A Tale of Two Contracts:

A-10 Thunderbolt II Sustainment Strategy

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Executive Summary

This paper examines the history of the A-10 aircraft as a case study on the application of single award Indefinite Quantity/Indefinite Delivery (ID/IQ) and multiple award ID/IQ contract structures. The report begins with a note on how the concept of competition is applied to government contracting and note the difficult budget environment that government programs will face for the foreseeable future.

The report examines the history and mission of the A-10 in order to delve deeper into how politics and military strategy impact the evolution of its sustainment programs.

The study continues with a structural analysis of the advantages and drawbacks of various ID/IQ contract types as they played out on the A-10 platform. The paper specifically examines the impact of contract structure on knowledge management, system investment, collaboration, coordination, and speed of delivery.

The study then concludes with four recommendations for sustaining technology platforms. Each recommendation has applicability to various contract types, although it was developed through the assessment of single and multiple award ID/IQ contract performance on the A-10. The recommendations are as follows:

1. **Think carefully about competition**. Competition is a vital part of the development and growth of platforms, but multiple contractor bids on task orders are not the only way to create competition or collaboration. Instead, program officers should clearly understand what positive outcomes they wish to derive from competition and which negative outcomes they would like to avoid. Conceptualizing the ramifications of a contract will help them to design incentives that will encourage desired behaviors from private contractors.
2. **Ensure necessary systems integration exists.** Weapons platforms make use of a systems integrator in order to ensure that multiple parallel technological innovations function together when installed, which is critical to mission performance. In order for platform upgrades to function, the systems integrator must be able to effectively coordinate multiple upgrades across various contractors. Without effective systems integration, various components of

technological and structural upgrades may not effectively function when installed on the platform.

3. **Prioritize continuity of strategy.** Continuity of platform sustainment strategy is vital to ensuring a long functional life of platforms. With each transfer of management and intellectual property ownership, knowledge management and expertise can be lost, which can shift the timeline of modifications and upgrades backwards and result in diminished operational readiness.

4. **Develop a climate for communication and collaboration.** Private companies and government entities are fundamentally different organizations that respond to different incentives, such as legal obligations and expected return on investment. Program officers should keep this in mind when designing contracts, and should develop an environment that motivates communication and collaboration accordingly. Private firms in direct competition with one another will not willingly share private information with one another if doing so leads to a perceived lack in competitive advantage.

In sum, contract structures have a significant impact on the lifespan of a platform. The A-10 platform has changed managerial hands multiple times during its long life span. At each transition, it has been vulnerable to losses in continuity, professional expertise, data collection, records management, and facility investment. Each contract type has inherent strengths and weaknesses. Thus, when changes in contract structure must occur, program officers may need to manipulate certain elements of the contract in order to capitalize on the potential benefits while mitigating the drawbacks in order to optimize the effectiveness and lifespan of the system. When designing modernization and sustainment contracts, program officers should always carefully investigate their assumptions regarding competition, collaboration, communication, and incentives.

I. Introduction

Competition and Sustainment

Competition in government acquisitions is essential to obtaining the best value, but it must be applied strategically in order to optimize platform sustainment. In some cases, competition can place burdens on government contractors that lead to losses in knowledge management and investment, with negative impacts on government programs. Often, competition takes the form of a task-order decision every two months. However, envisioning competition as a thorough, one-time decision regarding a suite of services by the user every five years can help to maintain steady performance improvement and cost reduction targets and can be a better option for sustainment. This paper assesses how single award and multiple award indefinite delivery/indefinite quantity (ID/IQ) contracting impacts competitive and investment incentives for government contractors. Single award ID/IQ contracts specify one contractor as the primary provider of goods or services, delivered through task orders, following an initial competition between contractors. Multiple award ID/IQ contracts sign multiple contractors following an initial competition. These qualified contractors then bid, or compete, on task orders. In both cases, the contract duration is typically between five and ten years.

A Grim Budget Environment: Sequestration

After two prolonged wars and the effects of the financial crisis and 2007 recession, Congress enacted budget sequestration, which has led to a $37 billion reduction in Department of Defense (DoD) resources in fiscal year 2013 alone. This includes a $37.4 million reduction in direct spending. As a result, the DoD must reduce the amount it spends on sustaining weapons platforms, while also ensuring that those weapons platforms last as long as possible. The A-10, known affectionately as the “Warthog,” will face this pressure directly: initially scheduled to remain in service until 2028, it may instead be retired within the next two years. Unfortunately, prior shifts in platform sustainment strategy have negatively impacted A-10 knowledge retention, driving up system sustainment cost.

II. Background

History of the A-10

Designed by Fairchild Republic in the 1970s to defend Europe against Soviet-style armored attack, the A-10 Thunderbolt II ("Warthog") was known as a tank-killer.[1] Initially equipped with a Gatling gun the size of a Volkswagen Beetle, the A-10 has high maneuverability at low altitudes and low speeds, allowing it loiter for long periods of time to provide cover to ground forces. However, the aircraft has always existed in a political gray space, serving the close air support (CAS) needs of the Army, as well as tactical Air Force missions.

