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The Modernization Dilemma: A Case Study of Systematic Failures in U.S. Army Acquisition Through the Lens of the M10 Booker

June 2026

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ABSTRACT

This case study examines programmatic issues that lead to cancelation, focusing specifically on the M10 Booker program. This research collects and analyzes available data to determine the root cause of failure for the M10 using the Ishikawa diagram and compares these findings to other high-level programs determining potential commonalities. The goal of this research is to determine lessons learned that could be applied to future acquisition strategies to help prevent potential cancelations or determine indicators that programs are on an unrecoverable path. The findings suggest that each program had similar issues and some differentiating concerns; the common trend among the three programs, and reason for the cancelation determination, was based on the evolving demands of future combat that the current materiel solutions could not satisfy. With this finding, the research group makes the recommendation to continuously revalidate programs on a new assessment cycle and ensure that materiel solutions address a validated gap for current and future warfare.

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From Richard (Ricky) Blakesleay:

I dedicate this project to my wife, Anna, for her unwavering support and for embracing our continued journey in the Army. To my family and friends: thank you for standing by me through eleven years of moves, deployments, and the challenges of life away from home. Finally, to my daughter, Eleanor, who joined our adventure during my time here at NPS—thank you for being our greatest joy.

From Zachary (Zach) Brittingham:

This work is dedicated in no small part to my wife, whose support, encouragement, and patience carried me forward and has been a constant source of strength throughout my career. To my family and friends, I am profoundly thankful for the love and understanding that sustained me through every stage of my life.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAE	Army acquisition executive
AAF	adaptive acquisition framework
ABCT	armored brigade combat team
ACAT	acquisition category
ADM	acquisition decision memorandum
AoA	analysis of alternatives
AOTC	Army Operational Test Command
APB	acquisition program baseline
CDD	capability development document
DA	Department of the Army
DoD	Department of Defense
DOT&E	Director, Operational Test and Evaluation
DOTmLPFP	doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy analysis
EMD	engineering and manufacturing development
FARA	future attack reconnaissance aircraft
FCS	future combat systems
FRP	full-rate production
FVL	future vertical lift
FY	fiscal year
GAO	Government Accountability Office
GCV	ground combat vehicle
IBCT	infantry brigade combat team
ICD	initial capability document
ICE	independent cost estimate
IFV	infantry fighting vehicle
INOP	inoperable
IOT	initial operational testing
ITEP	improved turbine engine program
ITRA	independent technical risk assessment
JCIDS	joint capability integration and development system

JROC	joint requirements oversight council
KPP	key performance parameter
LRIP	low-rate initial production
MCA	major capability acquisition
MDA	milestone decision authority
MDAP	major defense acquisition program
MDD	materiel development decision
MPF	mobile protected firepower
MRL	manufacturing readiness level
MSA	materiel solution analysis
MSAR	Modernization Selected Acquisition Report
MTA	middle tier of acquisition
MTA-RP	middle tier of acquisition rapid prototyping
O&S	operations and sustainment
OUSD(A&S)	Office of the Under Secretary of Defense for Acquisition and Sustainment
P&D	production and deployment
PDR	preliminary design review
PEO GCS	Program Executive Office Ground Combat Systems
PM	program manager
RCA	root cause analysis
RFP	request for proposals
TMRR	technology maturation and risk reduction
TRADOC	Training and Doctrine Command
TRL	technology readiness level

I. INTRODUCTION

The U.S. Army faces two immediate problems—one financial and one operational—following the cancellation of the M10 Booker program. Financially, the Army invested over $1 billion into development, testing, infrastructure, and low-rate initial production (LRIP) with no operational capability to show for it (Program Executive Office, Ground Combat Systems [PEO GCS], 2023). Operationally, the Army requires a light, armored, mobile platform capable of supporting infantry brigade combat teams (IBCTs). With no replacement platform, no validated alternative, and no clear institutional accountability, the Army is left with a capability gap and no formal understanding of the program's failure. This validates the question of what could have been done during M10 production to prevent wasted time and resources.

