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Fire Scout: The Navy, Northrop Grumman, and Acquisition in Adversity: A Case Study

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Fire Scout: The Navy, Northrop Grumman, and Acquisition in Adversity: A Case Study

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Abstract

The Department of Defense is experimenting with how to deliver new capabilities in 2 to 5 years. Program offices recognize that they are dependent upon their contractors for successful delivery. The MQ-8 Fire Scout started in 1999 and achieved initial operational capability of the MQ-8C in 2019, after 20 years and effectively three program restarts. After each restart, the contractor developed, manufactured, and delivered a functional product deployed by the Navy within *5 years* of contract award.

Conventional wisdom says that senior leadership support and customer urgency are critical to fast delivery. This study shows how a program office and prime contractor were able to deliver a new capability despite changes in procurement objectives, evolving technologies, and requirements.

Results Statements

This research developed a case study from publicly available sources. This case study highlights how intangible assets such as prime contractor employee intellectual capital, goodwill, and a sustained corporate interest in strategically positioning for a future market sector are complementary to a program's acquisition strategy and essential to program execution.

Research Limitations/Implications

This research used publicly available data from budget submissions, program-related reporting, contractor annual reports, and contemporaneous press releases. The findings are specific to the Fire Scout program, and suggest that factors previously considered in industrial base arguments are relevant to rapid product delivery.

Disclaimer

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Introduction

The Department of Defense (DoD) buys products and services collectively described as a *capability*. Acquisition *strategies* are business plans developed by program offices and approved by senior leadership, containing a statement of need for the capability, estimated cost and schedule, and the contracting and support plans (General Services Administration, 2019, pt. 7). The rate of change of both technology and adversary capabilities is pushing the DoD and defense contractors to speed capability development and delivery. MDAP capability requirements such as maximum speed, endurance, and payload capacity change over time. Programs proceed in phases from program start through program decision and assessment gates[1] to initial operational capability (IOC).

This research was part of a 2019 Acquisition Research Program grant study. We developed a case study from the 1999 Vertical Take-off and Landing Unmanned Air Vehicle (VTUAV) development through the delivery of the MQ-8 Fire Scout in 2019. The development and delivery occurred within the context of a defense-unique market defined by the contractor and a government stakeholder. Major policy changes enacted during the Fire Scout program include the Weapons System Acquisition Reform Act of 2009 and the 2016 Section 804 Middle Tier of Acquisition[2] and had little effect on Fire Scout.

Contemporaneous news articles and press releases provide the context for Fire Scout development. Programmatic information is from contract award data from FPDS.gov and publicly released Selected Acquisition Reports.

The research examined *contractor acquisitions and teaming on program outcomes.* These affect not only market competition by changing the numbers of buyers and sellers, but also represent long-term contractor strategies faced with substitute goods, regulation, and peripatetic demand[3].

Background

Northrop Grumman History

Northrop Grumman has a long history of aviation innovation. The company designed the first flying wing bomber in the 1940s, produced lightweight fighters such as the F-5 and target drones in the 1960s, and the B-2 stealth bomber in the 1980s. Northrop acquired Vought in 1992 and Grumman Aerospace in 1994, bringing additional product lines such as the F-14 and E-2 into the company and consolidating aerospace market position[4][5].

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[1] Examples include Engineering and Manufacturing Development, Critical Design Review, and Milestone C approval for production and deployment. Most but not all MDAPs have these gates as part of their acquisition strategy.

[2] For example, the 2016 National Defense Authorization Section 804 changes requires capability delivery within 5 years of program start to use these authorities.

[3] Porter (2008) discussed these as market forces.

[4] See https://www.northropgrumman.com/who-we-are/northrop-grumman-heritage/.