The Army's need for CAS required a low-flying, heavily-armored plane with a high payload capability. The Air Force, on the other hand, evolved from high-loss experiences in World War II. Accordingly, the A-10 was designed to sustain extensive damage, an element of its design that has been tremendously popular with pilots. Generally, however, the Air Force has a preference for faster fighter aircraft that rely on speed as the first line of defense and perform close air support only as a secondary or tertiary task.[2] Initially, the A-10 was an unwelcome addition to many in the Air Force. Many Air Force pilots flew the A-10 reluctantly, favoring the speed and appearance of other fighter aircraft.

> *The A-10s are pretty much the backbone of [air operations in Afghanistan] because they're flying all the time every day.*
>
> - British Royal Air Force Flight Lt. Matthew Adamson-Drage, 2006

The A-10 Warthog saw its first combat in Operation Desert Storm. It flew over 8,000 sorties and destroyed over 987 tanks, with the loss of only 6 planes. Its large payload and long loitering abilities allowed it to take on many roles throughout the war. The A-10 was instrumental in support of both Marines and Navy forces.[3] Since its engagement in Operation Desert Storm, the A-10 has also been instrumental to military success in operations in the Balkans, where it attacked Serbian ground targets while avoiding civilian casualties during the Bosnia-Herzegovina conflict and deployed against ground forces in the Serbia-Kosovo War. Most recently, the A-10 has provided significant CAS for U.S. and coalition forces in Afghanistan.

Historical A-10 Sustainment Approach

Tensions regarding military strategy meant that the future of the A-10 was never truly certain. Congress voted to defund the A-10 in 1983, and A-10 production ended in 1984. In 1987, Fairchild Republic sold off its aircraft business line to Grumman Aerospace (which became Northrop Grumman in 1994). As it goes with many acquisitions, the transition of knowledge, technology, and aircraft configuration was difficult.[4] Grumman Aerospace had difficulties acquiring accurate information and configuration management for the A-10s. Also, perhaps due to the change in facilities and management after the acquisition of Fairchild Republic, Grumman Aerospace struggled to acquire accurate records regarding which A-10s had been modified or upgraded. Upgrade information would be essential in determining the structural integrity of A-10s after thousands of hours of flight time under restrictive maintenance budgets.[5]

Between 1987 and 1997, Grumman Aerospace/Northrop Grumman served as the A-10's primary contractor, and could negotiate and execute task orders quickly because it had been pre-approved to perform work under a single award ID/IQ contract. However, some of the work for the A-10 was also competed outside of this single award contract structure.[6]

During the mid-1990s, base closures, and other administrative measures, led to a loss of approximately 80% of the System Program Office's (SPO's) experienced workforce, including program directors and engineers. One of the consequences was that regular inspections were not carried out as intended, leading to lapses in maintenance. For example, the "flight data recorder system… became unsupportable and no longer yielded accurate data."[7]

During this period, the Air Force often made use of "fallout funds" to support Northrop Grumman's work on A-10 systems design and analysis.[8] Fallout funds refer to funds budgeted to other programs, but unspent towards the end of the fiscal year. With a single award ID/IQ, a contractor could quickly be put on contract for upgrades or work orders according to the amount of money available (since the individual task orders did not need to be competed), within a matter of days before the budget year ended, and unspent funds returned to the Treasury.

Northrop Grumman Contributions

In 1998 Northrop Grumman delivered a report titled, "A-10A Aircraft Wing Center Panel Rework-Fatigue Life Improvement" which gave detailed instructions required to increase the service life of the A-10 under the assumption that A-10 upgrades had been implemented evenly across the fleet. The report inspired the A-10's program (which was known as the HOG UP) that would extend the structural life of the aircraft to 2028. In 1999, the SPO initiated the HOG UP program as a repair program, enabling work to be completed with maintenance funding.[9]

However, due to changes in sustainment and military strategy during the 1980s and 1990s, repair and modification programs were not implemented fleet-wide. Incomplete information made subsequent modification programs and upgrades difficult.

Figure 19. A-10 Fuselage and Wing Production[10]

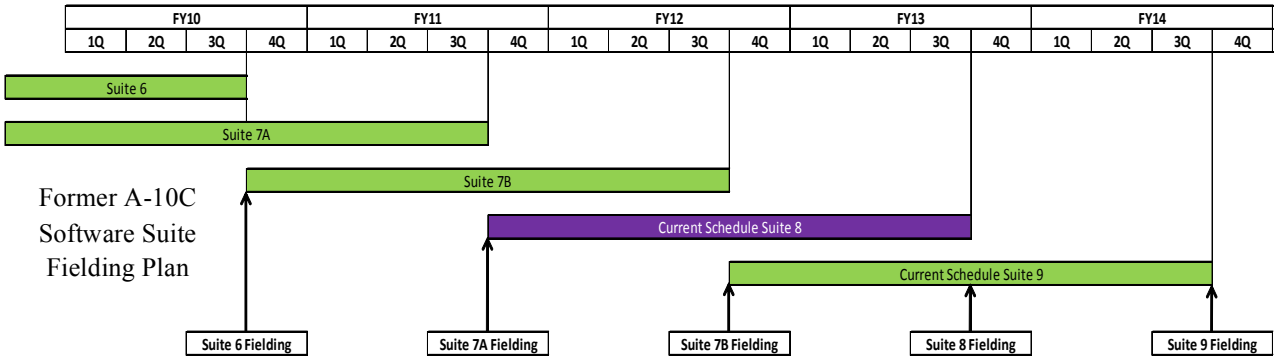
Lockheed Martin Contributions

Lockheed Martin Systems Integration won the second single award ID/IQ contract in 1997. Lockheed Martin continued to perform A-10 maintenance and upgrades, in large part by using annual fallout funds, which enabled the firm to negotiate task orders within a limited timeframe. For this contract, Lockheed Martin also served as the systems integrator or lead integrator,

