standpoint, this underscores the importance of balancing risk allocation: pushing too much risk onto industry can undermine the very competition that acquisition reforms are intended to foster.

b. Optimal Risk Sharing

The economic literature provides clear guidance on how to design contracts that balance risk allocation and incentives. Laffont and Tirole (1993) argue that efficient contracts must take into account both the risk preferences of the parties and the information asymmetries inherent in the relationship. When the agent (contractor) is risk-averse, the principal (government) should bear a larger share of uncontrollable risks while still structuring incentives to encourage efficient effort and truthful cost reporting.

One approach is the Cost-Plus-Incentive-Fee (CPIF) contract, which combines cost reimbursement with performance incentives (Leotta, 2017). By reimbursing costs, the government reduces contractors' exposure to uncontrollable risks, thereby lowering the required risk premium. At the same time, incentive fees tied to cost or schedule performance provide some motivation for efficiency. However, traditional CPIF contracts

often fail to fully resolve problems of asymmetric information. To address this, more advanced incentive schemes such as budget-based mechanisms that reward contractors for accurate cost forecasting may be necessary (Wang & San Miguel, 2013).

c. Aligning Incentives with Policy Goals

Beyond managing risk preferences, contracts must also align incentives with broader policy goals, such as sustaining a healthy defense industrial base and controlling long-term costs. If contractors face excessive downside risk, they may underinvest in innovation, withdraw from defense markets, or pursue mergers that further reduce competition. Conversely, if contractors face little or no risk, they may have weak incentives to control costs, leading to overruns and waste.

The challenge is therefore to design incentive-compatible contracts that strike a middle ground: contracts that do not expose contractors to catastrophic losses, yet still encourage efficiency, innovation, and truthful reporting. Economic theory offers tools for achieving this balance, but their application to defense procurement has often been inconsistent. Historically, shifts in acquisition policy such as the push from cost-plus to fixed-price preferences have reflected political pressures rather than careful attention to risk-sharing dynamics (McNicol et al., 2004).

d. Implications for MDAPs

In the MDAP context, optimal risk-sharing arrangements will vary depending on the stage of the acquisition life cycle. During early development, when uncertainty is high, cost-plus or CPIF contracts may be more appropriate, with carefully designed incentives to mitigate moral hazard. As programs mature and costs become more predictable, the government can gradually shift toward fixed-price arrangements, provided contractors are not forced to bear risks beyond their capacity.

Ultimately, the lesson from both economic theory and recent acquisition experience is clear: risk should be allocated to the party best able to bear it. For the government, this means absorbing much of the uncontrollable uncertainty inherent in MDAPs while using contract design to maintain strong incentives for contractor efficiency (Wang & San Miguel, 2013). For contractors, it means accepting responsibility

for factors within their control such as managerial effort, cost discipline, and truthful reporting, while being shielded from risks that could threaten their viability and destabilize the defense industrial base.

E. WANG AND SAN MIGUEL POLICY IMPLICATIONS

1. Challenging the Fixed-Price Orthodoxy

Over the past two decades, defense acquisition reform has often emphasized a shift toward firm-fixed-price (FFP) contracts as a way to control costs and impose discipline on contractors. Policymakers have argued that by locking contractors into predetermined prices, FFP contracts reduce opportunities for waste, inefficiency, and overruns (McNicol et al., 2004). However, Wang and San Miguel (2013) provide a critical counterpoint to this orthodoxy. They argue that the push for FFP contracts in the Major Defense Acquisition Program (MDAP) setting is misguided, particularly during the development phase when technical uncertainty and performance risk are at their highest.

According to their analysis, FFP contracts create perverse incentives in highly uncertain environments. Contractors, who are generally risk-averse, either demand high risk premiums to protect themselves from potential losses or simply refuse to participate. This dynamic not only raises program costs but also undermines competition, as capable firms walk away from opportunities that expose them to disproportionate risk (Wang & San Miguel, 2013). The resulting decline in competition can leave the government dependent on fewer suppliers, reducing bargaining power and increasing vulnerability to monopolistic practices.

2. The Case for Cost-Plus Contracting

In contrast, Wang and San Miguel (2013) advocate for the continued use of cost-plus contracts in MDAPs, especially during early developmental stages. These arrangements shift uncontrollable risk back onto the government, reducing contractors' exposure to catastrophic losses and thereby lowering the need for inflated risk premiums. By doing so, cost-plus contracts sustain contractor participation and help maintain a competitive industrial base.

Yet Wang and San Miguel (2013) acknowledge the well-documented shortcomings of cost-plus contracts, particularly their susceptibility to moral hazard and information asymmetry. Contractors reimbursed for all allowable costs may have weak incentives to control spending, while the government struggles to verify whether cost overruns reflect genuine technical challenges or managerial inefficiencies (Wang & San Miguel, 2013). Left unchecked, these dynamics can lead to the "blank check" problem that has long troubled policymakers (McNicol et al., 2004).

3. Improving Cost-Plus Through Budget-Based Mechanisms

To reconcile these competing challenges, Wang and San Miguel (2013) propose innovations in contract design rather than wholesale abandonment of cost-plus arrangements. Specifically, they recommend budget-based mechanisms that link contractor compensation to the accuracy of their cost reporting and forecasting. Under such schemes, contractors are incentivized to reveal truthful information about expected costs, since over- or underestimation would reduce their eventual compensation.

These mechanisms address the central principal-agent problem in MDAPs: how to induce contractors to share private information while still protecting them from excessive risk (Wang & San Miguel, 2013). By embedding incentives for truthful reporting into cost-plus frameworks, the government can mitigate information asymmetry without triggering the adverse effects of fixed-price contracting (Wang & San Miguel, 2013). In essence, Wang and San Miguel (2013) argue for a middle ground: retain cost-plus as the foundational contract type but modify it to incorporate more sophisticated incentive structures.

4. Implications for the Defense Industrial Base

The policy implications of this argument are significant. If policymakers continue to emphasize FFP contracts for developmental programs, they risk driving capable firms out of the market or discouraging them from bidding on strategically vital programs. This trend could accelerate industry consolidation, leaving the government with fewer suppliers and less innovation capacity at a time when great power competition demands a robust and diverse defense industrial base (Gholz & Sapolsky, 2000).

Conversely, adopting improved cost-plus mechanisms could help sustain contractor participation while also addressing policymakers' concerns about waste and inefficiency. By balancing risk allocation and improving incentive alignment, such reforms could preserve both the economic efficiency of defense contracting and the long-term health of the industrial base.

5. Situating Wang and San Miguel in Broader Literature

Wang and San Miguel's (2013) analysis aligns with broader findings in the economics of regulation and procurement. Laffont and Tirole (1993), for instance, argue that contracts must balance incentive provision with risk-sharing in contexts of asymmetric information. Similarly, research on procurement under uncertainty highlights the dangers of imposing excessive risk on suppliers, which often leads to inflated bids, opportunistic behavior, or market exit (Schmitz, 2023). Wang and San Miguel contribute to this literature by tailoring these insights to the unique features of MDAPs, where stakes are high, competition is limited, and program failure can have severe consequences for national security.

6. Conclusion

In sum, Wang and San Miguel (2013) challenge the prevailing narrative that fixed-price contracting is inherently superior. Their work underscores the importance of context-specific contract design: in MDAPs characterized by high uncertainty and long development horizons, cost-plus contracts remain indispensable. However, to address valid concerns about moral hazard and inefficiency, these contracts must be reformed through mechanisms that promote truthful reporting and align incentives. Policymakers who overlook these nuances risk weakening the defense industrial base at a time when it is most essential to U.S. strategic advantage.

F. CONCLUSION OF THE LITERATURE REVIEW AND TRANSITION TO ANALYSIS

The review of literature on contracting in Major Defense Acquisition Programs (MDAPs) underscores a central and enduring dilemma: how to design contracts that balance risk allocation, incentive alignment, and industrial base sustainability in an

environment of profound uncertainty. Across the sections, several key insights emerge that frame the path forward for this study.