[5] For example, Vought was a B-2 subcontractor, with Northrop as the prime contractor. See: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104482/b-2-spirit/

Today's Northrop Grumman corporation resulted from a series of strategic acquisitions by the former Northrop Corporation beginning in 1992, when the company acquired a 49% interest in the Vought Aircraft Company, a designer and builder of commercial and military aerostructures. In 1999, Northrop Grumman acquired Ryan Aeronautical from Allegheny Teledyne for $140 million. Ryan was a small company of about 300 employees, but was one of the national leaders in Unmanned Air Vehicle (UAV) development, designing the U.S. Air Force Global Hawk and the DARPA Unmanned Combat Air Vehicle (Muradian, 1999).

With the Ryan acquisition, Northrop Grumman had product lines and revenue from operational Navy and Air Force drone target and reconnaissance systems, becoming the prime contractor (through Ryan) on the Global Hawk, the Miniature Air Launched Decoy and the Unmanned Combat Air Vehicle, and now had organic capability to design and produce unmanned air systems, and active development and delivery contracts (Kresa, 2001).

Northrop Grumman also acquired advanced electronics and radar expertise and radar contracts with the purchase of Westinghouse Electric Corporation's defense electronic systems group, and information systems expertise by acquiring Logicon, a leading defense information technology company. By 2007, Northrop Grumman had established themselves as a key supplier of UAV and defense electronic systems. Table 1 provides a summary of Northrop acquisitions.

Table 1. Northrop UAV-Related Acquisition Actions. (Northrop.com).

Year	Company	Action	Notes
1992	Vought Aircraft	Acquisition	Aerostructures manufacture
1994	Grumman Aerospace	Acquisition	Aircraft and Apollo Lander expertise, F-14 support
1996	Westinghouse Electric Corporation	Acquisition	Defense Electronic Systems Group, aircraft radar systems
1997	Logicon	Acquisition	Information technology and battle management systems
1998	Inter-National Research Institute	Acquisition	Command and Control, data fusion expertise
1998	California Microwave	Acquisition	Airborne ISR, mission planning
1999	Teledyne Ryan Aeronautical	Acquisition	UAV expertise
2000	Vought Division	Sale	Divest—metal structures production
2001	Aerojet General	Acquisition	Smart Weapons expertise
2007	Scaled Composites	Acquisition	Specialty composites and flight test expertise

These were part of and in response to the larger consolidation of the defense aerospace industry.[6] These acquisitions allowed Northrop Grumman to acquire not only production contracts, but also the tacit knowledge necessary for creating autonomous unmanned air vehicles (UAVs). Northrop Grumman acquired the remainder of Vought Aircraft in August 1994, and sold the metal structures expertise to Carlyle Group,[7] allowing Northrop Grumman to concentrate on composite structures.

[6] In 1999, Northrop Grumman noted the intense competition from this consolidation in its annual report to the Securities and Exchange Commission (SEC; Kresa, 2000).

[7] See https://www.thestreet.com/investing/stocks/northrop-grumman-to-sell-aerostructures-unit-to-carlyle-group-957901.

Merger and Acquisition Literature Overview

There is extensive literature on corporate mergers and acquisitions. Bertoncelj and Kavcic identify three types of corporate relationships, namely ad-hoc teaming, contractual, and ownership, and qualitatively characterize these relationships in terms of relative trust, protection, control, and learning (Bertoncelj & Kavcic, 2011). In any merger, be it two households or two companies, a fundamental issue is what to do with the combined assets. Anand identifies two approaches—redistribution or consolidation (Anand, 2004, p. 387).

Hensel (2016) argued that defense industry consolidations are a response to cost pressures on contractor workforce and facilities. Zullo and Liu (2017) described major contractor responses to budget reductions as expansion-merger, expansion-diversity, consolidation—focus on core or consolidation-specialization. Smaller suppliers, or subprime contractors, tended to develop strategies that exploited unique or proprietary capabilities or advantages (Zullo & Liu, 2017, p. 363). Jackson (2007) adds another strategy, that he calls strategic market positioning, where acquisition decisions are enhance an existing competitive advantage. He argues that this strategy drove the Northrop Grumman decision to buy Ryan Aerospace in 1999 (Jackson, 2007).