A. PROBLEM STATEMENT

The Army continues to pursue the acquisition of new weapon systems and technology to maintain its warfighting edge. In 2018, the Army began work on the M10 Booker (originally Mobile Protected Firepower [MPF]), a new light tank variant, after "the Army Acquisition Executive (AAE) approved the use of Middle Tier of Acquisition (MTA) authorities to execute MPF rapid prototyping" (PEO GCS, 2023, p. 5). This new light tank would provide IBCTs with a mobile, direct-fire capability that could maintain the speed and agility of a light infantry formation while engaging enemy fortifications and light armored vehicles. Despite its approval and progress through initial operational testing (IOT) and the start of LRIP, the program was canceled by Secretary of the Army, Dan Driscoll, in 2025 (Luckenbaugh, 2025). The problem the Army now faces is that it has invested over $1 billion in the program, has still not met its light tank requirement, and does not have an answer for what went wrong (PEO GCS, 2023). With this being the most recent Army acquisition category (ACAT) 1 program canceled, no formal research has been conducted to identify the root cause of failure, resulting in a knowledge gap. This capstone research uses a case-study approach to identify the root causes of the M10's failure and cancellation as well as lessons learned that can be applied to other Army acquisition programs.

As the Army continues to focus heavily on acquisition reforms, process streamlining, and waste reduction, this research can prove instrumental to other ACAT 1 programs. By identifying the root causes of the M10 program's cancellation, this research can help other ongoing programs avoid the same pitfalls. These insights are valuable not only for programs underway but also for future ACAT 1 programs that have not yet entered the acquisition process. The findings help decision-makers develop acquisition strategies that strengthen risk management and improve institutional knowledge for future programs.

B. RESEARCH QUESTIONS

These primary and secondary research questions examine the systematic failures that led to the cancellation of the M10 Booker light tank project. By answering these questions, future acquisition professionals can apply the lessons learned from this research to future acquisition programs. The following are the primary and secondary research questions that are addressed.

Primary Questions:

- What are the root causes for the failure of the M10 Booker program?
- What lessons from past failures like the future attack reconnaissance aircraft (FARA) and ground combat vehicle (GCV) were ignored or repeated in the M10 Booker program?

Secondary Question:

- What lessons can be learned from M10 and implemented across other Army acquisition programs?

C. RESEARCH METHODOLOGY

This research focuses primarily on a root-cause analysis of the M10 Booker to identify failures during the program life cycle, using the Ishikawa diagram to visualize the causes. Specifically, this case study examines the M10 program from its inception as the mobile protected firepower (MPF) program through its cancellation, using a holistic approach to evaluate the program's acquisition strategy. This case study includes a comparative analysis of other cancelled programs and traceability analysis to determine any previously known lessons learned that could have been applied to the M10.

D. LIMITATIONS AND SCOPE

The case study analysis uses available information on both unclassified and controlled unclassified information security classification databases. This information includes M10 acquisition strategy reports, testing documentation, historical documentation on the MPF, and acquisition reports for other cancelled programs, the GCV and the FARA. This research is limited to available acquisition reports and information in current Department of Defense (DoD) databases, as no previous analysis of the M10 Booker has been conducted. The research is an unbiased examination of the causes of failure, yielding valuable insights that can be applied to future programs to achieve potentially successful results.

E. ORGANIZATION

The following chapters in this case study provide a historical look at the MPF program from its inception to the cancellation of the M10. Chapter II provides a comprehensive analysis, beginning with the history of MPF, the M10 acquisition strategy, and the M10's purchase description. Chapter III provides a literature review of available resources to examine and describe the selected acquisition approaches for the M10, a comparative analysis of past programs that were canceled, and a look into the program's requirements process with Congressional oversight. Chapter IV presents the application of the research methodology, the collected data, and the analysis. Chapter V concludes the research by presenting the answers to the research questions and recommendations for moving forward.

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II. BACKGROUND

This section focuses on the background of the Army's M10 Booker program, from requirements generation through program cancellation. The history of the program is beneficial to study because it provides a framework for identifying where requirements gaps existed, what mistakes were made at critical milestones, and how requirements creep affected the program's outcome. This section provides an overview of the program's background to illuminate the factors that led to the cancellation, which are analyzed in later sections.

A. MOBILE PROTECTED FIREPOWER PROGRAM HISTORY

The M10 Booker began the requirement generation stage as the MPF (Feickert, 2025). The M10 was created to fill an operational gap in the IBCTs. The requirement to produce a mobile, armor-protected, direct-fire support vehicle was valid; the Army had a capability gap in its IBCT, and the M10 addressed that need (Feickert, 2025). Furthermore, the requirement to destroy bunkers, fortified positions, heavy machine guns, and light/medium armor threats is ever-present in IBCTs, and a light tank variant could prove helpful in these formations (Feickert, 2025).