First, contract type matters, but not in isolation. The choice between cost-plus and fixed-price arrangements is not merely a technical or legal exercise; it reflects deeper assumptions about who should bear risk, how information asymmetry should be managed, and what incentives drive contractor behavior. Historical evidence and policy debates reveal that while fixed-price contracts appear attractive for controlling government liability, they often prove ill-suited for developmental programs with high technological uncertainty. Conversely, cost-plus contracts support contractor participation but risk creating perverse incentives without additional safeguards. The literature strongly suggests that contract type should be contingent on program phase, risk profile, and market conditions, not dictated by blanket policy preferences.

Second, agency theory provides a unifying framework for understanding defense procurement challenges. The government, as principal, must rely on contractors who possess superior knowledge of costs, risks, and technical feasibility. This asymmetry generates classic principal-agent problems: adverse selection before contract award and moral hazard afterward. Left unaddressed, these issues manifest in cost overruns, schedule delays, and reduced accountability. The application of agency theory, as developed by Laffont and Tirole (1993) and others, demonstrates why no contract can perfectly eliminate inefficiencies: tradeoffs between risk-sharing and incentive strength are unavoidable. Nevertheless, carefully designed contracts can mitigate these inefficiencies by encouraging truthful information revelation and aligning contractor incentives with government objectives.

Third, the literature demonstrates that risk attitudes play a decisive role in shaping contract outcomes. While many economic models assume risk neutrality, real-world behavior in defense contracting reflects a spectrum of risk tolerance. Contractors, particularly those with concentrated portfolios, often act as risk-averse agents, demanding premiums to shoulder uncertain development costs. The government, though theoretically capable of diversifying risk across a larger portfolio of programs, has increasingly adopted a risk-averse posture as well, as seen in its shift toward fixed-price contracts.

When both parties adopt defensive stances, the result is often the "no-deal problem": programs that fail to attract bidders or collapse under the weight of unrealistic risk allocation. This highlights the importance of designing contracts that recognize and accommodate heterogeneous risk attitudes, rather than assuming a neutral baseline.

Fourth, the health of the defense industrial base cannot be separated from contract design. Contracting practices influence not only individual program outcomes but also broader structural dynamics in the industry. Policies that impose excessive risk on contractors, or that fail to compensate them adequately for uncertainty, risk accelerating consolidation and reducing competition. Historical episodes of mergers and acquisitions in the 1990s, combined with recent examples of firms refusing to bid on developmental programs, demonstrate the fragility of the industrial base when contracting practices are misaligned with industry realities. Conversely, innovative contract mechanisms—such as Other Transaction Authorities (OTAs) or incentive-based schemes—can expand participation, bring in nontraditional suppliers, and sustain a competitive market that benefits the government in the long term.

Finally, Wang and San Miguel (2013) offer a path forward by reframing the debate. Rather than viewing contract type as a binary choice between fixed-price and cost-plus, they argue for improving cost-plus designs through budget-based incentive schemes that promote truthful reporting. This approach addresses the root problems of information asymmetry and moral hazard without triggering the negative externalities of a rigid fixed-price regime. Their analysis aligns with the broader theoretical literature while also offering actionable recommendations for MDAP contracting reform.

Taken together, the reviewed literature highlights that the central challenge is not which contract type to use, but how to design risk-sharing mechanisms that promote efficiency, sustain participation, and protect taxpayer interests. The government must resist simplistic solutions that privilege one contract form over another, and instead adopt a contingent, flexible, and incentive-compatible approach grounded in the realities of MDAPs.

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III. METHODOLOGY AND RISK SHARING IN THE CONTEXT OF MDAP

A. RESEARCH METHODOLOGY AND ANALYTICAL APPROACH

This chapter begins by outlining the research design that guides this thesis. Because the objective of this thesis is to evaluate the current risk sharing methods and optimal contract design in MDAPs a qualitative conceptual research design is used. The research for this thesis was aimed at understanding the current state of risk sharing in MDAPs. Examining contract type selection, program management techniques employed to manage risk in performance, and the implication of agency theory in government contracting. This integrates principal-agent theory, risk-sharing concepts and DoD acquisition policy guidance as the primary sources of evidence. This process evaluates existing literature, statutory guidance and contract structures to develop a coherent analytical basis for implementing incentive schemes in MDAP environments. This chapter examines the framework for identifying the underlying incentive misalignments in MDAP execution, applying economic concepts such as moral hazard, information asymmetry, and risk-sharing theory. Additionally, this chapter examines contract incentive schemes and how existing schemes can be modified to better align the misaligned incentives. Lastly, this chapter outlines the application and scope of this contract design scheme. Highlighting where and when it can be most effective and the benefits and caveats that may arise if executed.

B. OVERVIEW OF MAJOR DEFENSE ACQUISITON PROGRAMS

Major defense acquisition programs (MDAPs) are broadly used to classify large acquisition programs for the Department of Defense:

> An MDAP is an acquisition program that is designated by the Under Secretary of Defense for Acquisition and Sustainment (USD (A&S); or is estimated to require an eventual total expenditure for Research, Development, Test and Evaluation (RDT&E), including all planned increments of more than $480 million in FY 2014 constant dollars or, for procurement, including all planned increments, of more than 2.79 billion in FY 2014 constant dollars. (Office of the Under Secretary of Defense [Comptroller]/Chief Financial Officer [OUSD CFO], March 2024)

In simple terms – MDAPs represent the largest and often highest risk acquisitions within the department of defense portfolio. In the FY 2025 federal budget request there were 69 active MDAPs included, spread amongst the joint force with over half sitting with the U.S. Navy. These MDAPs represented 31% of the total funding request, or $96.1 billion. (OUSD CFO, March 2024).

MDAPs are unique acquisitions due to their high dollar values and expected long-term expenditures as well as their high levels of complexity. Examples of recent MDAPs are the F-35 Joint strike fighter, the Long-Range Strike Bomber, and the KC-46 Pegasus aerial refueling tanker. Simply put, MDAPs are the acquisitions that provide the greatest capabilities to the warfighter and are often used to provide capabilities to the entire U.S. department of defense rather than a single branch – but also carry the highest risk. There are also acquisition categories used to classify different acquisitions dependent on expected dollar expenditure. ACAT I the highest level of dollar spend, are considered Major Defense Acquisition Programs. Acquisition programs can also be classified as MDAPs regardless of dollar expenditure if they contain high-risk cost elements, high visibility or represent a great strategic interest. The designation authority typically sits with the defense acquisition executive (DAE) or the Under Secretary of Defense for Acquisition and Sustainment (OUSD A&S).

Due to their complex nature, it is helpful to view major programs in a life cycle approach, seen in Figure 1. This life cycle originates from the DoD 5000 series, also known as the adaptive acquisition framework which is a collection of policies and directives governing DoD acquisition processes and timelines (OUSD A&S, 2020). This figure details this life cycle view which is often used as the blueprint for major defense acquisition programs. Each milestone in this life cycle represents a maturity threshold, once the program has demonstrated certain characteristics needed to satisfy the requirements, it can pass on to the next stage of the life cycle. This life cycle approach is designed and implemented to reduce risk over time by providing an easy to apply framework to complex acquisitions. While it may seem obvious, the earlier stages of the life cycle tend to carry the highest risk, as technologies are immature and the full requirement is not completely understood. As we can see with the Joint Strike Fighter, the prototyping was completed around 2001 with full rate production being achieved in

mid-2024. These long lead times can incur heavy costs and require a framework that will allow for the necessary milestones and assessments to ensure an acquisition has completed the necessary steps and meets maturity levels prior to continuing through its life cycle. As a result of this greater risk, program offices have traditionally employed cost-reimbursement contracts early in the acquisition life cycle in order to distribute the risk appropriately between the government and the contractors and to allow for the developmental process to unwind without the strict risk allocation of a fixed-price contract.