Brock (2009) considered the effects of consolidation on contractor economic power, arguing that concentration prevents economic efficiency gains passing to the buyer, suppresses innovation, restricts buyer choice, and protects sellers from market penalties for poor performance. His point is the market acts to limit the power of a single buyer or seller (Brock, 2009, p. 397).

A company has tangible and intangible assets. Tangible assets are physical property owned by a company, and used to produce a product or service. Intangible assets are non-physical assets (such as a patent) that create value for the company. Allen (2010) describes three classes of intangible assets—intellectual capital, intellectual assets, and intellectual property. In her model, intellectual capital represents the employee's inherent knowledge and skill; internal processes, methods, are formulations are intellectual assets; and intellectual properties are those intangible assets with legal protections for right of use (Allen, 2010).

Company annual financial reports reflect intangible assets as goodwill (brand recognition and loyalty) or purchased intangible assets (patents, trademarks, and such). Ievdokymov et al. (2020) showed that intangible asset value[8] is related to company market value and this relation is stronger for larger companies (Ievdokymov et al., 2020, p. 169). Bollen et al. (2005) used surveys to analyze the relationship between intellectual capital and company[9] performance. They followed Bonti and used three elements—human, structural, and relationship capital and showed statistically significant but indirect relationships between each intellectual capital element and aspects of company performance. In particular, they found intellectual property, *but not the supporting intellectual capital* significantly related to company performance (Bollen et al., 2005, p. 1180).

The DoD has a renewed emphasis on intellectual property (IP).[10] Defense acquisition programs are required to have a life cycle IP plan, codified in an new policy requiring intellectual property planning throughout a program life cycle for both for acquisition and sustainment, balancing DoD technology needs with fair intellectual property owner treatment (Lord, 2019).

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[8] The conclusions are specific for Germany, France, and the United Kingdom.

[9] Conclusions are specific to the pharmaceutical industry.

[10] DODI 5010.44 defines IP as "Information, products, or services that are protected by law as intangible property, including data (e.g., technical data and computer software), technical know-how, inventions, creative works of expression, trade names."

A common belief is that vendors use intellectual property to extract economic rents and impose switching costs that cause the government not to compete work, called vendor "lock-in." Berardi and Cameron (2019) considered under what conditions software architectures and intellectual property rights favor vendor lock-in. They found that open software architectures are sufficient to prevent intellectual property or rights-based lock-in (Berardi & Cameron, 2019, pp. 69–72)

The Navy and Unmanned Helicopters

The DoD uses UAVs today for intelligence, surveillance and reconnaissance (ISR) missions and strike operations (USD AT&L, 2012). Unmanned air vehicles in the military were initially used as targets and as weapons and were derived from multiple enabling technologies, including propulsion, navigation, and controls (Erhard, 2000).

The Navy experimented in the 1950s with using shipborne helicopters for airborne anti-submarine warfare, but shifted to remotely piloted systems fielding the first maritime UAV weapons platform, called DASH,[11] in 1962. DASH operated from Navy ships until 1971 and were commonly used for naval gunfire spotting, surveillance, and torpedo or depth charge delivery (Gyrodyne Historical Foundation, 2020). The DASH control system suffered reliability and operability problems; controllability was so bad that few personnel could operate the system (Erhard, 2000, Chapter 7).

In 1998, the Navy posted a solicitation to develop an unmanned vertical takeoff and landing vehicle (VTUAV). A 1998 Navy press release named several teams intending to bid on the solicitation; one was led by Schweizer Aircraft Corporation (Lopez, 1998). At the same time, Northrop Grumman was acquiring Ryan Aerospace, a small 300-person company with more than 20 years' history in the development of unmanned aircraft. Northrop Grumman and Ryan Aerospace decided to submit a joint bid with Schweizer Aircraft on the VTUAV (Norris, 2003). Northrop Grumman and Ryan defined unmanned flight control as the critical development for program success. Northrop Grumman bought a Schweizer helicopter *in advance of contract awards* and worked with Ryan to develop a flight control system demonstrator (Norris, 2003).