The initial capability document (ICD) for the MPF was approved by the Joint Requirements Oversight Council (JROC) in December 2015 (Department of the Army [DA], 2021). The ICD is the first requirement document in the Joint Capability Integration and Development System, so the document's approval formally concluded that the Army lacked a critical capability. The ICD also framed the operational risk of failing to fill the capability gap, further validating the requirement. Although the ICD did not specify a particular system design, it did outline a pathway to a solution (DA, 2021). In September 2017, the JROC completed an analysis of alternatives (AoA) for the MPF, evaluating options to address the direct-fire support gap in IBCTs and thereby guiding the materiel solution analysis (MSA) phase. (DA, 2021).

The AoA was used to examine whether existing or upgraded systems could meet the Army's needs. Options studied included a wheeled platform like "the Stryker mobile gun system was considered. A tracked system consisting of a main battle tank turret, large-caliber gun, and an infantry fighting vehicle (IFV) hull was also considered" (DA, 2021, p. 14). "These alternatives were rejected because they did not meet multiple transportability, mobility, logistics, survivability, and lethality requirements" (DA, 2021, p. 14).

The AoA also considered a "no-action" alternative as a baseline for comparison (DA, 2021). Under this alternative, the Army would continue to accomplish mission objectives using existing capabilities (DA, 2021). This would mean relying on current IBCT assets to conduct operations. However, the MPF ICD included an assessment of non-materiel solutions, and it was determined that they were insufficient to address the identified capability gaps, making the "no-action" alternative an impractical long-term option (DA, 2021). After the doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy analysis (DOTmLP-FP) analysis, it was concluded that a new materiel solution was required to fill the capability gap.

With an approved ICD, the program moved forward with the materiel development decision (MDD), which was approved in October 2016 (DA, 2021). The MDD authorized the Army to begin exploring solutions to address the capability gap.

B. ACQUISITION STRATEGY

In September 2018, a middle tier of acquisition rapid prototyping (MTA-RP) pathway was approved, and in December of the same year, rapid prototyping contracts were awarded (PEO GCS, 2023). Under the MTA-RP contract, two vendors, BAE Systems and General Dynamics Land Systems, would each provide 12 M10 prototypes (DoD, 2018). The Army planned to integrate mature subsystems, such as the vehicle's powertrain, suspension, protective armor, main armament, and onboard electronics, into a unified design. This approach was intended to accelerate development and reduce overall program cost compared to a standard acquisition process (DA, 2021).

In June 2022, the AAE issued an MTA Outcome Determination that moved the program into the adaptive acquisition framework major capability acquisition (AAF-MCA) pathway as an ACAT1B program (PEO GCS, 2023). Also, the AAE approved Milestone C, enabling entry into LRIP. Four days later, on June 28, 2022, General

Dynamics was selected over BAE Systems as the sole-source contractor and received the LRIP contract (PEO GCS, 2023). In the same month, the JROC updated and approved the capability development document (CDD) update. The CDD update included seven key performance parameters (KPPs). The KPPs included force protection, system survivability (kinetic), system survivability (cyber), net ready, training, sustainment (operation availability), sustainment (materiel availability), energy, and lethality (DA, 2021). These KPPs aligned with the program's overall goal of giving IBCTs the firepower and protection needed to take the initiative in combat, maintain that momentum, and secure tactical advantages during extended ground operations (DA, 2021). The approved acquisition program baseline (APB) included a full-rate decision scheduled for April 2025, with an estimated cost of $6.96 billion (Government Accountability Office [GAO], 2024).

C. PURCHASE DESCRIPTION

PEO GCS (2023) noted the total acquisition funding for the program was $7.7 billion, including the production and life-cycle sustainment of 350 vehicles. The program office planned to use a three-year LRIP production cycle to produce a total of 96 vehicles (PEO GCS, 2023). The purpose of this three-year cycle was to gather cost data to better inform full-rate production costs and drive contract negotiations. They determined that vehicles produced in LRIP 1 would be used for production qualification testing, live-fire test and evaluation, and initial operational test and evaluation, as well as equipping the first unit in the fielding schedule. LRIP 2 and LRIP 3 tranches would finish equipping the first M10 battalion, begin equipping a second battalion, and supply Training and Doctrine Command with a company-level set for institutional training (PEO GCS, 2023).