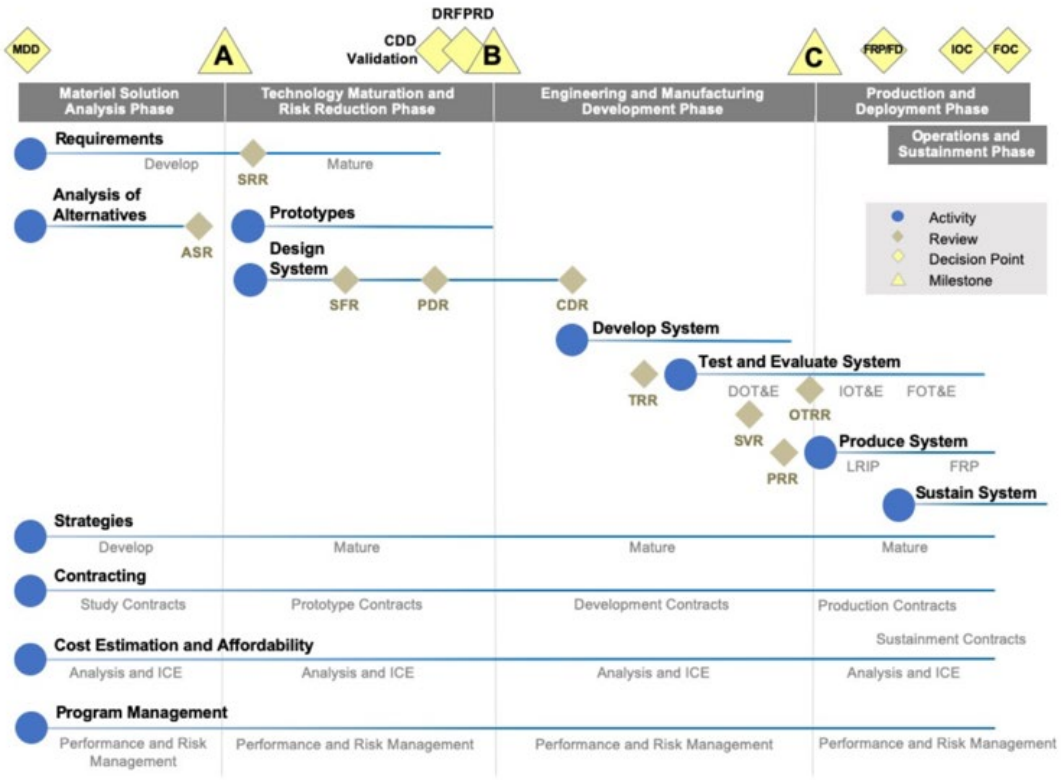

Figure 1. Life cycle View of Major Capability Acquisition. Source: OUSD A&S, DoDI 5000.02 (2020)

Furthermore, MDAPs are particularly complex due to their large stakeholder makeup. MDAPs can encompass developmental technologies such as next generation stealth technology or advancements in AI implementation that carry heavy risk in developing and implementing across a dynamic Joint Force. MDAPs also often involve a multi-service and interagency approach like the Joint Strike Fighter which even contains an international component. As a result of these factors, these programs tend to span over

decades or sometimes longer. Finally, MDAPs are unique because of their life cycle timelines; because most of the MDAPs are major capabilities used to fuel the next generation of military dominance their life cycles do not end once the developmental stage is completed, with the majority of current MDAPs in the operations and sustainment phase today.

Figure 2 represents a compiled data set from over 200 programs initiated from FY 1963 to present compiled by the Center for Strategic and International Studies (Blivas et al., 2020). This figure demonstrates the significant commitment services must make to these capabilities, also of note once the MDAP is "complete" there are still sustainment and operations programs occurring until the product or service is retired.

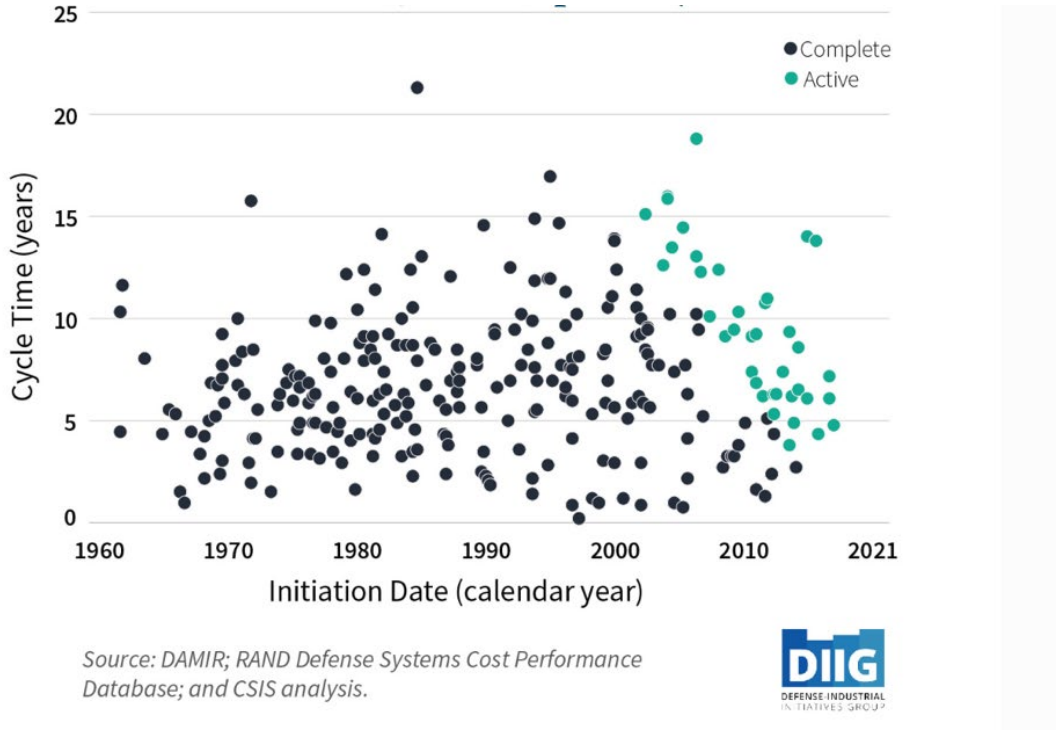

Figure 2. Cycle Times for Active and Complete MDAPs FY 1963–Present Source: Blivas et al. (2020)

As a result of MDAPs representing our nation's largest acquisition programs these projects often align directly with high-level national defense strategy priorities and are used to field capabilities to support the next generation of warfighter needs. With these larger budgets and longer timelines there is often greater congressional and public scrutiny. Although MDAPs do not make up the bulk of total spending across the DoD, they are the biggest ticket items in the portfolio and as mentioned earlier, many of the

programs that dance across the news headlines are MDAPs that are either behind schedule or incurring cost overruns during their life cycle.

In MDAPs the DoD is dealing with the largest programs in the portfolio, these programs often begin in the extremely developmental stages with technologies that are still being created and tested. As a result, the cost estimation and analysis can be difficult as the government may know what it wants, but not how to get there. Due to the complex nature of MDAPs often involving several different contractors and government agencies there can be schedule delays driven by cooperation needs. The more parties involved in an acquisition can lead to an increase in the timeline of development. Furthermore, as many of these programs can take decades to develop MDAPs are plagued with evolving technologies and the struggle of where and when to integrate them. A common problem is the speed of technological advancements, and with rapid development in the past two decades with the rise of home computing and artificial intelligence long-term MDAPs are faced with making hard decisions about when to implement a new technology during the process or to continue with what is already included in the program. This problem leads program offices faced with the challenge of struggling to integrate new technology into an existing budget, or risk producing a product that immediately outdated. This predicament can lead to scope creep, an acquisition term defining the scope of the requirement tends to expand as time goes on and technology matures. While it is possible to include buffer room within the program it is nearly impossible to completely predict the changing technological advancements that may play a key role in the future of the acquisition.

Additionally, as technology evolves there are programmatic risks to the acquisition. As mentioned earlier, MDAPs are high-visibility acquisitions and congressional leadership do not shy away from critiquing their progress. As a result of this oversight and the changing political landscape acquisition programs can face budget cuts and changing in political sentiment that can dramatically impact the program. The Peacekeeper Rail Garrison program was a large acquisition program in the late 1980s and early 1990s that was being developed during the onset of negotiations with foreign nations about reducing our missile capacity. As the program continued there was a large sentiment that the program was going to be cut as the cold war began to wind down. As a

result, the system was canceled during its development, and the products were repurposed (R. Rendon, personal communication, 2024). This demonstrates how political trends can impact major defense acquisition programs even if the program is healthy and on track. Finally, as MDAPs take a large chunk of capability and budget there can be an over-reliance on single contractors as the program matures. Due to the nature of MDAPs filling a critical and large capabilities need they can overrepresent a single contractor in a portfolio as often only one provider moves into full rate production and sustainment.