ensuring that updates developed by other companies would function together when installed on the A-10. Lockheed Martin's core competency was in electronics and avionics. The company had a history of systems integration, well-developed program and technical management, and its estimation of costs was competitive. Lockheed Martin had the capability to replace the insides of planes with new missions systems and cockpits.[11]

As the single award ID/IQ contractor with a contract life of up to 10 years, Lockheed Martin invested heavily in the first-ever A-10 Systems Integration Lab (SIL), which became operational in 2004. The SIL was equipped with weapons hardware in order to imitate the aircraft on the flight line.

The single award team was able to deliver integrated platforms ever more quickly and cheaply, shortening the required upgrade schedule and delivering upgrades on, or below, budget. In 2007, Lockheed Martin and the U.S. Air Force won a Top 5 Department of Defense Program Award for excellence in systems engineering and program management.[12] The single award contractor was knowledgeable enough to leverage the power of the SIL, and its resources, to release software upgrades annually, as opposed to every two years, as had been the custom in the past. In 2009 the first annual software upgrades, or suites, were delivered on schedule. Furthermore, the suites began to arrive one quarter early, giving users and engineers additional time to troubleshoot issues that arose during integration. Lockheed Martin also developed user manuals for pilots, increasing the rate at which pilots learned how to use the new software.



Software Delivery: A-10C Software Suite Fielding Plan[13]

The A-10 program evolved into an extremely well-managed and well-regarded program. Dark Blue and Purple Contractor Performance Assessment Reporting (CPAR) scores, which denote strong performance in private contracting, indicated that the management, engineering, product performance and responsiveness provided by the A-10's primary contractor met the SPO's expectations. In 2007, Lockheed Martin's competency in software upgrades and integration earned the company excellent CPAR scores. Two of their highest scoring categories were Schedule and Cost Control; which can only be achieved through "a singular benefit with great magnitude" or "multiple significant events that earn a high score." Both show the capability of the organization to keep cost within budget, while maintaining high scores in the majority of categories. The Air Force highlighted the collaboration between the Lockheed Martin Prime Team, the procurement office, and operations and maintenance on Precision Engagement (PE) upgrades as one of its most successful programs. [14]

In addition, work orders for service were completed quickly and efficiently. Individual task orders could be negotiated within a matter of days, owing primarily to the structure of the single-award contract, which did not require competition, reducing administrative costs.

Systems Integration

Modeling and simulation are key tools for the development of advanced aerospace and defense vehicles. Simulation tools and techniques allow companies to design their products more quickly and cheaply. Simulation fosters advances in operational awareness, safety, and performance. As mentioned, Lockheed Martin invested more than $60 million into an A-10 Systems Integration Lab (SIL), which opened in February of 2004 to support A-10 modernization and sustainment. According to the contractor, the SIL:

> "…duplicates the aircraft's wiring and cabling infrastructure and is outfitted with actual weapons hardware, missile seekers, suspension racks and rocket launchers to emulate an A-10 aircraft on the flight line."[15]

Lockheed Martin's A-10 SIL allowed engineers to test designs and upgrades to ensure compatibility, enabling quicker and more cost effective integration. The SIL was critical for troubleshooting, software design, and training newly-updated avionics equipment to facilitate smooth upgrades.[16] Pilots had the ability to test new software against structural modifications and were able to evaluate usability and compatibility across systems on the A-10 prior to the

software's final installation.[17] Software that did not function smoothly could be identified and modified, reducing the time it took to install and test updates. Lockheed Martin was able to deliver annual avionics modernization and sustainment updates, quickly returning A-10s to service.

As discussed previously, much of the original aircraft data, including systems configuration and flight data, had been lost prior to the signing of Lockheed Martin as prime contractor. In fact, a key element of Lockheed Martin's contract was data recapture: the company spent years recapturing data and recreating drawings.[18] This recaptured data made the systems integration process more efficient. Lockheed Martin remained the systems integrator until 2007, and performed yearly updates to ensure full systems integration and training for users.

Lockheed Martin pursued incremental upgrades while ensuring that modernization upgrades and sustainment programs developed by subcontractors were synced effectively across systems. The company partnered with Southwest Research Institute to work on the A-10's structure; and in 2004, the Air Force requested that Northrop Grumman be included as an active member of the team because of its advanced knowledge of the platform.[19] In addition to ensuring effective collaboration between contractors, Lockheed maintained regular contact with the user, meeting with Air Force officials every 6 weeks.