The Navy canceled the program in 2002 and restarted the program in July 2003. Northrop restructured their efforts, moving prototype demonstrations to Patuxent River, MD, and redesigning the prototype for a more powerful engine (Norris, 2006). In July 2005, Northrop Grumman conducted flight and live fire testing at Yuma Proving Grounds (Paynter, 2005), and demonstrated autonomous landings on USS *Nashville* (LPD-13) at-sea in January 2006 (Staff Writers, 2006).

Northrop Grumman sought new customers and new roles for the Fire Scout, including the Army, Coast Guard, and foreign governments. The Army included Fire Scout in the Future Combat System, and procured eight systems before canceling the Future Combat System program.[12] Other prospects were interested, but generated no additional sales.

The program office and Northrop Grumman developed a plan to get early production systems to the fleet, which would accelerate identification and correction of design and employment issues. The Navy canceled procurement of five Littoral Combat Ships between 2006–2008 (O'Rourke, 2019), resulting in Fire Scout procurement deferrals (Smith, 2013). The Fire Scout program reached Milestone C in May 2007, allowing low-rate initial production. On December 10, 2008, Fire Scout embarked on USS *McInerney* (FFG-8) and deployed in 2009

[11] Drone Anti-Submarine Helicopter, manufactured by Gyrodyne Company of America.
[12] The Navy converted these systems to fit Navy specifications.

(Northrop Grumman, 2009). During the deployment Fire Scouts were used in intercepting drug smugglers (Evans, 2014).

In 2009, Defense Secretary Gates directed cancellation of the Future Combat System (Robinson, 2009). In 2011, Fire Scouts deployed with Helicopter Anti-Submarine Squadron Light (HSL) 42 Detachment 2 aboard USS *Halyburton* (FFG-40; HSL-42, 2011), and provided forward observation and targeting over Libya (Axe, 2020).

According to the 2012 Selected Acquisition Report (SAR) the inventory objective was 168 production systems by 2032 (Dodge, 2013). However, the same SAR shows a two year gap in procurement after ordering 23 systems, reportedly to align with Littoral Combat Ship (LCS) delays (Dodaro, 2013). The Fire Scout program saw user demand but procurement quantities decline.

Some Key Corporate Actions

Northrop Grumman had some corporate expertise in unmanned systems with their target drone product lines. They did not have extensive vertical flight experience, so they teamed with Schweizer Aircraft on the Vertical Takeoff UAV (VTUAV) solicitation. Northrop's acquisition of Ryan Aeronautics immediately them design and production expertise with the Global Hawk and Unmanned Combat Air Vehicle UAVs, but also experience with vertical takeoff and landing platforms. Combined with prior acquisitions of airborne sensor, command and control, and mission planning companies, Northrop had the experience within the company for adapting a commercial helicopter into a VTUAV system.

Northrop Grumman (Ryan) focused on the historical problem with remotely piloted systems—flight control (Erhard, 2000). They eliminated significant technical challenges by scaling to a proven commercial platform—the Schweizer 330—with known performance characteristics. Schweizer had already modified the helicopter and redesigned the transmission to accommodate a 420-horsepower turboshaft engine, and developed a 4-blade hub, allowing for future growth in lift capacity (Norris, 2006).

The program office supported Northrop Grumman's efforts and helped create new capabilities. The Navy made significant design choices, including adaptable interfaces and payloads, ground systems and datalinks (NAVAIR, 2000), a common launch and recovery system, and a ground control system that could operate from land or ships and feed existing data networks (Smith, 2013). The Fire Scout was re-designated as a multi-mission platform, and in July 2005, a Fire Scout fired rockets during flight testing at Yuma Proving Grounds (Paynter, 2005). The final variant had increased payload and sensor capacity (Soderberg, 2019).

Figure 1 shows the acquisition and teaming relationships Northrop Grumman continued with commercial helicopter manufacturers after acquiring Ryan, enabling an organizational balance of expertise between the platform and the unmanned system.