In recent months concerns with a robust and efficient industrial base to serve MDAPs have surfaced with respect to shipbuilding. The GAO has made long-standing recommendations to the Navy that the Shipbuilding infrastructure is not sufficient to meet the high demands of our nation's Navy. The GAO has stated that "infrastructure and workforce limitations often worsen the Navy's shipbuilding challenges. Shipyards have problems with aging facilities and equipment as well as space limitations that are affecting shipbuilding performance. Shipyards are also struggling to replace the loss of experienced skilled workers with new ones" (Oakley, 2025). As a result of these industrial challenges the U.S. Navy has failed to increase its fleet size in over two decades despite almost doubling its budget for these programs. These problems are further magnified by the dramatic increase in Chinese Naval Force development in the last decade. The Center for Strategic and International Studies (CSIS) details that today, China now has a larger naval fleet than the United States, a key distinguisher in historic conflicts around the globe. Furthermore, China's manufacturing is more efficient than the U.S., the CSIS found that "about 70 percent of Chinese warships were launched after 2010, while only about 25 percent of the U.S. Navy's were" (Palmer et al., 2024). The majority of active ships in use in the U.S. Navy were launched between 1990 and 1994, whereas the majority of active ships in the Chinese Navy have been launched in the last decade (Pape, 2023). This disparity demonstrates an urgent and alarming capability gap facing our Navy and defense department as a whole. This real-world example underscores just how impactful a particular sector of the industrial base can be on our nation's multi-layered defense strategy.

A deeper dive into the supplier issues affecting shipyards show that skilled labor shortages are severely limiting the means of production. There is a two-fold problem

effecting the labor force for shipyards; first an aging workforce of skilled workers which is causing greater and greater labor force exits as time goes on; and second a lower input of younger skilled workers to take their place. One shipyard in Jacksonville Florida even reported that his average age of skilled workers is 55 years old, and that steady work has been nearly impossible for his employees leading to a reduction in new workers by over 30% (Kreisher, 2019). These issues have risen to congressional levels of concern and have led to the recent discussion of the SHIPS for America Act or the Shipbuilding and Harbor Infrastructure for Prosperity and Security for America Act of 2025 (2025). This bill is designed to rebuild and strength the industrial shipyard base and creates a dedicated fund to support revitalizing the industry. The bill also focuses on enhancing maritime academies and training programs while offering financial assistance for modernizing and construction of new shipyards and manufacturing facilities. These cracks in our defense industrial base not only leads to concerns with national security, it also leads to widespread trade concerns. With shipyards backlogged months and years in some areas, overall ship making has taken a huge hit, this impact defense vessels but also critical trade vessels needed to maintain sea trade across the globe.

C. CURRENT RISK MITIGATION TECHNIQUES IN MDAPS

Being that MDAPs are innately high risk there have been recent developments to reduce risk throughout the life cycle when possible. The following sections outline different techniques and programs that are used to mitigate risk across a major program's life cycle.

1. Rapid Prototyping

There has also been a rise in rapid prototyping and fielding as authorized by the National Defense Authorization Act for Fiscal Year 2016 (2015). As we can see from previous acquisitions prototyping and development make up the majority of the schedule delays as the unknowns are higher. This middle tier acquisition pathway aims to reduce this exposure by allowing programs to streamline the process and deliver early-stage products and services faster than previously permitted under the DoD 5000 series life cycle. There are also cost estimation checks conducted by the office of Cost Assessment

and Program Evaluation (CAPE). This independent assessment offers programs an external view at cost estimation and allows for more thorough cost analysis from a strategically positioned organization. These estimates if accurate can increase realism in the budgeting and planning of MDAPs.

2. Contract Type Selection

Contracting organizations also have tools for risk mitigation in the MDAP framework. Selecting different contract types commensurate with the acquisitions current level of risk is vital in ensuring a balanced risk environment for the contractors and the government (R. Rendon, personal communication, 2024). Traditionally in the early-stage development of the program (prior to milestone C in Figure 1) contracting offices tend to use cost-reimbursement contracts to share the risk of the developmental acquisition as it progresses into a more known, and less risky state (R. Rendon, personal communication, 2024). Once an acquisition has moved past milestone C contracting offices tend to use more fixed-price contract vehicles. As the technology has matured, the unknowns have been discovered and the contractors' designs become more stable fixed-price contracts can better serve both parties as the acquisition progresses. These contract types also offer subset contracts that can align incentives with contractor performance. As we have seen earlier in this paper the government has recently tried to roll out fixed price contracts in largely developmental and risky early-stage programs which has led to a reluctancy from contractors to engage in government needs. As fixed price contracts are by nature riskier on the contractor, companies are shying away from a high-risk environment that does not include a contract vehicle that allows for adequate risk sharing.

3. Relational Contracts in MDAP

Relational contracts could prove beneficial in the MDAP context due to their aims to drive long term value creation and facilitate a mutually beneficial relationship moving forward. Relational contracts are legally enforceable agreements that focus on outlining the key characteristics for a healthy and successful relationship between the contractor and the program office. Relational contracts differ from traditional transactional contracts designed for procurement by outlining the principles, decision making techniques, and

communication expectations as the program matures. These relational contracts are particularly beneficial in the MDAP context because of the long-term relationships ingrained into major programs. Relational contracts are not a traditional component of acquisition programs but can prove useful when adopted by all parties. Relational contracts also get to the heart of the issues raised when we examine the impact of agency theory on major defense acquisitions. By outlining the foundational principles that will be adopted by both parties the government can mitigate the information asymmetry that naturally occurs. Furthermore, with clear decision-making processes and communication expectations the government can more efficiently monitor contractor performance and tighten the boundaries for morally hazardous activities. One of the key tenets of a relational contract is creating an environment of trust. This is aimed at improving transparency and eliminating potential room for resentment as the program progresses. Economics Nobel Prize winner Oliver Hart and David Frydlinger (2019) discusses the drastic improvements a relational contract brought to the business relationship of Dell and FedEx. While the two companies had a mutually agreed upon transactional contract they eventually found themselves at an impasse that led to them scrapping their previous agreements in favor for a formal relational contract (Hart and Frydlinger, 2019). Hart noted that "in the first two years, Dell and FedEx were able to reduce costs by 42%, scrap by 67%, and defective parts per million to record-low levels" (Hart and Frydlinger, 2019).

Relational contracts are extremely popular in commercial industry but have failed to make a large transition into government contracting. In commercial practices, long standing, highly relational agreements between vendors provide a foundation for long-term success and value creation. In private industry, vendor loyalty is often highly valued and companies build trust on the basis of continued business, a principle that is difficult to establish in government acquisitions. This is due to government contracting being heavily constrained in supplier selection and preference as outlined by the FAR and other governing documents. Due to competition and evaluation requirements under law, it can be difficult to establish a positive vendor relationship when no preferential treatment is permitted. However, relational contracts are not impossible to implement and can prove

beneficial in long term acquisitions so long as the legal boundaries of government and vendor relations are made clear.

In the context of risk-sharing in major defense acquisition programs relational contracts can serve a key role in outlining how decisions will be made in the future to include risk consideration from both the contractor and the government. Being that risk-sharing is a balancing act, having a foundational document that can provide key principles to be referenced as the program matures, can ensure that risk is adequately understood from both sides of the contract and shared appropriately.

4. Incremental Development and Modular Open Systems Approach

Incremental approaches propose developing capabilities in blocks to manage risk and mitigate the timeliness of technology development in fielding. Rather than having one product go through years of development and potentially be left behind by emerging technologies external to the program, incremental development aims to deliver capabilities in a more timely manner. Additionally, modular approaches aim to reduce the reliance on a single vendor. This approach requires that contractors employ a modular opens systems approach (MOSA) to their designs that allows components of the design to be sustained or replaced by multiple vendors. This open system approach reduces the reliance on a single vendor by expanding different components for competitive acquisitions in hopes of driving down price and improving results. The U.S. Army most recently required an open systems approach in the development of its new rotor-wing aircraft (Program Executive Office Aviation, 2024). This MOSA requirement will allow the Army to better sustain the aircraft once it is operational by opening the door to other vendors limiting supply chain risk and single vendor cost concerns.