III. Current Strategy: Multiple Award ID/IQ Sustainment

Between 2006 and 2007, Congress became concerned that single source ID/IQ contracts were not providing adequate competition. This became particularly evident with the Logistics Civil Augmentation Program (LOGCAP) single award ID/IQ contract in Iraq. The lack of competition on the high dollar value task orders, made many in Congress uncomfortable. As a result, Congress limited the ceiling for single source ID/IQ contracts to a maximum of $100 million by amending section 843 of the FY 2008 National Defense Authorization Act (NDAA).[20] The NDAA provided exemptions under certain conditions: [21]

- Only one responsible source
- Unusual and compelling urgency
- Industrial mobilization, engineering, developmental, research capability, or expert services
- International agreement
- Authorized or required by statute
- National security
- Public interest

--Other Than Full & Open Competition Slide. Adapted from 10 U.S.C. 2304(c). Enhancing Competition Awareness in DoD. Training Presentation.

The A-10 projected contract expenditures for upgrades and maintenance exceeded the $100 million ceiling. However, the Air Force could have pursued an exemption by arguing that Lockheed investments in research, development, and engineering, especially with regard to the A-10 Systems Integration Lab, qualified under "Industrial mobilization, engineering, developmental, research capability, or expert services."

However, the Air Force shifted its A-10 sustainment program to a multiple award ID/IQ contract structure, in compliance with the new law. The new contract was referred to as the Thunderbolt Lifecycle Program Support (TLPS).[22] Under the new contract structure, the Air Force assumed the role of lead integrator, bearing responsibility for integration, modernization, and sustainment work orders.[23] The Air Force provided two and one half Full Time Equivalent (FTE) staff roles

to support its integration responsibilities. The new TLPS contract included a $1.5 billion ceiling over five years, with five additional one-year options.[24]

Under a multiple award ID/IQ contract structure, several companies pre-qualify for limited competition on future task orders. Under the new TLPS contract, the Air Force issues task orders on an "as-needed" basis, and the contractors then bid on the issued task orders, creating a competitive environment between the contractors. Additionally, each company competes on at least 90% of new task orders, per the terms of the new contract.[25]

The contract assumed that three contractors, Northrop Grumman, Lockheed Martin, and Boeing, would collaborate in systems engineering and design, to deliver programs that complemented each other and improved the A-10. Over time, however, it became evident that the three firms were reluctant to share engineering and design data for fear that their competitors would be able to use that information to win the next TLPS task order.

Multiple Award ID/IQ Contracts—Outcomes

Background

The TLPS program had a ceiling of $1.5 billion; however, only a small fraction of this amount has been spent.[26] Based on the lead time required, fallout funds are no longer a practical source of funding; rather, A-10 funding now must be programmed through the Planning, Programming, and Budgeting System (PPBS) process. Although this places the A-10 platform on equal footing with other platform sustainment programs (it also places the A-10 in direct competition with them), much more lead time is required to compete, negotiate, and perform the required sustainment activities As a result, very few task orders have been initiated under the TLPS program

The low expenditure rate should not be perceived as "cost savings" in that much of the work on A-10s is now being delivered through alternative contract vehicles, which do not carry the same competition requirements. Although there is some speculation that spending on the A-10 platform has trended downwards because of the economic recession, rather than political choices and contract structure, a difficult budget environment does not account for the fact that A-10 program spending is well below its targeted and approved budget ceiling, or why the A-10 program is losing funds because it fails to obligate them by the end of the year.[27] Nor does the budget environment explain the many task orders that are completed outside of the intended

contract structure. These factors are better explained by failures in project management and features of the contract structure.

Many task orders are now executed by small businesses. This fragmentation of platform work results in even longer lead-times to integrate updates and still lower levels of collaboration, increasing risk and creating a larger integration burden for the Air Force. Finally, as more task orders are initiated and delivered outside of the TLPS contract, incentives for the three TLPS awardees to maintain expertise on the A-10 continue to erode.

Performance

As a result of fragmented task order competition and delivery, A-10 upgrades are being delivered less frequently, while administrative costs are rising, project delays for modifications and upgrades are increasing, and communications between users and developers is fading. [28]

Program losses can be attributed, in part, to the following factors:

- ***Decreased Collaboration***

  Three contractors are, in theory, responsible for developing sustainment upgrades for the A-10. In the past, contractors had significant input into modification design for the A-10. They would draw upon their expertise in fields such as avionics and structural engineering to collaborate with the Air Force to create task orders that would meet specifications for design, usability, service life, budget, and delivery. Now, the Air Force has assumed full responsibility for establishing specifications. As a result, each contractor now conducts research and development separately, using their expertise for competitive advantage in order to win task orders. The exchanges and cross-cutting insights generated between the three engineering giants dedicated to improving the A-10 have been lost.

  Under previous contract structures, the single award contractor was responsible for integration, ensuring that upgrades worked together. Under the current contract structure, the Air Force has assumed the role of integrator. Integration is not a core capability of the Air Force and updates are no longer designed collaboratively, therefore, utility across updates has been reduced.