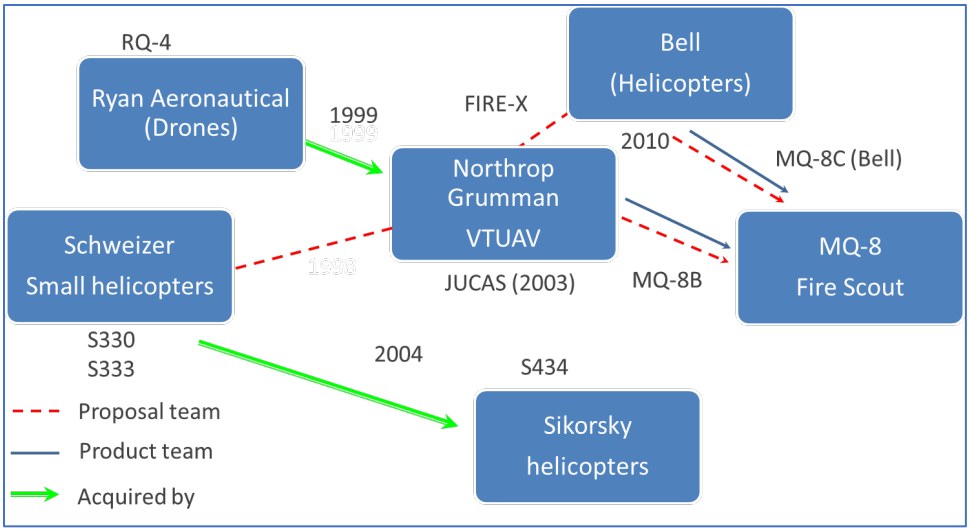

Figure 1. Fire Scout Teaming Arrangements

Findings

Fire Scout Budgets and Procurement Objectives

The Fire Scout budget profiles from 2000 to 2020 show the effects on research and development from program cancellation in 2002 and 2012 procurement cuts.[13] The two procurement budget phases in Figure 2 are related to conversion of Army-configured systems in 2008 and MQ-8C procurements in 2016.

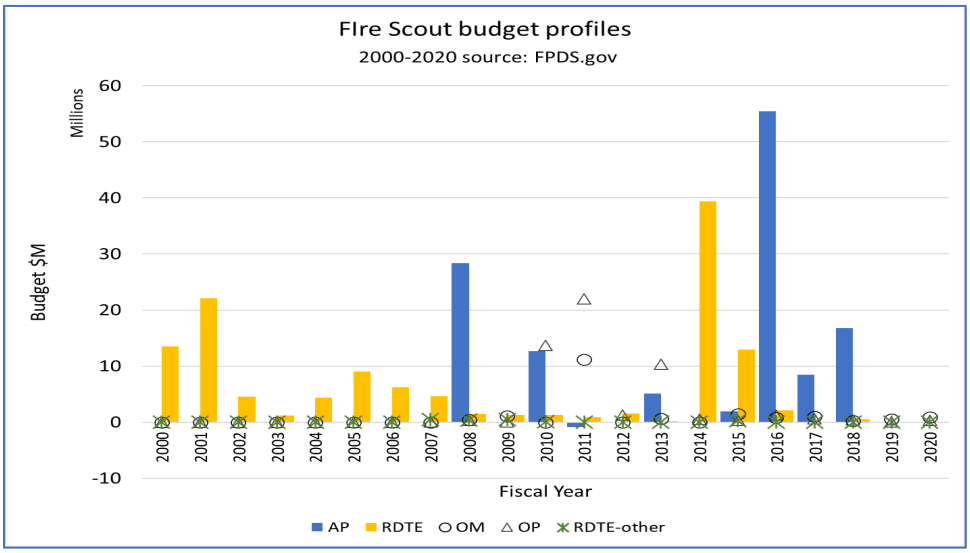

Figure 2. Fire Scout Budget Profiles. (FPDS.gov).

Contract work continued at about this same rate through 2020, in part due to the company continuing to develop new capabilities ahead of demand.[14] Notwithstanding the program office and contractor efforts, the program delivery was limited by funding, the realized

[13] Due to Future Combat Ship program reductions, which was to use the Fire Scout in mission packages.
[14] For example, the ability to launch weapons, the upgraded turboshaft engine system, and the adaptation of a new airframe to create the larger and more capable MQ-8C.

annual production capacity of about six systems per year, and the dependency on other acquisition programs.