A MOSA offers risk management benefits to the government by managing the components of the overall acquisition. The MOSA approach requires that contractors use modular and open systems that can be found elsewhere on the commercial marketplace if needed in the acquisition life cycle. This is mostly beneficial for the government during the later stages of the acquisition when a program has moved into operations and sustainment. This open system approach will allow multiple vendors to compete for the sustainment and maintenance of the program and will drive down prices through

competition. In a traditional approach that does not require open systems integration, contractors become the only provider for sustainment for their product and this grants a larger leverage position to the contractor and exposes the government to a sole-source environment. Furthermore, this can prove higher risk for the government not only due to cost but in a limited supplier environment supply chains are more susceptible to single points of failure. With a small vendor pool the government cannot ensure the supply chain resiliency needed to deliver the product whenever and wherever needed without an overreliance on a single supplier. In the U.S. Army's recent acquisitions under their aviation programs, they have implemented a mandatory MOSA implementation through six major directions. These directions include software strategy, architecture models, intellectual property strategy, and hardware elements. The Army also stood up the MOSA transformation office to integrate MOSA practices into program offices. The Army has seen the clear benefits of the open systems approach and believe that with effective implementation they can lower supply chain risk and sole source borne costs in the future.

5. Earned Value Management

Earned Value Management (EVM) is a program management tool that encapsulates the triple constraint—cost, schedule and performance—into a measurable baseline. This provides a metric for contracting officers and program offices a way to measure the work, or value, being accomplished and created compared to what has been planned and what has been spent. EVM is broken down into different indicators: Planned Value which consists of the budgeted cost of work scheduled, Earned Value which is the budgeted value of the work completed, and Actual Cost which is the cost incurred for work completed. Using these indicators program offices can understand if they are over or under budget by finding cost variance from the difference between earned value and actual cost. If the program is ahead or behind schedule by finding the difference between earned value and planned value and how efficient the program is by dividing earned value by actual cost. Lastly, Cost Performance Index (CPI) and Schedule Performance Index (SPI) can be computed as well.

CPI and SPI are key metrics in risk detection and mitigation by showing a potential likelihood of problems prior to becoming visible in the program itself. For example, a large cost variance early in the program's life cycle indicates that there are cost overruns early, and steps should be taken to mitigate them, so they don't snowball into later stages of the program. Additionally, finding the SPI can demonstrate the program's success in staying on schedule, different SPI readings can result in schedule changes that can best suit the program. These metrics are extremely valuable because they provide objective metrics with respect to risk and performance of a program. These data-driven metrics mitigate reliance on contractor reporting and oversight by allowing program offices to check reporting metrics against actual work performed data.

In cost-reimbursement contracts earned value management can indicate the efficiency and health of a program as it progresses allowing the government to intervene in potential problems early. DFARS 234.2 outlines that earned value management shall be used for cost-reimbursement and incentive contracts valued at $20M or more, furthermore the contractor must have an EVM system for contracts value at $50M or more (DFARS 234.201, 2025). As the program progresses the program office can evaluate any emerging trends or patterns in the EVM reporting to better understand the risk their program faces and how to mitigate them in the future. As the program progresses throughout the acquisition life cycle EVM data is designed to be evaluated and provide insight to decision makers as to how the program has been doing and if it should move forward to the next stages. By understanding the previous EVM data and trends program offices can also forecast future implications on cost, schedule, and performance and use EVM data to implement lessons learned as the program matures through the life cycle.

EVM is not a perfect system, and its utility relies heavily on the management and implementation of the tool in decision making. One of the major constraints of EVM is that it is only as useful as the value it is given by the program office. Meaning that if the EVM metrics are not accurately calculated and implemented into decision making, then the value from the tool doesn't emerge. Furthermore, EVM cannot become the one and only metric to understand program efficiency and health, it is one tool in the toolbox used to evaluate the program's performance. Additionally, EVM does not focus heavily on

performance with respect to the triple constraint. This focus on cost and schedule could result in a program that is effectively managing the budget and schedule but is not meeting key performance indicators or KPIs.

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IV. OPTIMAL CONTRACT DESIGN IN MDAP

A. THE GOALS OF OPTIMAL CONTRACT DESIGN

The main goal of optimal contract design is to aspire towards a win-win outcome for both the government and the contractor. While it may seem popular at times to favor a contract that places disproportionate risk on the contractor, as demonstrated in earlier chapters, this is actually detrimental to the government in the long-term. The employment of major defense acquisition program contracts that place too great of risk on the contractor only leads to a weaker industrial base and a subsequent weaker national defense. Defense firms, under appropriate oversight, deserve to make fair and healthy profits for their contributions to national defense, and the broader commercial marketplace. On the other hand, the government has an overarching obligation to the American taxpayer to judiciously fund these contractors and ensure profits do not become excessive. The danger of a no-win outcome cannot be overstated, and optimal contract design should ensure both parties are being treated fairly.

Traditional cost-reimbursement contracts such as CPFF or CPIF effectively take away unpredictable risks from contractors' shoulders and ensure contractors' willingness to participate. However, this benefit comes with a cost. Under CPFF, since cost is fully reimbursed and profit is fixed, the contractor has no incentive to exert cost-saving effort since such effort brings disutility without any benefit. Put it equivalently, moral hazard problems become a major concern. CPIF tries to mitigate this problem by structuring the profit as a function of cost variance (i.e., the difference between the target cost and actual cost). If target cost is greater than actual cost (cost under-run), profit is increased by a fixed share of the cost variance. On the other hand, if target cost is lower than actual cost (cost over-run), profit is decreased by a fixed share of the cost variance. This way CPIF partially addresses the moral hazard problem with a major drawback , that is, CPIF in particular relies on a robust target cost estimation from the government which is inherently difficult due to the information asymmetry that exists in major defense acquisition programs. In lower risk, more mundane acquisitions, the government attempts to limit information asymmetry and distill a more accurate estimate through competitive

bids, market research and previous acquisition history. In the context of major defense acquisition programs there are often major components of the acquisition that do not allow for competitive bids, adequate market research and have no previous acquisition history. This environment exacerbates the information asymmetry that already exists may limit the governments access to reliable information and places greater reliance on the contractor who is often the subject matter expert in early stage MDAPs. Stemming from an environment of information asymmetry contractors could leverage these information advantage and extract information rents in order to earn excessive profits. Hence, the moral hazard problem is difficult to control under traditional cost reimbursement contracts. This thesis proposes proper contractual mechanisms that motivate contractors to truthfully report cost estimates, and in the meantime limiting shirking behaviors that are detrimental to the government's objective. By promoting win-win outcomes through efficient contract design the government can ensure a long-lasting and healthy industrial base while providing lethal capabilities for the warfighter to meet their critical mission.

B. IDENTIFYING MISALIGNED INCENTIVES IN CONTRACT DESIGN

While MDAPs are extremely complex, economic incentives guiding firms are fairly straightforward. Firms engaging in MDAP proposals are largely profit driven, often with a fiduciary responsibility to their shareholders to deliver returns on a quarterly and annual basis. Conversely the government is charged with judiciously awarding taxpayer dollars in support of national priorities and public policy. While the government seeks a fair and reasonable price in all of its dealings, firms often attempt to score wins and profits wherever possible. While these two priorities are often opposing there is an opportunity to better calibrate our contract design schemes in order to more closely align these two incentives and support win-win outcomes. The government has clear acquisition policy that outlines firm's profit limits. The government does not and cannot advocate for firms to lose money or not return a profit to their stakeholders, however excessive profits are what is under scrutiny. CPIF contracts attempt to address these incentives by adjusting contractor fee (profit) based on cost performance relative to a previously agreed upon target cost. However, determination of target cost is a major challenge for the government because the government typically does not possess the

necessary information that facilitates good assessment. If target cost is set too high, the contractor enjoys a windfall profit at the expense of taxpayers; if target cost is set too low such that cost overrun is unavoidable, then the contractor is unfairly penalized (Wang & San Miguel, 2013). Therefore, knowing the true expected cost of the project is essential. This explains why inducing truth-telling behavior is important. Under the proposed budget-based cost-plus scheme (BBCPS) i.e., a modified CPIF, the job of estimating target cost shifts from less informed government to better informed defense contractors (Wang & San Miguel, 2013). In addition, the BBCPS is carefully designed to induce the contractors to truthfully report their expected cost in maximizing their own profits. Any deviation from truthful reporting would make them worse-off. This effectively addresses the problem of traditional CPIF while still keeping its risk-sharing benefits.

