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Built for Speed: The Army's Integrated Visual Augmentation System (IVAS): A Middle Tier Acquisition Case Study

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Abstract

This case study examines how the Army used Middle Tier Acquisition processes to rapidly accelerate development and fielding of the Integrated Visual Augmentation System (IVAS). After decades of precursor developments, the Army adapted emerging commercial virtual reality goggles for field conditions and use. It uses publicly-released data from 2018 to 2021 consisting of budget submissions, program-related reporting, and contemporaneous press releases to describe how the Army used Middle Tier Acquisition authorities to accelerate IVAS development, testing, and fielding.

Research limitations/implications – This research is specific to the IVAS program. The data used in this analysis was derived from public sources and results and conclusions may differ if restricted sources are used to replicate this work.

Keywords: Middle Tier Acquisition, Other Transaction Agreement, rapid prototyping, and fielding

Introduction

This case study is a product of our research during the last year on schedule risks associated with Modularity, Agility, and Middle Tier Acquisitions[1]. It presents an overview of the Army's Integrated Visual Augmentation System (IVAS) Middle Tier Acquisition project, that went from solicitation to initial fielding in less than five years. This speed was due in part to acquisition strategy decisions, and consistent execution. All information used in this case study is publicly available.

The Integrated Visual Augmentation System (IVAS) is a project allowing soldiers to train, rehearse, and fight with a common architecture and kit. It is composed from existing commercial technologies and fielded training and operational systems and reflects decades of Army interest in training for complex missions, and is in production after a two-year rapid prototype development effort. IVAS combines a heads-up display play and a synthetic training environment capability allowing soldiers to "fight, rehearse and train on the same system"

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Background

Congress enacted Middle Tier Acquisition (MTA) processes in 2016 to enable fielding and prototyping of new capabilities within two to five years of approval. Key statutory changes enabled service acquisition executives to bypass traditional requirements and acquisition processes, and establish direct-reporting program managers for these rapid acquisition programs (NDAA, 2015). Congress also modified other transaction agreement (OTA) statutes in the 2016 NDAA, revising funding approval thresholds, authorities, and applicability criteria[2], making OTAs a viable option for the IVAS program without requiring a cost share or a not-traditional performer, and allowing direct transition to production under specific conditions[3].

Program schedule speed is relative, meaning that it is fast or slow relative to plans or average programs. Programs may be slow relative to plans due to "oversell and resulting performance bias" (GAO, 1992) or overall system immaturity (Kamp, 2019). Weber and Rohracher identified systemic failure causes, such as early lock-in to sub-optimal technology, and adaptation failure (Weber & Rohracher, 2012)). Van Atta et al. identified "fast-to-field" factors including an urgency of need, senior leader sponsorship, and rapid access to available funding (Van Atta et al., 2016). Tate identified strategy decisions associated with shorter schedules such as using proven systems or developing and fielding systems with incremental performance improvements (Tate, 2016). Finally, Jaifer et al. noted that organizational competence affects planning and execution (Jaifer et al., 2020).

The Army has a long history of developing innovative technologies to gain tactical advantage. The Army developed night imaging systems at the end of World War 2, providing a sensing advantage to forces with night vision systems (Tishman & Schoen, 2021). Figure 1 shows example helmet mounted displays.

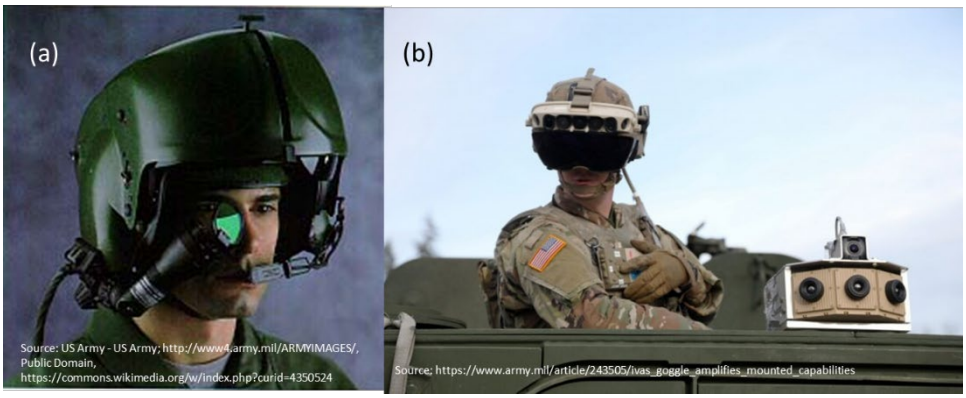

Figure 1. Helmet imaging systems.