Two events affected production quantities. The first was the Army's 2010 decision to cancel MQ-8 procurement plans with the Future Combat System termination. The second was the 2011 restructuring of the Littoral Combat Ship program and resulting delay of Fire Scout production. The reduction of both ship and mission module inventory objectives reduced required buys (Smith, 2013). The loss of Littoral Combat Ship demand contributed to a Nunn–McCurdy Breach (Smith, 2013). By 2019 the Navy inventory objective was reduced to 68 platforms (9 development and 59 production) as shown in Figure 3.

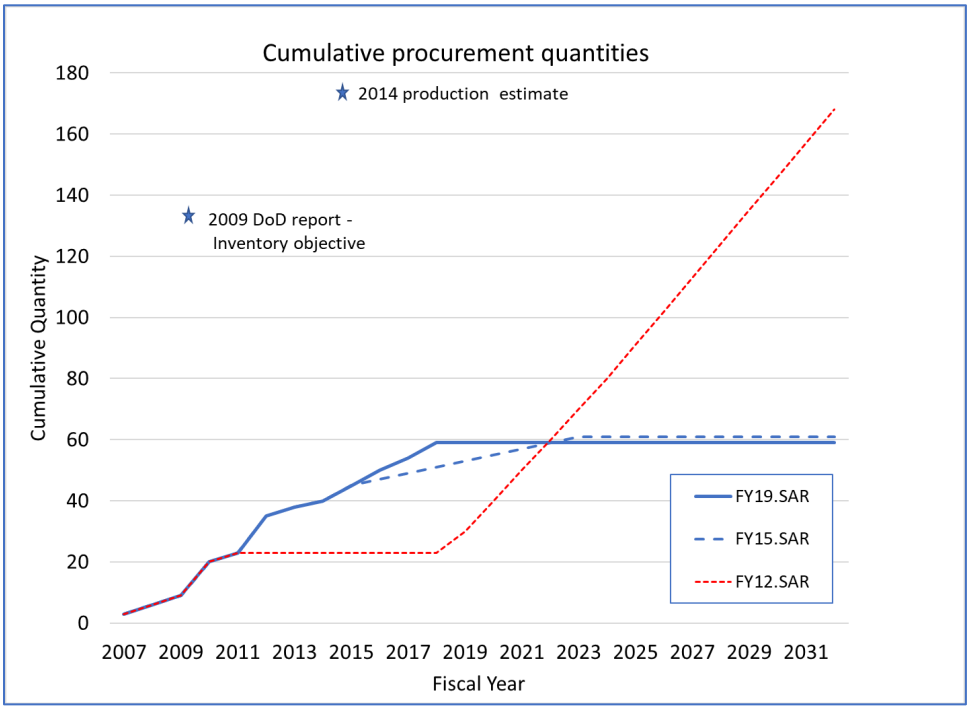

Figure 3. Cumulative Procurement Quantities. (MQ-8 SARs).

The final SAR showed required production quantities dropped from 168 in 2013 to 61 in 2015 (Soderberg, 2019). The red dashed line (2012 SAR data) shows the short-term result of the Future Combat System termination and Littoral Combat Ship procurement delay. The blue lines (2015 and 2019 SAR data) reflect the reduced procurement quantities (blue lines) to 61 plus 9 developmental units (Dodge, 2015) resulting from the decision to truncate Littoral Combat Ship procurements.

Northrop Grumman Impacts

Northrop Grumman is a diversified technology company, with multiple government and commercial customers. Contract award data between 1977 and 2020 shows obligations to Northrop Grumman in 200 different Product and Service Codes (PSCs). The Navy had the most overall contract activity with Northrop Grumman, in part due to Northrop Grumman shipyard ownership.

Figure 4 shows Northrop Grumman government-reported obligations for specific aviation PSCs by service.