C. BUDGET-BASED COST-PLUS INCENTIVE SCHEME OVERVIEW

Wang and San Miguel (2013) propose a budget-based cost-plus scheme as an improvement to traditional CPIF. Since the BBCPS maintains the framework of CPIF, it retains the desirable feature of risk-sharing that is essential to ensure defense contractors' participation. Moreover, recognizing that the mitigation of moral hazard problem is not effective under traditional CPIF, the BBCPS introduces unique functional features for target profit and cost sharing parameter that induce contractor's truth-telling behavior. It is also worth noting that under BBCPS, contractors are invited to submit their target cost knowing that the target cost they submit will determine the target profit and cost parameter in certain way. The beauty of this design is that the determination of target cost is no longer the government's job, rather, it is the contractor who is better positioned to estimate target cost does the job. Even better, as long as we carefully design the functional form of target profit and cost sharing parameter, the contractor will be guaranteed to tell the truth because doing so maximizes their own benefits. Any deviation from truth telling would make them worse-off. Thus, we effectively address the information asymmetry problem and remove any information rents. As long as the government knows the true expected cost of the project, the government can use this information to facilitate a fair and efficient contracting practice.

Now let's first examine the profit function under the BBCPS and demonstrate how this incentive scheme aligns firm and government goals. Second, we will demonstrate how this scheme works in the acquisition environment and its application in MDAP.

Under the budget-based cost-plus scheme proposed by Wang and San Miguel (2013) the profit function is: $\mathbf{p(c, TC)} = \frac{N}{TC} + \frac{N}{TC^2} * \mathbf{(TC - c)}$. Where **c** denotes actual cost, **TC** is the contractor submitted target cost or budget cost in this format, and **N** is a constant used to scale profit levels. In order to provide a deeper understanding of this formula to acquisition professionals I want to offer these definitions. In the above formula: $\frac{N}{TC}$ is the target profit, $\frac{N}{TC^2} * \mathbf{(TC - c)}$ is the profit earned (lost) from cost efficiency (inefficiency). This term is the incentive component that addresses moral hazard problem. $\frac{N}{TC^2}$ is the cost-sharing parameter (i.e., the penalty or bonus rate that determines the impact of overruns and underruns)**.** It is worth noting that under traditional CPIF, both target profit and cost sharing parameter are constants that do not vary with target cost. While under the BBCPS, they do. As shown in this particular case, both target profit and cost-sharing parameter are inversely related to the budget target cost submitted by the contractor.

The scheme invites the contractor to submit **TC**, resulting in a menu of contracts rather than a single fixed contract being available to the firm. In doing so this allows the firm to select the value of **TC** that maximizes expected profit. As shown by Wang and San Miguel (2013), knowing that the submitted target cost will impact their target profit and cost-sharing parameter, the contractor will choose truthful reporting from the menu because any over-reporting or under-reporting will reduce expected profit.

A key function of this formula is that for every additional dollar of actual cost the contractor loses $\frac{N}{TC^2}$ dollars in profit. Therefore, there is no benefit to the contractor for higher spending, a large contrast to CPIF where inflated costs can result in higher fees. Finally, because profit is derived from the difference between **TC** and **c** rather than absolute cost values, the scheme ties contractor reward to cost efficiency, not cost volume. The contractor earns additional profit only when it generates a project at an actual cost below **TC**, and loses profit when costs exceed this benchmark. Unlike in

traditional CPIF the base fee is not positively related to target cost, therefore under BBCPS the firm cannot gain by strategically inflating **TC** because doing so reduces $\frac{N}{TC}$ (the base fee) and increases the incentive penalties $\frac{N}{TC^2}$**.** This incentive scheme only allows for profit growth paired with genuine cost efficiency instead of increased cost.

Wang and San Miguel (2013) demonstrate the decision matrix available to firms. As evident in Figure 3, expected profit is maximized when the firms chooses TC=100 (i.e., truthful reporting). Both under-reporting (TC=50) and over-reporting (TC=150) result in a lower expected profit.

Firm's Profit		*C (actual cost incurred)*			
		50 (p = 1/3)	100 (p = 1/3)	150 (p = 1/3)	*Firm's Expected Profit*
$\overline{TC}$ *(budget target cost)*	50	N/50	0	−N/50	0 (under-reporting)
	100	3N/200	N/100	N/200	N/100 (The highest profit is achieved by telling the truth)
	150	N/90	2N/225	N/150	2N/225 (over-reporting)

Figure 3. Budget-Based Cost-Plus Scheme Inducing Contractor's Truth Telling Behavior. Source: Wang and San Miguel (2013).

D. BENEFITS OF BUDGET-BASED COST-PLUS INCENTIVE SCHEMES

The optimal contract design presented above aims to strike at the heart of concerns with MDAPs, cost overruns and inadequate program estimates. These schemes aim to incentivize and reward contractors for accurate budget cost estimates and invoke truth-telling throughout the acquisition life cycle. While the contract scheme presented below is not perfect, it does provide a foundation for a more honest, and transparent contractual relationship. This scheme does so by directly rewarding accurate estimates with a higher profit, while minimizing profit on over or under-estimated costs. Instead of being rewarded for the highest total cost or dragging programs over budget, contractors are given a clear roadmap: honesty is the most profitable option. This transforms honesty

from an ethical choice into a best business practice and financial advantage for the contractors.

Contractors often know more about the specific work that needs to be done for a program than the government. This is amplified as layers of prime contractors and subcontractors are entered into the mix—further distancing the government from where the actual work is taking place. By shifting the cost estimation to the contractor the government allows those most closely familiar with the intricate details of the work to create the most accurate budget. This takes a major step towards mitigating information asymmetry concerns in the program—these concerns are also at an abnormally high level in comparison to more common acquisitions as MDAPs are often developmental and largely unknown. By obligating the contractor to create the budget cost, the government is actually leveraging the contractor's subject matter expertise and capitalizing on the contractor's superior knowledge and technical details of the program.

This contract design methodology directly aligns the contractors' incentives to control costs and mange resources efficiently throughout the program. This contract type does so by tying profit directly to cost controls—allowing firms to even increase profit with effective resource management. This is also ties to the win-win outcome, with effective resource management on the part of the contractor the government is fulfilling their obligations to the taxpayer while the contractor is operating at maximum efficiency. This also forces contractors to be realistic during the offer phase. In traditional settings contractors may bid unrealistically low to win the job or inflate costs to account for risk premiums. This contract type discourages both behaviors and ties profit not to a lowest amount or a highest amount, but to a most accurate amount. This not only leads to more accurate proposals limiting cost overruns over the life cycle of the acquisition but also gives the government a more detailed understanding of the true cost of a program prior to the acquisition progressing. This benefit also builds upon itself and provides dividends to the government for years to follow. As stated earlier the government relies on previous acquisitions for lessons learned and cost estimate information. As our cost estimation becomes more accurate, the benefits are reaped in future acquisitions. These improved estimates can also be used to better allocate resources and empower decision makers in the future.

Finally, a potentially unseen benefit of implementing BBCPS is the subsequent oversight functions gained from the inherent formula. Program offices are often overworked and understaffed, with pricing support varying by dollar value, priority, and manpower. The BBCPS offers not only cost control functions but by incentivizing the firm to control costs for their own benefit there is inherent oversight being provided. Program offices can leverage this contract scheme in environments where there is reduced oversight capability to bolster contractor accountability and help defend the government against moral hazard and traditionally profit maximizing techniques from the contractor.