Figure 1(a) shows a circa-1980 Cobra attack helicopter helmet mounted display. These systems included head tracking with optics allowing sensing and targeting (Li et al., 2013). The actual display in Figure 1(a) is the small monocular system covering the pilot's right eye. Figure 1(b) is a recent image of a soldier wearing a prototype Integrated Visual Augmentation System

[2] Section 815 approval authorities were modified to allow ''The senior procurement executive for the agency determines in writing that exceptional circumstances justify the use of a transaction that provides for innovative business arrangements or structures that would not be feasible or appropriate under a contract, or would provide an opportunity to expand the defense supply base in a manner that would not be practical or feasible under a contract." (NDAA, 2015).

[3] This is allowed provided competitive procedures were used in the original award and the contractor successfully completed the prototype project (NDAA, 2015)

(IVAS). The IVAS in Figure 1(b) is a ruggedized version of the Microsoft Hololens[4] headset[5] and projects images onto the visor. Figure 2 shows the evolution of night vision systems to IVAS.

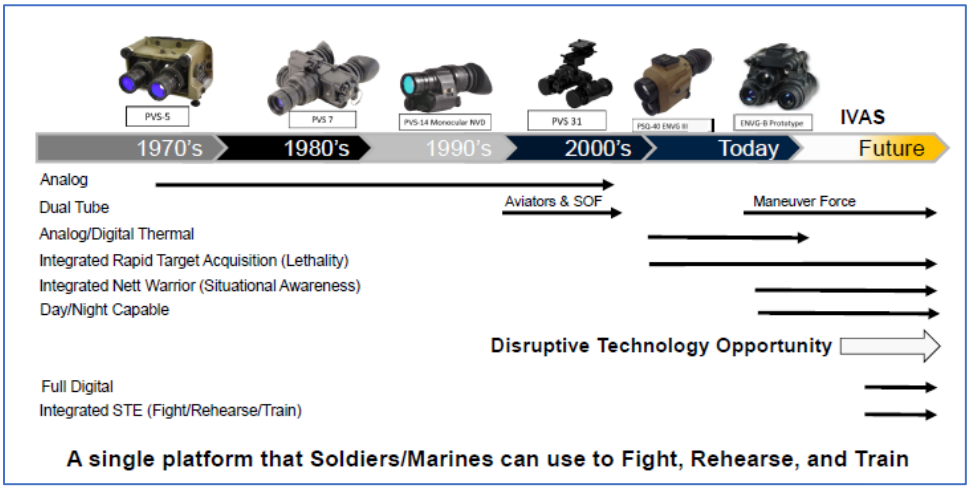

Figure 2. Envisioned IVAS capabilities (Source: 2018 Industry Day).

Early helmet-mounted display systems were designed for specific applications. The military services train to develop proficiency in individual and team skills and practice and rehearse to improve team performance and improve the likelihood of success. Simulations and game-based training are becoming more common for complex or expensive operations. Straus et al. noted that effective training elicits performance-related responses and may or may not require high physical fidelity (Straus et al., 2019). The Army had been experimenting with virtual reality headsets for solider training (Parkin, 2015), so it was a natural extension to consider using IVAS for other applications as noted in Figure 2.

Findings

The Army IVAS acquisition strategy included a number of these choices. In particular, the program focused on rapid testing and iterations over traditional acquisition program systems engineering. On September 25, 2018, the Army Acquisition Executive approved IVAS as a Middle Tier Acquisition rapid prototyping project with four hardware and software sprints and "soldier touchpoints" between sprints (Behler, 2019). Figure 3 shows the initial IVAS program schedule (Yamakawa, 2018).

[4] A detailed description of the commercial product is on the Microsoft website (Microsoft, 2021)
[5] Also known as a goggle.