The Army officially named the system the M10 Booker during its 248th birthday celebration on June 10, 2023 (PEO GCS, 2023). General Dynamics was later awarded the second LRIP contract on June 26, 2023 (PEO GCS, 2023). In February 2024, the first LRIP vehicles were delivered. Initial operational testing took place from October 2024 through February 2025 (PEO GCS, 2023).

On June 11, 2025, the Army announced that it was terminating the M10 Booker program and would not proceed to full-rate production (Luckenbaugh, 2025). The cancellation coincided with the Secretary of Defense's Army transformation and acquisition reform and the Army's transformation initiative, which re-evaluated force structure and favored capabilities other than a light tank to augment IBCTs. During testimony to the House Appropriations Committee in May 2025, Secretary of the Army Dan Driscoll stated,

> "The service must own the fact that it got the Booker wrong, but what we are trying to do is not fall prey to the sunk cost fallacy where because we have invested all of these dollars into this machine that turned out to be inadequate we're going to keep purchasing it. The risk is much greater, keeping the status quo, and sending soldiers into combat with inadequate systems." (Luckenbaugh, 2025, para. 9–10)

D. THE CAPABILITY GAP IN HISTORY

The state of warfare is constantly in flux, and just as much as combat changes with technological advances, it also stays the same. The M10 Booker program stemmed from similar calls for a "light tank" following World War I but was met with mixed results. The Army needs equipment that can support dismounted infantry units "to neutralize enemy prepared positions and bunkers and defeat heavy machine guns and armored vehicle threats during offensive operations or when conducting defensive operations" (PEO GCS, 2023, p. 5). The following section presents an exploration of past programs, the reasons they began, the issues they faced, and their ultimate cancellations. This helps frame the capability gap that the Army has faced, explain why the MPF/M10 Booker program began, as well as explore the connections between past and present issues the programs have encountered.

1. M3 and M5 Stuart Tanks

As World War II was being waged, the U.S. determined that there was a requirement to update the M2 light tank; thus, began production of the M3 Stuart, depicted in Figure 1. The most notable upgrade was its armor thickness. Through the Lend-Lease Act, the British were able to utilize the American M3/M5 tanks, and the tanks received much praise for their reliability but were criticized for not being able to contend with enemy medium tanks and armor units (Miskimon, 2021). Despite seeing combat in Europe and Africa, the tanks were typically modified by crews and utilized for roles outside of their main purpose of fighting other tanks, such as troop transport and reconnaissance (Miskimon, 2021).

Source: American Fighting Vehicle Database (2024)

Figure 1. M3 Stuart Light Tank

The M3 Stuart Tank weighed 13.7 tons and had a maximum speed of 36 mph, a range of 75 miles and a mounted 37 mm cannon (Miskimon, 2021). The M5, which was the final upgrade of the M3, was powered by twin Cadillac engines and had an increased range of 100 miles (Miskimon, 2021). While the United States utilized the M3/M5 series light tank throughout World War II, the tank was simply outmatched by enemy tanks, and by the end of the war, it was obsolete due to its thin armor and high silhouette and was deemed no longer suitable for use (Miskimon, 2021).

2. M24 Chaffe

With the M3/M5 quickly becoming obsolete in the early 1940s, the Army sought to replace it as quickly as possible and began work on multiple variants to try to find its replacement. This included the T7, which became a poor medium tank that was canceled relatively quickly, and the T24, which became the M24, depicted in Figure 2, which was led by Cadillac Motor Company (Seelinger, n.d.). Cadillac took it upon itself to attempt innovation and speed by utilizing a sloping armor design, which would allow maximum protection while keeping weight in check for a light tank, as well as wider tracks for mobility, improved transmission, and various other technological updates (Seelinger, n.d.). Going into LRIP, there were some small flaws that were quickly resolved, and full production began (Seelinger, n.d.).

Source: American Fighting Vehicle Database (2024)

Figure 2. M24 Chaffee

The M24 Chaffe could reach a top speed of 35 mph and had a range of 175 miles and sloped armor that allowed for better protection in comparison to a flat surface (Seelinger, n.d.).