E. CHALLENGES WITH BUDGET-BASED COST-PLUS INCENTIVE SCHEMES

Although BBCPS does provide improvements to the traditional CPIF and CPFF structures, there are potential challenges with this incentive format. With the introduction of a new contract incentive scheme there can be expected growing pains among the parties involved who may have to take time to understand how the mechanisms in this incentive scheme differ from the previous norms. Additionally, the government contracting workforce may struggle with the oversight and management required by this type of contract scheme or the mechanisms in which it relies on. In addition to oversight and management the design of the specific formulas and functions that control profit and incentivize performance may require additional training and learning from government contracting professionals. Designing these formulas may prove difficult at first as new contract incentive schemes on such large projects often require a multi-functional team and various disciplines to collaborate. Furthermore, while this contract design rewards truth-telling, it can unintentionally punish genuine mistakes. While it may be possible that cost estimates are intentionally inaccurate, there is potential that inaccurate estimates rooted from genuine error or miscalculation will be punished similarly to intentional dishonesty. Contract managers should work with their contractor counterparts to establish a space in which contractors can communicate openly and honestly with the government to disclose any errors and allow the government to assess the legitimacy of these reports.

A key concern for this contract type is the public perception and potential scrutiny this incentive scheme may draw. A common misconception that could arise is that a contractor is unilaterally setting the budget for a major defense program. Or that a contractor will be incentivized to inflate budget cost and as long as they can justify their inflated cost they will still receive a larger profit. Simply put, as long as contractors are dishonest from the start, there are no mechanisms in place to curtail this behavior. In actuality, this is not the case—a key concept in this proposed contract scheme is that as budget cost increases, both target profit and cost share decrease. This incentivizes not only an accurate budget cost, but a more modest proposal where possible. As we have seen in the past, public perception does matter, and an incomplete view of this contract methodology can result in improper judgements. Similar to the fixed-price push following cost overruns in cost-reimbursement programs, we need to be mindful of viewpoints that attempt to cure symptoms rather than the true problem.

BBCPS can also bear risk larger risk to smaller, less established firms. As we have seen in recent months, major defense companies have been held accountable for cost-estimation shortcomings with Northrup Grumman among others booking a quarterly loss (Insinna, 2025). With smaller firms these contract mechanisms may pose a larger threat as the risk of inaccuracy is directly impacting the bottom line. Smaller firms may also not have the robust infrastructure and manpower in order to formulate an extremely accurate budget cost and as a result may see profit diminish due to inaccuracies. This higher risk may limit competition among smaller firms who may choose not to enter into a program in which the risk of cost estimation is placed on their shoulders – benefitting larger companies who can bear the financial risk of inaccuracies and have the staffing to support a more fine-tuned proposal.

It is inevitable that critics may suggest that contractors may attempt to evade the truth-telling mechanisms demonstrated above through extreme means, however we must be mindful that no contract is perfect, and the goal of this incentive scheme is to lay the foundation for improvements that promote win-win outcomes. No contract design is perfect and unfortunately there will always be a potential for parties to try and take advantage of the other, underscoring the need for appropriate oversight and robust contract management. The overall goal of this incentive scheme is for the government to

leverage a more accurate and beneficial design to promote truth-telling and reducing moral hazard and information asymmetry concerns to allow for a more favorable acquisition outcome.

F. APPLICATION OF BUDGET-BASED COST-PLUS INCENTIVE SCHEMES

As detailed earlier, BBCPS offers a wide variety of benefits and drawbacks. The application of this contract incentive scheme requires thoughtful consideration of the factors at play between firms and the government. In MDAPs the BBCPS method is particularly useful in the early stages of the acquisition life cycle, when risk and information asymmetry are at their height. A key advantage to using BBCPS is mitigating information asymmetry through a contractor proposed budget cost, in early-stage acquisitions where technology is largely immature offering a cost control mechanism like those offered in BBCPS could stop the waterfall effect often criticized in CPIF.

It is also important to include that BBCPS should be used in complement with other contract types. Not every MDAP and every CLIN is perfect for BBCPS therefore implementing BBCPS as blanket approach is not a recipe for success. For example, reimbursement for contractor travel does not offer any meaningful cost-efficiency decisions for the firm. Firms cannot work harder to reduce airfare, nor do they have any leverage due to information asymmetry regarding the technical details of the work. There is potential that a BBCPS could actually distort behavior and degrade performance in this case as pure pass through costs should not carry incentives. BBCPS is best used when the government wants to incentivize efficiency and cost controls in an environment of information asymmetry—subcontractor costs under mandatory flow-down clauses and catalog priced items do not offer these opportunities.

An example of an excellent situation to use BBCPS is in prototype design and development. Initial design, manufacturing, and testing of the prototype are likely to carry large uncertainties, design risk and deeply held contractor knowledge. Government cost estimation is likely to struggle with understanding the real cost of prototype iterations and developments and the contractor controls the materials, engineering

methods and working strategies. In this environment the government can leverage BBCPS to incentivize cost-controlling behaviors from the contractor.

V. FINDINGS AND RECCOMENDATIONS

The purpose of this research was to dive deeper into risk sharing in the major defense acquisition ecosystem in order to preserve and promote the health and strength of the U.S. defense industrial base. As stated earlier, the U.S. is at a critical point in its history in which the country must rise to the occasion and prepare for near peer competition, a threat we haven't faced in nearly a century. By leveraging one of our greatest strategic advantages, the DIB, the U.S. can ensure it remains atop of the world stage and maintains the ability to project power anywhere at any time. The key questions raised at the beginning of this paper were: How can risk be allocated in a way that sustains industry participation while protecting taxpayers? Can cost-plus contracts be modified to limit moral hazard and information rents without driving firms out of the market? And, more broadly: What contract design techniques can reconcile the government's need for efficiency with industry's need for sustainable risk-sharing? Through examining long-standing economic principles regarding incentive schemes and their uses in government acquisition and contracting, as well as diving deeper into the problems outlined in agency theory, understanding that there are inevitable concerns with moral hazard and information asymmetry and how to best mitigate these, this paper aims to provide a menu of options for acquisition professionals to improve risk-sharing in government acquisitions between the firms, and the government, in order to improve outcomes and protect both parties. Through leveraging program management techniques, alternative contracting approaches, and innovate contract incentive designs, government acquisition professionals can better position the government to oversee and execute major defense acquisition programs that our nation so heavily relies on. This chapter will consist of the key findings from the research provided, followed by key recommendations derived from the findings and their likely consequences.

A. KEY FINDINGS

The key findings of the above research supports that there is no "one size fits all" approach to risk allocation. Risk allocation in major defense acquisition programs is a fluid system that needs to be evaluated with inputs from both the firm and the

government, to find an appropriate balance for both parties. This thesis has also found that improper risk allocation has led to serious risks in maintaining the health of the DIB. The DIB does not just represent firms and profits; the DIB represents the forum in which capabilities are generated and delivered to warfighters. It is in the best interest of acquisition professionals and the taxpayer to ensure the DIB is healthy and participating in major defense acquisition programs. This thesis identified that major acquisition programs face risks in many different forms during different stages of the life cycle. As a result, there is no one solution to risk management, but rather a menu of program management techniques that the government must implement at the appropriate time and stage in the acquisition. Finally, this research supports that implementation of effective contract incentive design can simultaneously support the government's mandate of preserving taxpayer interests, while promoting a firm's goal of healthy profits.

When evaluating the current risk sharing dynamics in MDAPs and examining the role agency theory plays in government contracting a pattern has emerged where improper risk sharing has created unintended consequences for both the government and the firms. In attempts to combat moral hazard an over-reliance on FFP in developmental acquisitions has led to disastrous outcomes for firms biting off more than they can chew and delayed and degraded capabilities for government program offices. In order to combat information asymmetry, the government tries to align incentives across the period of performance to direct the firms to control costs and provide accurate estimates and projections upfront. However, this attempts to curtail ex-ante performance and does not address the problem of inadequate requirements understanding in the early stages of acquisition development. Through examining current risk sharing techniques used by firms and program offices and applying agency theory incentives extrapolated from deep rooted economic literature, a contract incentive design formula can be proposed that accounts for the impact of agency theory on government contracting. This formula will account for information asymmetry through a contractor proposed budget cost, empowering the more technically inclined party to develop proposals that require inside knowledge. Furthermore, the formula accounts for moral hazard in performance by aligning cost-controls and efficient performance incentives with profit for the firm.

B. RESEARCH QUESTION 1

Major finding: it is not unusual to find poor allocation of risk among MDAP programs. Often, defense contractors are pressured to accept fixed price contracts for projects that are inherently risky or in highly uncertain development stage. For such high-risk programs, risk-neutral government, as opposed to risk-averse industry firms, should bear most of the risk. Unfortunately, in reality we often see the opposite. This exactly explains why Boeing, among many others, expressed strong reluctance or even stopped bidding for fixed-price contracts. This lack of willingness to participate greatly impairs the health of the U.S. DIB and in turn will do severe damage to the US's warfighting capability.