  The competitors now update their A-10 technical baselines separately. When they develop solutions based off of these diverging baselines, upgrades require an additional

round of integration to ensure that all systems work effectively. This added round of integration contributes to further delays.

- ***Lost Knowledge***

  Knowledge management among the three contractors is suffering. Private companies use financial projections in order to make decisions about staffing and investment. Under previous contracts, with steadier and more predictable funding, A-10 teams felt justified in making investments in staff training and systems integration research because they could expect a return on investment.

  Under the current contract, with few task orders being delivered consistently to the three multiple award ID/IQ competitors, engineering and project management staff who had been dedicated to the A-10 have been moved to other projects.[29] Those professionals are not being replaced. This is likely to happen in any private organization as Air Force management and competition structures shifts, because employees must continue earning revenue for the company. Therefore, the A-10 program is facing a significant loss of knowledge capital regarding its structural engineering and avionics systems, much as it did during the Northrop acquisition of Fairchild Republic.

  As a result of this loss of knowledge, the ability of reduced numbers of engineers and managers to make significant improvements to the A-10 platform to carry it through its planned 2028 lifespan has been significantly diminished.

  Decisions to modify contract structures, including delays and cuts in funding, can cause unintended reactions from contractors. Under proposed Air Force budget cuts, the A-10 modernization will be reduced. This means engineers, pilots, and other A-10 experts may lose their jobs or be transferred to different platforms. Those who know the project best will have to be transferred to new projects and the time and money spent on this platform may be lost.[30]

- ***Reduced Investments***

  Lockheed Martin Systems Integration- Owego was the Lockheed facility dedicated to maintaining an optimized A-10 platform. Lockheed funded, managed, and built the facility in order to better manage its performance as the lead integrator. The SIL was

critical for testing and troubleshooting newly updated avionics equipment to facilitate a smooth upgrade.

Past research conducted by the University of Maryland's Center for Public Policy and Private Enterprise demonstrates the investment incentive that long-term, high-value contracts have on companies to develop intellectual property in support of government-owned platforms.[31] Lockheed Martin's incentive to continue to maintain its SIL has been significantly reduced, and it is unclear whether other competitors are capable of investing at a similar level. The commitment needed would include producing a facility that could provide the same realistic flight simulation and the ability for A-10 experts to design and test modifications.

When valuable information is lost, costs increase. For example, HOG UP, the repair and wing replacement program for the A-10 that grew out of research conducted by Northrop Grumman, cost $600 million instead of its budgeted $140 million. The program was designed to extend the lifespan of the A-10, but its goals of replacing cracked and damaged wings across the A-10 fleet were "un-validated" because the "actual structural condition of the fleet remained unknown" after various A-10 changes in management and sustainment led to losses in modification records and system data.[32] The costs of making irregular, inconsistent upgrades increased sustainment and modernization costs across the fleet.[33]

IV. Contract Analysis

Both of the contracting strategies covered in this case study have inherent strengths and weaknesses in achieving the competitive, collaborative, holistic, and structural and electronic excellence necessary to maintain a major weapon system. We discuss the following benefits and challenges of each strategy to inform decision-making in order to optimize future collaborative platform sustainment programs.

Single Award ID/IQ Contracts

A single award ID/IQ contract is issued to one provider following a competition among several firms with similar capabilities. The contract often takes the form of a long-term arrangement in which one source completes the majority of covered work orders

Advantages

Systems integration drives coordination and knowledge management for faster installation.

The single award contract provides benefits to the user, the developers, and the Air Force. A single provider can enable a high level of systems integration because it is in a position to coordinate activities among managers, developers, and users. A single provider organization implements more rapid systems integration by sharing knowledge across the team with fewer inhibitions. As a result, the provider develops expertise on the technology and system in question.

Furthermore, the government or the provider can contract additional firms to perform work on the platform, allowing competition and collaboration to co-exist.

A single award contractor is incentivized to invest in improved performance.

When appropriate incentives are included in the contract, the systems integrator is incentivized to invest in performance and quality on a platform because the extension of its contract depends on the program's success and progress. As has happened in the past, investments made by the systems integrator have resulted in increased research and development, making platforms mission ready, while remaining cost-effective. With one contractor, the focus and care for a project can increase.

Updates to the platform are made holistically.

Modifications and upgrades are holistic, because systematic testing and user feedback ensure that new components have been engineered to work together. A single contractor understands all of the requirements before a project starts.

For example, aircraft are modified in a fly-and-fix environment: in other words, updates are regularly tested by users and debugged by engineers and program staff in an ongoing process. This level of care can be applied across platforms. This quick, but effective, method ensures that the system is mission-ready. One company becomes adept at administering a certain type of contract in concert with the systems engineering needs of the aircraft.[34] A systems integrator understands each component of the program and is able to leverage its expertise to produce upgrades on time and under budget.

Responsibility is centralized.

In the case of the A-10, the contractor for the single award ID/IQ contract was also the systems integrator. The responsibility for the success of the modernization initiatives resided with a single contractor. The centralization of responsibility requires that the contractor be highly transparent and accountable to all managers, developers and users, while still being responsible for making sure all modifications and upgrades are integrated smoothly. If something were to go wrong during the integration process, there is a clear line of responsibility, so that individuals can be held accountable.