Upon the M24 Chaffe's arrival at the European theater in 1944, crews initially praised the tank for its speed, mobility, low silhouette and reliability but soon found fault with the equipment, which echoed similar problems that Army light tanks had faced in the past (Seelinger, n.d.). The Chaffee's weaknesses included little protection against enemy mines due to the thinness of its armor, an inability to challenge enemy armor, and ammunition carrying capacity. Ultimately, the M24 found the most success as a reconnaissance asset, and by 1953, the Army began to replace the Chaffee with the M41 Bulldog light tank (Seelinger, n.d.).

3. M551 Sheridan

The M551 Sheridan, depicted in Figure 3, was one of the Army's last attempts to produce an effective light tank before the M10 Booker. Development began in 1957, when the Army believed there was a need for a light tank or armored reconnaissance/airborne assault vehicle (Seelinger, n.d.). The Sheridan incorporated new technology such as the XM81 gun-missile launcher that used combustible cartridges instead of brass shells. With the new technology came multiple delays, which led to full-scale production not beginning until 1966 (Seelinger, n.d.).

Source: American Fighting Vehicle Database (2024)

Figure 3. M551 Sheridan

The Sheridan could reach up to 45 mph, had a range of 373 miles, was amphibious and able to cross water obstacles, and was air-droppable to provide fire support to light infantry airborne units (Seelinger, n.d.).

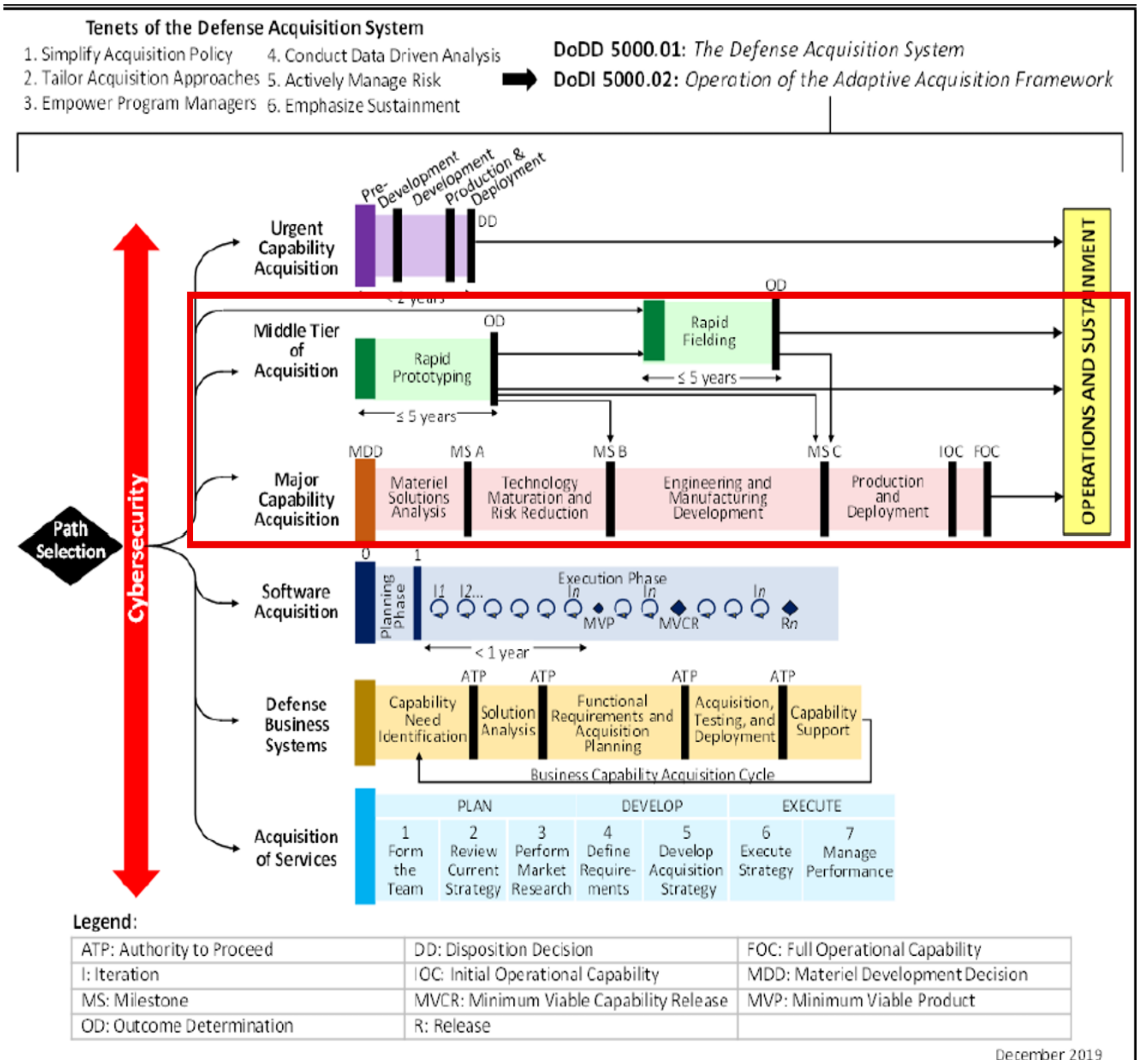
After seeing combat in Vietnam and Panama and limited use in Operation Desert Shield, the Sheridan was phased out and no longer utilized. During combat, the Sheridan provided effective cover against enemy infantry, pillboxes, and bunkers. It also very rarely had issues throwing track and becoming immobile (Seelinger, n.d.). But for all its attributes, it was also vulnerable to mines, rocket-propelled grenades, and, occasionally, machine-gun fire due to its thin armor (Seelinger, n.d.). Additionally, due to the strength of its cannon and the lightness of the tank itself, the tank would sometimes buck and dislodge equipment when fired, endangering the crew. The water and humidity of Vietnam also plagued the vehicle's electronics, though crews struggled to prevent this (Seelinger, n.d.). Eventually, the Army began phasing out the Sheridan despite upgrades. Other programs were considered for replacement, but budget cuts ultimately led to each program's cancellation (Seelinger, n.d.).