Recommendation: To ensure participation of the DIB, we must correct the misallocation of the risk. We must retain cost reimbursement contracts as the major contracting type for MDAP programs, especially when they are at the developmental stage. The importance of proper risk allocation cannot be overstated

C. RESEARCH QUESTION 2

Major finding: While cost reimbursement contracts ensure DIB's participation, traditional CPFF and CPIF have their own problems. CPFF does not address the moral hazard problem at all, while CPIF only partially does. In both cases, the firm has incentive to inflate cost estimate ex-ante so they can shirk or earn cost-underrun bonus. Moreover, due to information asymmetry, the government is likely to be ineffective in challenging the inflated cost estimate and limiting information rents. To summarize, how to modify traditional cost reimbursement contracts in the context of MDAPs to limit information rents and induce cost-saving efforts becomes essential.

Recommendation: A revised CPIF contract, namely, the BBCPS should be adopted to induce truth-telling (and hence removes information asymmetry and eliminates information rents) while still effectively motivates defense contractors to make their best cost-saving efforts.

D. FINAL RECOMMENDATIONS

Resulting from the research and key findings this paper offers three recommendations for the acquisition workforce and policymakers. The first recommendation is to evaluate the risk allocation between the firm and the government in acquisition programs and determine if the risk is being appropriately distributed across the parties. Furthermore, the government should review program management techniques being used in the acquisition and evaluate their impact on oversight and risk management over the acquisition's life cycle. Identifying early-stage acquisition programs utilizing FFP contract vehicles and converting them to cost-reimbursement contracts where possible is vital in balancing risk and eliminating wasteful risk premiums. Second, the government should begin to employ BBCPS contract design scheme where applicable to supplement traditional cost-reimbursement contracts in order to incentivize truth-telling and mitigating information asymmetry. Additionally, BBCPS should be implemented by government offices that lack oversight capability. A key function of BBCPS is aligning firm cost estimation accuracy with firm goals, this allows for an oversight function that can supplement a government office that may lack staffing or capability to do so. It is important to understand that this contract design scheme does not take the place of appropriate contractor oversight practices or contracting officer representative roles, however it does offer incentive schemes that functions as a controlling mechanism.

VI. CONCLUSION AND AREAS FOR FURTHER RESEARCH

A. CONCLUSION

This research examines two central challenges in the design and implementation of contracts for Major Defense Acquisition Programs (MDAPs): the persistent misallocation of risk between the government and defense contractors, and the limitations of traditional cost-reimbursement mechanisms in addressing information asymmetry and moral hazard. The findings from Research Question 1 reveal that current practices often impose excessive risk on industry partners—particularly when fixed-price contracts are used for programs characterized by high technological uncertainty. Such misaligned incentive structures deter capable firms from participating in MDAPs, weaken the defense industrial base, and ultimately threaten the nation's long-term warfighting readiness. To sustain a healthy and competitive industrial base, the government must realign contractual risk with the parties best equipped to bear it. This requires maintaining cost-reimbursement contracts as the predominant contractual form for high-risk developmental programs.

Research Question 2 underscores that, although traditional cost-reimbursement contracts safeguard industry participation, they suffer from inherent flaws. CPFF contracts fail to mitigate moral hazard, while CPIF structures only partially restrain inefficient behavior. Both are vulnerable to inflated cost estimates driven by information asymmetry, enabling firms to secure rents without commensurate performance gains. As MDAPs continue to grow in complexity and scale, these weaknesses limit the government's ability to ensure both fiscal discipline and effective program execution.

To address these challenges, this paper recommends the adoption of a revised CPIF mechanism, namely, the BBCPS contract. By inducing truthful cost revelation, the BBCPS approach eliminates informational rents while still providing strong incentives for cost-saving efforts. In doing so, it offers a more efficient and strategically aligned contracting framework that better balances risk, enhances transparency, and supports the long-term vitality of the U.S. defense industrial base.

Together, these findings highlight the imperative for thoughtful reform in MDAP contracting practices. Proper risk allocation and the adoption of incentive-compatible mechanisms are essential not only for improving acquisition outcomes but also for preserving the industrial and strategic capabilities critical to national defense.

B. AREAS FOR FURTHER RESEARCH

1. Government Cost Estimation and The Impact of Contract Type Selection

A constant theme that emerged from this research was the cost estimation deficiencies that have plagued government acquisitions for decades. Cost estimation is a vital part of any acquisition, large or small, however despite a constant need for accurate estimates, several oversight bodies in place to manage estimates, the government gets it wrong time and time again. While this is in part expected due to the participating firms information asymmetry and technical expertise in the matter, this does not excuse the issues in government cost estimation. An extremely pertinent and useful topic to explore is how the government can improve cost estimation, not just in large acquisitions, but across the portfolio. One of the key components of this thesis is the implementation of the BBCPS, a contract incentive scheme aimed at correcting the inherent errors in government cost estimating. While this solution does not attack the issue of government cost estimation internally it defers the estimating to the subject matter experts with government concurrence. This solution speaks to the severity of the problem in government cost estimation.

Furthermore, problems borne from government cost estimation manifest themselves into contract type selection. In environments where cost estimation is more accurate and reliable the government is more likely to rely on firm-fixed price contract types. While using cost-reimbursement contract types does not necessarily imply that government cost estimation has become unreliable, there are concerns with waterfall effects as cost-reimbursement contracts run overbudget. That initial estimate, even in a cost-reimbursement environment, is not as precise as needed to prevent overruns.

2. Quantifying Risk-Premiums in FFP Contracts

It is well understood inside the government acquisition community that while FFP offers some cost protections – there is potential for the government to largely overpay for a product or service. Where the government wins in lower cost overrun risk, they lose in ensuring that they are paying a fair price relative to the cost of the product or service to the firm. While FFP contracts are still deemed fair and reasonable, there is still some opportunity for excessive profits for firms. Because firms absorb significant program risk under firm fixed price offerings they often will price in a healthy profit as well as risk buffer. When entering into FFP contracts firms understand that they are required to deliver the products at the price agreed upon, if the price of the product increases, the firm absorbs this cost in most cases. As a result when developing proposals firms will price in this volatility risk by including a buffer on top of product costs to provide a safety net if prices do increase. If prices don't increase, the firm gets additional profit, if it does increase, the firm is covered. FFP does offer safeguards against cost overruns but it trades this benefit in exchange for true cost ignorance. A good research topic would be diving deeper into these FFP offerings and trying to quantify risk premiums. A deeper understanding of how great these risk premiums are, how often they occur, and ways to track and measure these premiums across the DoD portfolio. In order to completely understand the impacts of contract type selection the government needs to be able to apply metrics and extract values for the consequences of FFP and cost-reimbursement contract type implementation in different acquisitions. While cost-reimbursement offers a more "face up" view of costs, FFP carries costs as well they are just masked behind the mechanisms of the contract. In addition to quantifying these risk premiums, once an accurate separation of product or service cost and risk premium can be ascertained, the government can begin to see at what rate firms are profiting from FFP contracts. Identifying this spread can give the government a deeper insight into the fee or profit rates firms are realizing on FFP contracts which is not regulated as CPIF profit/fee rates are.

3. Non-FAR Based Development Contracts Risk Sharing

In recent years there has been a large push towards non-FAR based contracting methods to both spur innovation and remove burdensome processes that may deter non-traditional defense firms and slow down acquisition processes. While it seems like common sense to use contracts that allow for more flexibility in acquisition programs – with less rules and administrative processes can often come increased risk. More specifically, as we dissect the risk sharing between the government and firms using different FAR based contract offerings, an area of further research would be the risk sharing dynamic in non-FAR based agreements. While the benefits are often praised with more flexibility comes more inherent program risk. Does this risk disproportionately sit on the government? Or perhaps the lack of oversight and administrative requirements prescribed in the FAR imputes more risk onto the firm. As the government begins to popularize non-FAR based contracts in larger and larger acquisition programs, most recently in support of the "golden-dome" missile defense initiative, what are the second and third order effects of the risk sharing on firms (Albon, 2025).

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