Direct communication facilitates quality.

A singular contract creates continuity and streamlines communication. The communication gap between users and developers shrinks because of incentives to deliver quality of projects and investments. Companies with long-term managerial control are able to manage communication with users through regular interaction, and relationship building. Through private investments like the SIL, users are able to test technology and upgrades and give direct feedback to developers. This direct communication ensures that upgrades are made towards the needs of users and ultimately contributes to mission readiness.

Longer term contracts can increase contractor investment.

Longer term contracts can incentivize contractors to invest their funds in needed infrastructure,

with an expectation of earning a return on their investment. Private firms generally have more discretion over funds needed to make long term investments than does the Air Force.

Administrative Cost Control

With a single award, the team assembles and submits a proposal for work that includes costs, quality, and plans. This contract is negotiated and finalized and the work is carried out over a set amount of time. The program office and the contractor are both able to save on administrative costs during the proposal period, since the individual task orders are not competed.

Drawbacks

Low Cost Transparency

A single award guarantees that all of the task orders (under the ID/IQ contract) will be fulfilled by a single source. When a single contractor provides the services, extra costs can be eliminated. However, a single source is not under competitive pressure to compete in the short-term. This can result in lower cost transparency. Some worry that with only one contractor, the Air Force does not achieve accurate price visibility, or receive the best value for its customer, the American people. However, cost visibility can be increased through contract mechanisms that enable the Air Force to examine items billed by the contractor.

Competition may not drive innovation

The structure of a single award ID/IQ contract has the potential to limit competition. However, a properly structured contract can drive investments, research and development, and effective systems integration, even in the absence of recurring competition.. For example, an incentive to perform well in order to earn rewards written into a contract may encourage a company to design new improvements to a system or reduce program costs, thereby achieving innovation through an alternative route. On the other hand, if a contract's incentive is too low or is not properly structured, it is not likely to eliminate inefficiencies in a program or platform, even in a competitive environment

Trust between parties may be lacking.

Interviews with contractors indicated a declining trend in trust between government buyers and private contractors. There is skepticism that contractors may not be keeping prices low throughout projects. This skepticism can also be felt during the initial proposal period, as evidenced by government buyers now writing task orders without consulting the contractors who

also have expertise in platforms.

Intellectual property and expertise may be subject to increased risk.

When one company develops expertise as a single award contractor, it naturally advances further in its understanding of a particular platform and its associated design and technology issues than another company, or, at times, even the government. As a result, that company may be more likely to retain a contract when it is recompeted; otherwise, the platform may experience losses in knowledge and expertise when the contract changes hands. Expertise is vulnerable to the changing demands and incentives of a private company, just as it is to the changing directives of the government.

One company may not meet all the needs of the platform.

When only one company maintains a platform, the owner faces the risk that the company may not fully "see" certain problems or issue areas. For example, a structural engineering firm may not upgrade a plane's avionics efficiently, while a software company may miss issues with the wings. Instead of seeing a platform as a whole, a team might be "putting avionics upgrades on planes [even though]the wings are about to fall off."[35] These gaps in vision can be mitigated through careful contract design, and the incorporation of several sub-contractors assisting the single award contractor.

Multiple Award ID/IQ Contracts

Multiple award ID/IQ contract structures pre-qualify several contractors to bid on task orders. Each task order goes through a competitive process, during which the contractors bid estimates of time, cost, and technology needed to complete the task.

Advantages

Achieve competition on every task order.

Multiple award ID/IQ contracts can include stipulations that all contractors must bid for a minimum percentage of task orders issued under the contract . This can ensure cost visibility by providing multiple estimates of costs for parts and labor on each task order..

Multiple organizations maintain expertise on a system platform.

Platforms evolve over time. When contractors actively maintain a platform, they accumulate expertise in that platform. Utilizing multiple contractors can ensure that multiple organizations maintain a minimum level of expertise on a platform's systems. To a degree, shared expertise can mitigate the negative effects that can occur during a major shift in service provider. In theory, sharing expertise on a platform with several organizations can protect a platform, ensure more holistic upgrades and sustainment across the platform, and can ensure more fair and equitable future competition. In practice, however, platforms require a strong systems integrator in order to ensure that all of its parts and systems receive upgrades. Without systems integration or steady task orders, multiple organizations will not maintain high levels of expertise, or deliver comprehensive system updates.

Drawbacks

The Air Force accumulates added responsibility to integrate work across contractors.

Multiple award contracts require careful coordination and close monitoring by a Systems Integrator, perhaps even more careful coordination than do the single award contracts. This is because numerous contractors are involved in a project and no specific contractor is held responsible for the cohesion of technology and structural upgrades on the end product.

With a single award ID/IQ contract structure, Lockheed Martin took on a lead integrator role for ensuring that upgrades made by contractors worked effectively when installed on the A-10. Under a multiple award structure, the Air Force must now ensure that upgrades developed by different contractors are integrated. This requires technical expertise and proactive and involved administration, which has proven difficult for an Air Force team with a limited program budget. Depending on its ability to perform systems integration, the arrangement can create higher costs for the user as well as reduced readiness through delays and longer lead-times on installation.