a. Why Does It Matter?

As evidenced by the provided examples, the light tank has had mixed results, stemming from early technological challenges, confusion over its intended purpose, and difficulties meeting protection requirements for troops. These examples are used as a framework to identify where the M10 Booker succeeds relative to its predecessors or falls into the same traps.

E. ACQUISITION STRATEGIES: THE ADAPTIVE ACQUISITON FRAMEWORK

The Adaptive Acquisition Framework (AAF; Figure 4) is a multi-option approach that enables program managers (PM) to tailor acquisition strategies to deliver capabilities efficiently and on time. This framework is governed by the DoD's 5000-series handbook, which details each pathway to guide acquisition teams through the process. The M10 Booker program began through an approved MTA-RP pathway, which led the program to transition to a Major Capability Acquisition (MCA) pathway (OUSD[A&S], 2021). For reference, these selected pathways are depicted by the red box in Figure 4.



Source: Office of the Under Secretary of Defense for Acquisition and Sustainment (2021)

Figure 4. Adaptive Acquisition Framework

The approved program is given an ACAT level, which is split based on program type and dollar threshold, and governed by specific policies at the category level as depicted in Table 1 (OUSD[A&S], 2020).

Table 1. Acquisition Category Level Breakdown

ACAT		

ACAT I	• MDAP[1] (Section 2430 of Title 10, U.S.C.)
	  ○ Dollar value for all increments of the program: estimated by the DAE to require an eventual total expenditure for research, development, and test and evaluation of more than $525 million in Fiscal Year (FY) 2020 constant dollars or, for procurement, of more than $3.065 billion in FY 2020 constant dollars
	  ○ MDA designation
	• MDA designation as special interest[3]
		ACAT ID: DAE
		ACAT IB: SAE[2]
		ACAT IC: Head of the DoD Component or, if delegated, the CAE

ACAT II	• Does not meet criteria for ACAT I
	• Major system (Section 2302d of Title 10, U.S.C.)
	  ○ Dollar value: estimated by the DoD Component head to require an eventual total expenditure for research, development, and test and evaluation of more than $200 million in FY 2020 constant dollars, or for procurement of more than $920 million in FY 2020 constant dollars
	  ○ MDA designation (Section 2302 of Title 10, U.S.C.)
		CAE or the individual designated by the CAE[4]

ACAT III	• Does not meet dollar value thresholds for ACAT II or above • Is not designated a "major system" by the MDA	Designated by the CAE[4]

1. Unless designated an MDAP by the Secretary of Defense (SecDef), AIS programs[5], Defense Business System programs, and programs or projects carried out using rapid prototyping or fielding procedures pursuant to Section 804 of Public Law (PL) 114-92, do not meet the definition of an MDAP.
2. ACAT IB decision authority is assigned pursuant to Section 2430 of Title 10, U.S.C. Paragraph 3A.2.b. provides DoD implementation details.
3. The Special Interest designation is typically based on one or more of the following factors: technological complexity; congressional interest; a large commitment of resources; or the program is critical to the achievement of a capability or set of capabilities, part of a system of systems, or a joint program. Programs that already meet the MDAP thresholds cannot be designated as Special Interest.
4. As delegated by the SecDef or Secretary of the Military Department.