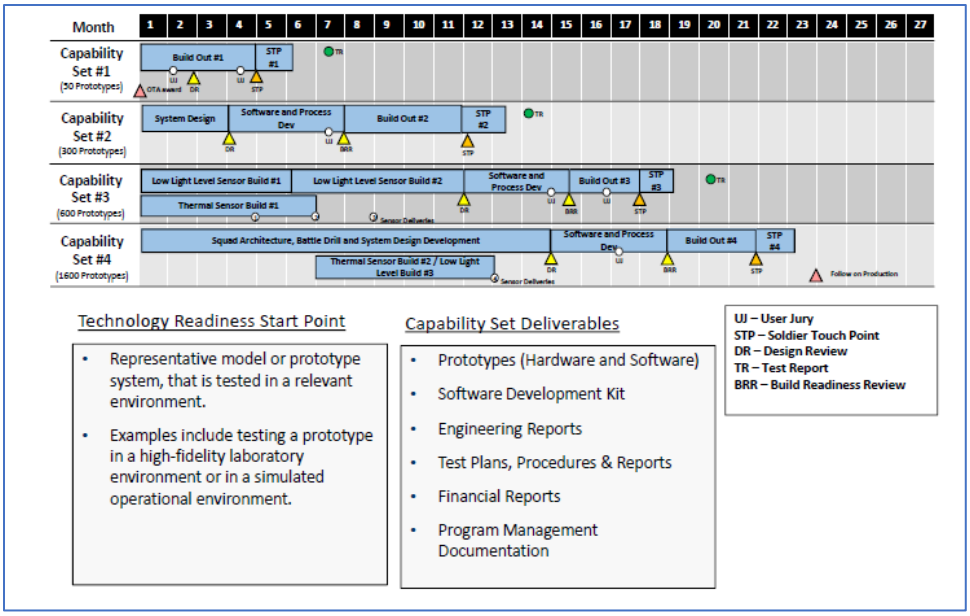

Figure 3. Initial IVAS project schedule (source: 2018 Industry Day).

The rapid schedule and cumulative capability set builds shown in Figure 3 would require performers to restrict development of enabling technologies and focus on system integration [6]. The Statement of Objectives supporting this schedule describes what is expected at each Capability Set, but is silent on explicit quantitative requirements metrics (Keller, 2018), meaning that performance would be assessed during frequent user interactions. Figure 3 also includes summary technology start point assumptions and expected deliverables. This is an efficient method to tell proposers the technology readiness and delivery expectations for a competitive proposal.

The Army decided to use a competitive Other Transaction Agreement (OTA) for the IVAS project (OUSD(A&S), 2018). The solicitation disclosed the Army's intent to award an Other Transaction for Prototype, giving the Army an option for follow-on sole-source production following successful prototype demonstration (Keller, 2018) awarded to Microsoft on 20 November 2018[7]. As a rapid prototyping effort, IVAS deferred formal requirements definition, and used the soldier touchpoints to provide Microsoft feedback to guide development of a functional product (Jasper, 2021). Executing the IVAS strategy would require collaboration between multiple Army programs within various programs as shown in Figure 4.

[6] As an example, the Army Night Vision and Electronic Sensors Directorate was concurrently developing a modular night vision sensor and would provide modules to performers as government furnished equipment (Yamakawa, 2018).

[7] Source was W91CRB1990001 base award (General Services Administration, 2021)

Figure 4. PEO Soldier programs interacting with IVAS.

For IVAS, the Army announced it would award a single Firm-Fixed-Price type OTA with specific milestones (Yamakawa, 2018). Firm Fixed Price agreements and contracts transfer all cost risk to the contractor, and are typically used during mature production[8] (Grady, 2016). When cost uncertainty is higher, cost-type contracts allow the government to manage and assume risk share. Boukendour and Hughes note incentivized contracts were created to offer an alternative between fixed-price and cost-plus contracts (Boukendour & Hughes, 2014), and reward cost, schedule or technical performance with a pre-defined award or incentive schedule. The Army awarded Microsoft an Other Transaction-IDV [9] base award on November 20, 2018. The obligations are summarized in Figure 5.

[8] The intent is to incentivize contractors to maximize profits by reducing costs below the fixed price.
[9] IDV is an "Indefinite Delivery Vehicle." According to fpds.gov, W91CRB1990001 initial obligation was $215,638,968.76.