Information-sharing becomes more difficult, resulting in a lack of collaboration.

Under a multiple award structure, the "government takes on responsibility of generating statements of work, administrative piece of putting together requirements." In this case, the Air

Force took on more project management, engineering, and systems design responsibility than under previous arrangements.[36] The Air Force, at first, allowed contractors to review requirements, utilizing their input in the design of program specifications. Later, the Air Force reversed this decision in order to pursue clearer "competition" on bids and began writing requirements without input from industry.[37] When the Air Force writes requirements without contractor consultation, it must shoulder the burden of providing expertise in engineering and avionics to achieve the same holistic effects that inputs from various organizations, each with a different core competency, would provide.

Multiple award ID/IQ contracts reduce the incentive to collaborate.

In a multiple award ID/IQ contract, contractors have reported experiencing a dramatically reduced incentive to cooperate. Although the contract authors envisioned partnership among multiple collaborators in order to maintain the A-10, in practice, contractors have reported that they do not actively collaborate.[38] Major weapon system contractors hold specialized knowledge as a key to competitive advantage: therefore, they believe that sharing information would diminish their chances of winning the next task order under a contract.

Shrinking profits lead to reduced investment.

Under the A-10's single award ID/IQ contract and prior to the 2009 recession, the contractor could plan on a reasonably steady flow of work and revenue for the A-10 in a given calendar year through the use of fallout funds. As a result, the contractor could make private investments that would improve performance, such as the SIL. It could also afford to train and equip staff to maintain expertise on the A-10 platform. However, under the current multiple award ID/IQ contract, which has been unable to fully discharge its budget in any given calendar year, each contractor earns and expects less annual profit, which reduces the amount that each contractor is willing to invest in maintaining its A-10 expertise.

Administrative cost control can be more difficult to achieve.

With a single award, the team assembles and submits a proposal for work that includes costs, quality, and plans. This contract is negotiated and finalized and the work is carried out over a set amount of time. The company and the contractor are both able to save on administrative costs during the proposal period as well as afterwards by not having to re-compete on each of the task

orders. Additionally, the government team does not have to evaluate several proposals for each task order.

V. Recommendations

There are benefits and disadvantages to choosing either a single or multiple award ID/IQ contract. In the case of the A-10, a close-knit team of developers and users greatly benefitted the program. Without teamwork and political support, A-10 upgrades have occurred less frequently and have been less integrated.

However, each weapons platform has different needs and those needs can be met through different types of contracting strategies and structures. The analysis of the A-10 program provides one example of how contract structure can impact various program elements, including cost, collaboration, innovation, and readiness. The following recommendations take into account the basic fact that no two programs are the same. Accordingly, they have a broad application to many weapons systems and platforms.

Think carefully about competition.

Each program requires a different set of skills, and an appreciation for understanding the needs of the platform. It is important to understand what aspects of competition will best support the program. Competition is a vital part of the development, modernization, and sustainment of platforms, but multiple contractor bids on task orders are not the only way to create competition or collaboration.

Appropriate incentives linked to a program can achieve some of the desired results achieved through competition. Including appropriate incentives within a contract structure can mitigate some of the negative outcomes of a single award or multiple award ID/IQ contract structure. By knowing what is important to the contractor, program officers can create greater systems reliability through incentives. These could include financial motivations, or term awards that extend the life of a contract. In the case of the A-10, the potential duration of the initial single award contract (ten years) facilitated a high level of trust between the contractor and the Air Force. Costs were kept low and upgrades and maintenance were performed on (and often ahead of) schedule. Management, engineering, product performance, and responsiveness are all areas where the single award ID/IQ contract excelled. It is vital that a contract meet knowledge management and investment needs of the platform.

Ensure necessary systems integration exists.

Weapons platforms make use of a systems integrator in order to ensure that multiple parallel technological innovations function together when installed, which is critical to mission performance. In order for system upgrades to function, the integrator must be able to effectively coordinate multiple upgrades across various contractors. If the government cannot perform this task, it is more beneficial to the platform to have a contractor perform the integration function, to enhance performance, maintain mission-readiness, and keep costs low and manageable.

The Air Force is now responsible for the integration of A-10 modernization initiatives. However, it does not appear that the Air Force has the necessary funding to support the additional functions that this role requires, considering that only 2 FTEs have been assigned to the program office to perform this task. According to various professionals knowledgeable about A-10 sustainment, having the contractor perform this function was more successful. The systems integrator needs to have the ability to efficiently integrate all parts of the platform from beginning to end. This fluid integration does not appear to be occurring under the current contract arrangement.

Prioritize program continuity

Continuity is vital to the life of platforms. With each transfer of management and intellectual property ownership, knowledge management and expertise can be lost. When shifts in continuity occur, the new management team must spend time, money, and other resources learning to effectively maintain the platform or risk the loss of capabilities.

Each time there was a shift in contract strategy, the A-10 platform was negatively affected. Early on, the platform experienced a loss in technical data and records regarding wing upgrades, leading to increased costs and complications during subsequent structural upgrades. Each loss reduced the functionality and cost-effectiveness of the A-10 platform.