Source: Office of the Under Secretary of Defense for Acquisition and Sustainment (2020)

1. Middle Tier of Acquisition Pathway

The MTA pathway is an approach that is meant for more mature technologies that have a greater chance of becoming functioning prototypes within a shorter period and do not require the amount of time that new equipment needs to develop from concept to physical system. The guide that governs this pathway is DoD Instruction (DoDI) 5000.80, *Operation of the Middle Tier of Acquisition (MTA)*, which describes the appropriate uses, authorities, and policies, along with the process that is taken for this approach (OUSD[A&S], 2019). According to DoDI 5000.80, this specific pathway is meant to "fill a gap in the DAS [defense acquisition system] for those capabilities that have a level of maturity to allow them to be rapidly prototyped within an acquisition program or fielded, within 5 years of MTA program start" (OUSD[A&S], 2019, p. 3). Rapid fielding has the same 5-year timeline in that fielding of equipment must begin within 6 months of program start under the MTA pathway but not exceed 5 years to completion.

Depending on the state of the new technology or capability, equipment can enter either the rapid prototyping or the rapid fielding portion of the pathway. All equipment that is requested for the MTA pathway is to be prioritized based on new capabilities and technologies that fill a specified need to the force to fill a capability gap (OUSD[A&S], 2019). Once a capability is selected for the MTA pathway, the decision authority signs the acquisition decision memorandum, which provides the rationale for the new technology to go through rapid prototyping or rapid fielding and identifies funding (OUSD[A&S], 2019).

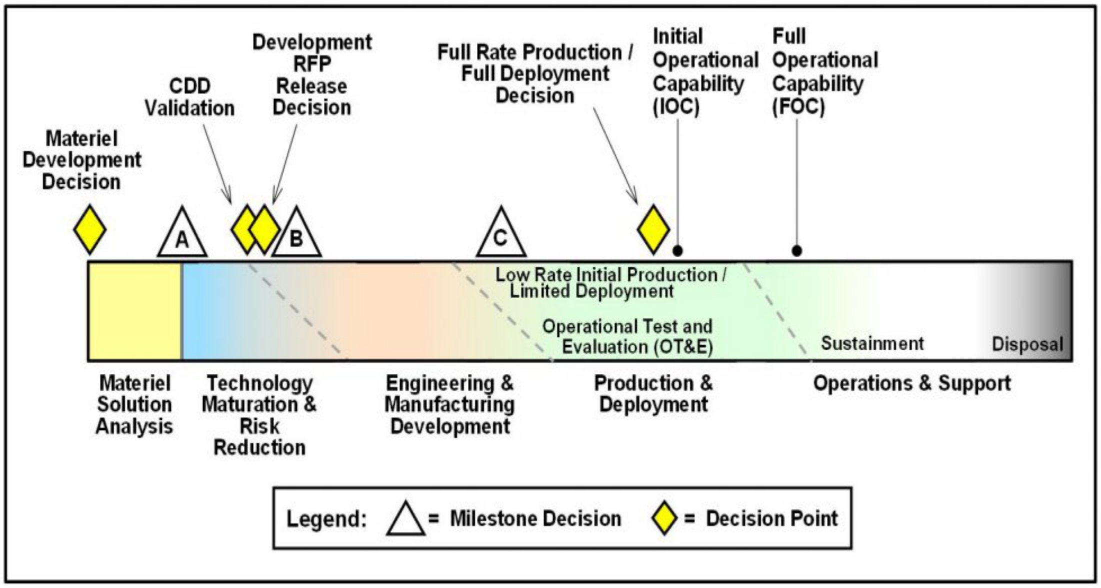
If the capability or technology is chosen for rapid prototyping, an acquisition strategy is then created; this document describes the funding plan along with estimated costs, schedule, risks, and security, and a performance and evaluation standard that is used to assess progress. These performance standards formulate a test strategy that allows documentation and validation of operational performance (OUSD[A&S], 2019). When technology has reached the required level of maturity (based on the acquisition strategy and standards created), the PM and the acquisition team recommend a transition plan for the Milestone Decision Authority (MDA), who makes the final decision.