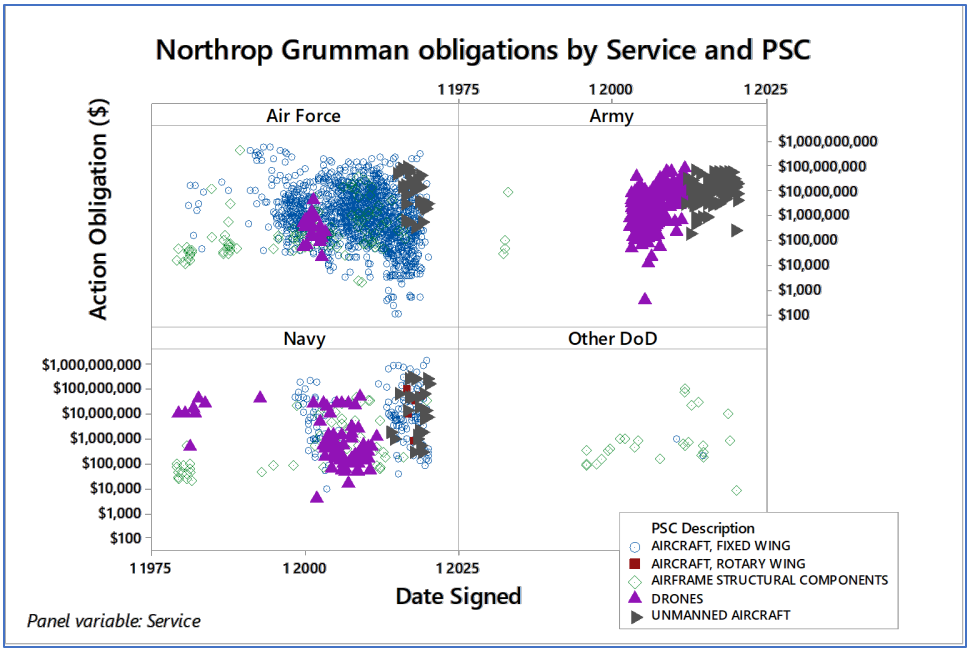

Figure 4. Northrop Grumman Obligations by Date Signed for Aviation PSCs. (FPDS.gov).

The figure highlights Northrop Grumman's base aircraft and airframe work activity, and shows the significant and increasing work in these areas in all services. While Northrop Grumman provided drone and unmanned systems and support to all services, the Navy had a long-term relationship covering multiple platforms, including Fire Scout early and later Triton (a Global Hawk variant). The drone and unmanned aircraft work (purple and grey triangles in Figure 2) became important after 2000.

The results of Northrop Grumman's strategy to establish a market position in unmanned air systems are shown by contract award data. Northrop Grumman earned twice the revenue on Fire Scout related contract work as other performers. The Ryan acquisition cost was recovered in 5 years and was a steady revenue source for the next 15 years as shown in Figure 5.