Develop a climate for communication and collaboration.

Any program that prioritizes communication and collaboration will become more successful at integrating modifications. Again, private companies face dilemmas that public organizations do not . The use of proper incentives can enhance communication and collaboration. Communication and trust between parties is essential to fostering the collaboration that will ultimately lead to the successful implementation of advances in technology.

Conclusion

Weapon systems have long lifespans. The A-10 platform was designed and built in the 1970s and has been in operation through 2014. These platforms extend beyond the careers of program officers, engineers, developers, users, and administrations. Although current program officers must administer government programs with an eye on the prevailing budget and political climate, they must take extreme care in effectively maintaining knowledge, technical baseline data, and the managerial history of their platforms. The A-10 has suffered flosses in each of these areas.

Successful contract terms can prolong the lifespan of a platform and rejuvenate an ailing one. The A-10 has, at times, benefitted from contract structures that have fostered collaboration and knowledge sharing, which have enabled the affordable sustainment of a key platform.

Both the government and private contractors have a sustained interest in maintaining world-class systems, in developing new technologies, and in sustaining maximum effectiveness of their systems. Successful partnerships will build upon these mutual interests to achieve sustained excellence in technology development and sustainment.

List of Acronyms

A-10	A-10 Thunderbolt II is a jet aircraft. It was designed for the U.S. Air Force by Fairchild Republic in the 1970s, and has maintained operational capacity through the time of writing in 2014.
CAS	Close air support
CPAR	Contractor Performance Assessment Reporting
DOD	Department of Defense
FTE	Full-time employee
ID/IQ	Indefinite Delivery/Indefinite Quantity
LOGCAP	Logistics Civil Augmentation Program
NDAA	National Defense Authorization Act
PE	Precision Engagement
PPBS	Planning, Programming, and Budgeting System
SPO	Systems Program Office
SIL	Systems Integration Lab
STBT	Simulator Training Block Time
TLPS	Thunderbolt Lifecycle Program Support
USAF	United States Air Force

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References

[1] Campbell, Douglas. The Warthog and the Close Air Support Debate. Naval Institute Press. Copyright 2003. Page 102.
[2] Ibid. Page 13.
[3] Government Accountability Office. Source for Desert Storm Facts: Operation Desert Storm: Evaluation of the Air Campaign. Pre-Desert Storm Missions and Actual Use; Appendix VII. Letter Report, 6/12/97. https://www.fas.org/man/gao/nsiad97134/app_07.htm
[4] Interview. A-10 contractor. July 15, 2013.
[5] Jacques, David R and Strouble, Dennis.
[6] Ibid. Page 54.
[7] Jacques, David R and Strouble, Dennis (Page 56), and The California State Military Museum. "Historic California Posts: McClellan Air Force Base." http://www.militarymuseum.org/McClellanAFB.html
[8] Ibid. Page 56.
[9] Ibid. Page 58.
[10] Ibid. Page 54.
[11] Interview. A-10 contractor. July 15, 2013.
[12] Data provided by Lockheed Martin.
[13] Data provided by Lockheed Martin.

[15] "A-10 Thunderbolt II." Lockheed Martin. http://www.lockheedmartin.com/us/products/a10.html
[16] Emteq. "Systems Integration Labs." http://www.emteq.com/228.php. Last accessed April 16, 2014.
[17] Internal data provided by Lockheed Martin.
[18] Ibid.
[19] Jacques, David R and Strouble, Dennis. Page 56
[20] Enhancing Competition Awareness in DoD. Required training for all in the contracting career field. Recommended training for all involved in the acquisition process to provide a fundamental understanding of competition and resulting benefits. Updated May 5, 2010.
[21] Ibid.
[22] Interview. A-10 contractor. July 15, 2013.
[23] Data provided by Lockheed Martin, and Interview. A-10 contractor. February 26, 2014.
[24] Data provided by Lockheed Martin.
[25] Interview. A-10 contractor. February 26, 2014.
[26] Data provided by Lockheed Martin.
[27] Data provided by Lockheed Martin.
[28] Ibid.
[29] Interview. A-10 contractor. February 26, 2014.
[30] Block, Dustin. "Facing loss of A-10 Thunderbolt II, Selfridge Air National Guard members welcome new commanders." http://www.mlive.com/news/detroit/index.ssf/2012/03/facing_loss_of_thunderbolt_fig.html. March 10, 2012.
[31] O'hatnick, Jacob. H-60 Tip-to-Tail Performance Based Logistics Program Case Study. Center for Public Policy and Private Enterprise. University of Maryland School of Public Policy. Published October 2012. Page 32.
[32] Jacques, David R., Ph.D, LtCol USAF (Ret), and Strouble, Dennis D, Ph.D. A-10 Thunderbolt II (Warthog) Systems Engineering Case Study. Air Force Center for Systems Engineering, Air Force Institute of Technology.
[33] Ibid.
[34] Ibid.
[35] Ibid.
[36] Interview. A-10 contractor. February 26, 2014.
[37] Ibid.
[38] Ibid.

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