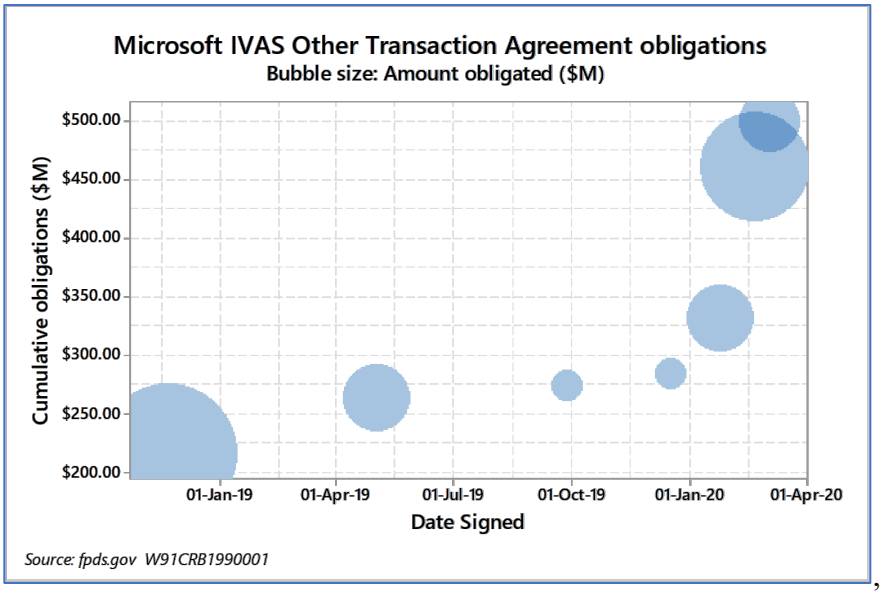

Figure 5. IVAS Other Transaction Agreement obligations by date signed.

The Army used a large initial obligation and a series of following payments to manage progress. Note the initial large obligation, consistent with award, and the subsequent payments, consistent with soldier touch points and capability set deliveries and transition to rapid fielding. Table 1 provides a summary of IVAS funding by product service codes (PSCs).

Table 1. Army funding of Microsoft by Fiscal Year ($K)

PSC Description	2018	2019	2020	2021	Total
INFORMATION TECHNOLOGY COMPONENTS	$10	$0	$0	$0	$10
INFORMATION TECHNOLOGY SOFTWARE	$9,141	$2,566	$24	$0	$11,731
IT AND TELECOM-PROGRAMMING	$0	$60,620	$112,987	$153,255	$326,862
IT AND TELECOM- SYSTEM ACQUISITION SUPPORT	$0	$2,916	$21,474	$4,792	$29,182
IT AND TELECOM-TELECOMMUNICATIONS NETWORK MANAGEMENT	$11,140	$5,131	$3,430	$4,901	$24,601
SUPPORT- MANAGEMENT: OTHER	$114,922	$90,245	$23,707	$0	$228,874
SUPPORT- PROFESSIONAL: ENGINEERING/TECHNICAL	$399	$7,828	$27,559	$15,417	$51,204
Total	$135,612	$169,307	$189,180	$178,366	$672,465

Table 1 shows that most of IVAS program funding supported programming, management, and network functions. This is consistent with an Agile program strategy, where the performer must adjust as users learn what they really want and what really matters[10]. Figure 6 shows obligation data plotted by award date and product service code.

[10] PEO Soldier stated: "When a soldier says 'this sucks,' it may not be technical, but it has great meaning" (Freedburg, 2019).

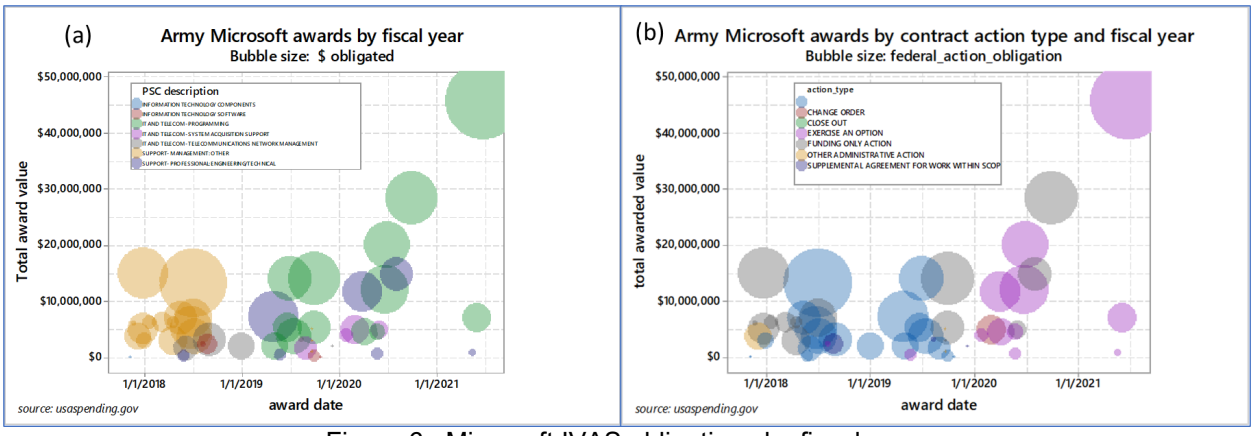

Figure 6. Microsoft IVAS obligations by fiscal year.