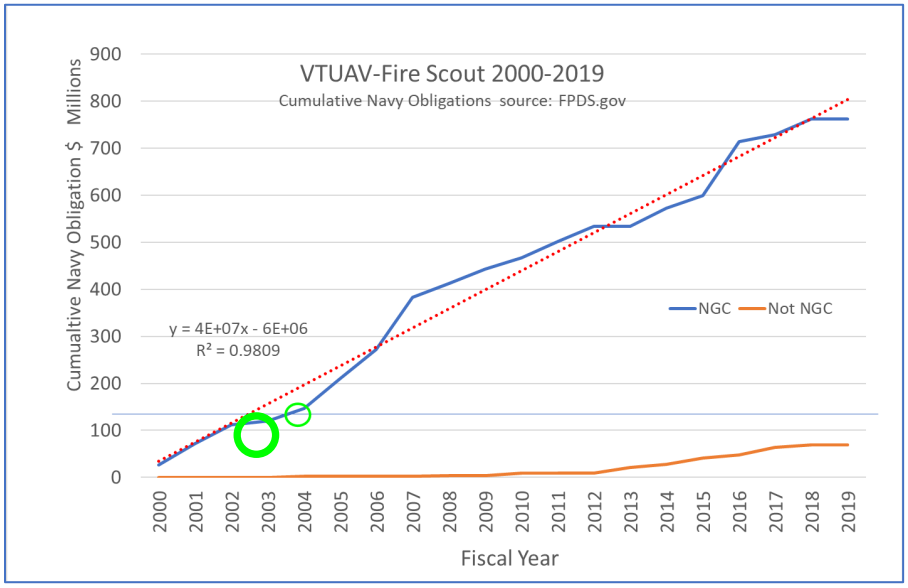

Figure 5. Fire Scout Obligations 2000–2020. (FPDS.gov).

In 1998 Northrop Grumman had one flagship aircraft acquisition program—the E-2 Hawkeye. By 2018, unmanned air systems had become major acquisition programs with annual budgets exceeding $1 billion per year. After years of strategic acquisitions and sustained activity, Northrop Grumman was one of the major unmanned air systems (the Global Hawk/Triton) manufacturers for the Department of Defense as shown in Table 2.

Table 2. Selected Major Weapons System Summary

System	Name	1998 ($M)	2018 ($M)	NOC
AH-64	Longbow Apache (C/D/E/reman)	609.2	1,441.9	Sub
E-2	Hawkeye (C//D)	374.8	1,116.4	*Prime*
F-18	Hornet (E/F) //Super Hornet	3274.6	1,253.1	Sub
B-2	Spirit	307.6	0	*Prime*
E-8	JSTARS	850.3	0	*Prime*
F-35	Joint Strike Fighter//Lightning II	909.1	10,837.9	Sub
V-22	Osprey	985.1	961.8	Sub
F-15	Eagle	274.8	963.1	Sub
F-22	Raptor	2,406.5	915.5	Sub
C-130	Hercules	0	886.1	Sub
P-8	Poseidon	0	1,609.4	Sub
MQ-1	Predator UAS	0	174.4	*
RQ-4	Global Hawk UAS	0	1,282.3	*Prime*
MQ-9	Reaper UAS	0	1,009.8	*
UAV	Smaller UAVs	0	129.7	*

Northrop Grumman was the prime contractor of four systems in Table 2—the E-2, B-2, E-8, and RQ-4. Only acquired programs were receiving production funding in 2018. Northrop Grumman's long-term acquisition strategy helped them remain a significant military aircraft producer.

Discussion

The Department of Defense is experimenting with how to deliver new capabilities in 2 to 5 years. Conventional wisdom says that senior leadership support and customer urgency are critical to fast delivery. This case study shows how contractor decisions and actions satisfying long-term strategic interests of the company affected program office success.

The program started in 1999 as the VTAUV and achieved initial operational capability as the MQ-8C in 2019, after 20 years of change and several programmatic restarts and changes. The Navy and Northrop Grumman were able to sustain program progress despite adversities such as program defunding in 2002, loss of a customer in 2008, and early operational deployments.

Northrop Grumman's long-term strategy to acquire a market presence in unmanned air systems aligned with the program office objectives. Their strategy ensured that the people with the experience and understanding to address the critical technical needs behind emerging government requirements. They anticipated government requirements evolution. Northrop Grumman and the program office kept finding new user bases and made critical adjustments to satisfy operational requirements. They transformed assets built for the Army Future Combat System into Navy assets, and deployed them for operational use. The sustained emphasis on

operational use and future markets created confidence in system capabilities and identified new modifications meeting emerging needs.

The MQ-8 Fire Scout remains an unusual program. Navy program office and contractor tenacity and complementary objectives mattered in final program outcomes. This study shows how a program office and prime contractor were able to mature and deliver a new capability despite changes in procurement objectives, evolving technologies, and requirements. The Program Office benefitted from Northrop's experience and willingness to assume risk. Early field deployment and operational is a high-risk, potentially high-reward strategy. The Navy and Northrop Grumman had to respond when systems failed or were lost in combat (Axe, 2020). This required extraordinary dedication, but resulted in an extraordinary record of development and delivery—in the face of adversity.

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