Note that Figure 6(a) shows individual award values, and shows the relatively large number of smaller awards. Figure 6(b) provides an alternate view of the same information, but grouped by action type. In this view, the data shows relatively few change orders and several exercised options, implying the contracting strategy anticipated and supported program execution. The obligations shift by product service code over time, showing how spending patterns shifted from early emphasis on management to later spending on programming, consistent with an Agile development effort.

Note that program spending and Microsoft programming effort increased during 2020, when Covid-19 was affecting corporations around the world. According to DOT&E, the Army delayed soldier touchpoint 3 from July to October 2020 (Behler, 2021). Microsoft and the Army were able to maintain the program pace and continue system development and testing after the pandemic delay. Soldier touchpoint 4 was executed in March 2021.

The above figures do not include procurement funding. The IVAS Rapid Fielding Decision was approved December 14, 2020 by the Army Acquisition Executive and on January 19, 2021 by the Under Secretary of Defense, Acquisition and Sustainment. The IVAS follow-on production OTA was awarded March 25, 2021 (ASAFM, 2021). The Army is planning to procure over 44,000 IVAS at a per-system unit cost of over $20,000 in the next two years, with the first lot delivery in October 2021 (ASAFM, 2021).

Discussion

The technology had matured in the commercial market to where proxies for government objectives existed in the market. The Army was able to spend most of its effort ruggedizing the system and developing user-focused applications. Technology vectors affecting IVAS include the development of low-cost high quality thermal and infrared imaging systems and their increasing use in vehicle safety and surveillance (Mounier, 2011). Smart phones saw increasing market demand for messaging, imaging and video systems, and internet access (Meeker, 2018), driving down component costs and raising performance.

Microsoft business strategy aligned with Army objectives. In 2014, Microsoft purchased key intellectual property from the Osterhout Design Group for virtual reality headsets (Lunden, 2014), and announced that its Azure cloud computing platform would embrace open standards (Roberts, 2014). By 2018, Microsoft had sold about 50,000 headsets with an estimate unit price of about $3,500 (Hills-Duty, 2018), so when the Army was starting to develop IVAS, Microsoft and the market had matured key technology elements.

Concurrent with IVAS program development, the Army reorganized, creating an advocate for future readiness, called Army Futures Command, which provided a champion, advocacy with external stakeholders, and in particular a process to rapidly interact with users, specifically the Soldier Lethality Cross Functional Team[11].

IVAS development featured iterative testing with frequent user and key stakeholder involvement. The Program Executive Officer[12] stated: "Our number one factor that we evaluate …is… do soldiers love it?" (Freedburg, 2019). The Army focused development on addressing the first user issues and making IVAS something they would want to use, and using MTA authorities to eliminate programmatic obstacles (Freedburg, 2019). The Army did not have a formal operational test strategy, but brought in the operational testing activities with each soldier touchpoint. The Director, Operational Test and Evaluation was able to observe the first soldier touchpoint occurred less than four months after award and report their findings to Congress (Behler, 2019).

The contracting strategy mattered. The Army could have used a traditional request for proposal or Broad Agency Announcement, followed by a full and open competition. Typical contracting timelines for such efforts are over a year from solicitation to award. Other Transaction Agreements do not use Federal Acquisition Regulation requirements. They do define objectives, deliverables, payments, and risk share. They can be structured in many ways, but are like a fixed price payable milestone contract. The Army was able to obtain permissions and approvals to use an OTA shortly after program start, and structure the program to use both OTA flexibility to develop prototypes, but also use the new authorities to transition to production.

The Army established novel control methods, such as mandating a government-owned architecture, using government furnished equipment to segment technical risk, and aligning payments with measurable progress events such as soldier touchpoints and capability set deliveries. Use of soldier touchpoints had the additional advantage of stimulating contractor innovation, and the frequent interactions resulted in rapid incremental changes meeting user needs.

The Army was able to largely remain on schedule, despite the Covid delay. The result was that most objections were not provided in time to slow program progress. In 2020 Congress enacted a funds limitation on IVAS (P.L. 116-283, 2021). This did not slow the Army. They awarded Microsoft a production contract on 31 March 2021 worth nearly $22 billion including all options (PM IVAS, 2021).

The IVAS program is still in execution, but continues to move at a rapid pace. It is an ambitious and is built for speed. The Army acquisition professionals who imagined, created, executed, and sustained this effort contributed not only to the rapid acquisition body of knowledge, but provided an exciting and innovative example of what can be done to deliver a long-desired capability to soldiers. Hooah![13]

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[11] Cross functional team descriptions are on the Army Futures Command website (Department of the Army, 2021).
[12] The Program Executive Officer Soldier in 2019 was BGEN (Freedburg, 2019).
[13] Army battle cry (Sicard, 2017).

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