To continue with rapid fielding, whether directly or as part of the transition plan, capabilities need the approved ADM and must include a fielding strategy that delivers to the force (OUSD[A&S], 2019). Like rapid prototyping, rapid fielding must have an acquisition and testing strategy. The additional requirements for this pathway include a "tailored life cycle sustainment plan" that addresses logistics support and training and identification of opportunities to reduce total ownership cost (OUSD[A&S], 2019, p. 9). This pathway culminates within 2 years after fielding completion and then transitions to the operations and sustainment phase.

2. Major Capability Acquisition Pathway

The MCA pathway is the standard approach to the acquisition and/or development of major capabilities that are intended to fill a capability gap in the Service.

Figure 5 depicts a more detailed look at the MCA that includes decision points and milestones that shall occur at each stage. Phases are separated by milestone decisions, called Milestones A, B, and C; entrance to and exit from each milestone require approval from the MDA.



Source: Office of the Under Secretary of Defense for Acquisition and Sustainment (2020)

Figure 5. Major Capability Acquisition Pathway

While the MCA pathway ensures rapid capabilities development and deployment to fill capability gaps based on the urgency of need and the technology and manufacturing process maturity level, determining whether a new capability follows the MCA pathway requires approval at the MDD. Two things must be completed for this decision to be made: (a) the ICD, which is the verification of requirements that are needed for the capability, must be completed, and (b) an AoA plan, which is executed in the MSA phase to ensure any possible alternative solutions that may exist are used to meet the requirements, must be created (OUSD[A&S], 2020).

Though this pathway depicts a linear path, the reality is that at the MDD, the MDA determines which milestone the approved materiel solution enters. This is based on factors such as available resources, required delivery dates, and the associated risk of the technology being utilized. Risk can be thought of in terms of technology readiness levels (TRLs) and manufacturing readiness levels (MRLs). The following section provides an explanation of the MCA phase, production and deployment, the M10 underwent following the MTA rapid prototyping effort, entering at Milestone C.

Milestone C is the review of the capability created during the EMD phase. The MDA must ensure that the production design is stable enough for the pre-determined LRIP quantity. The PM shall provide proof of stability, which is supported by testing and evaluation results, technological maturity, full funding, and planned timelines for fielding (OUSD[A&S], 2020). Once the MDA approves the capability during Milestone C, the program may enter the P&D phase.

a. Production and Deployment

Entry into the P&D phase means that the new capability is stable enough for potential full-rate production (FRP) and delivery to expecting units in the force whose operations are being impacted by a capability gap that the program can eliminate. "The P&D phase is guided by an updated CDD if required, the acquisition strategy, and the test and evaluation master plan" (OUSD[A&S], 2020, p. 17). This phase also involves interaction between the acquisitions team and the end-user community to conduct training on the new equipment to ensure it is utilized correctly for maximum effectiveness.

One of the key events that takes place during this phase is the FRP or full deployment decision to either produce the remaining equipment quantity or request a full release of the capability (OUSD[A&S], 2020). "Proceeding to FRP requires control of the manufacturing process, acceptable performance and reliability, the establishment of adequate sustainment and support systems, and for MDAPs [major defense acquisition programs], an ICE and an ITRA [independent technical risk assessment]" (OUSD[A&S], 2020, p. 17). Once the criteria are met and the MDA approves the program to continue, it can enter the O&S phase.

The entire MCA pathway lacks a specific timeline for the listed activities, and progression depends on the capability to meet each phase's requirements. If at any point the MDA does not approve entry into the next phase, the product remains in its current phase until the requirements for advancement are met.

F. SUMMARY

Understanding the history of past light tank programs, the origins of MPF and the framework for acquisition strategies, allows a deeper analysis of the M10 Booker. Prior to doing so, the following chapter provides insight into the research methodologies to be employed and examine similarly recent canceled programs. The related, published literature provides a foundation to identify the root cause of the cancelation of the M10 and to compare lessons learned across major capability acquisitions.

III. LITERATURE REVIEW

Our research uses a root cause analysis approach with the Ishikawa diagram to identify the factors that led to the M10 program failure. This methodology is applied across other U.S. Army programs that ended in failure, enabling a comparative analysis, identifying similarities, and capturing lessons learned for future programs.

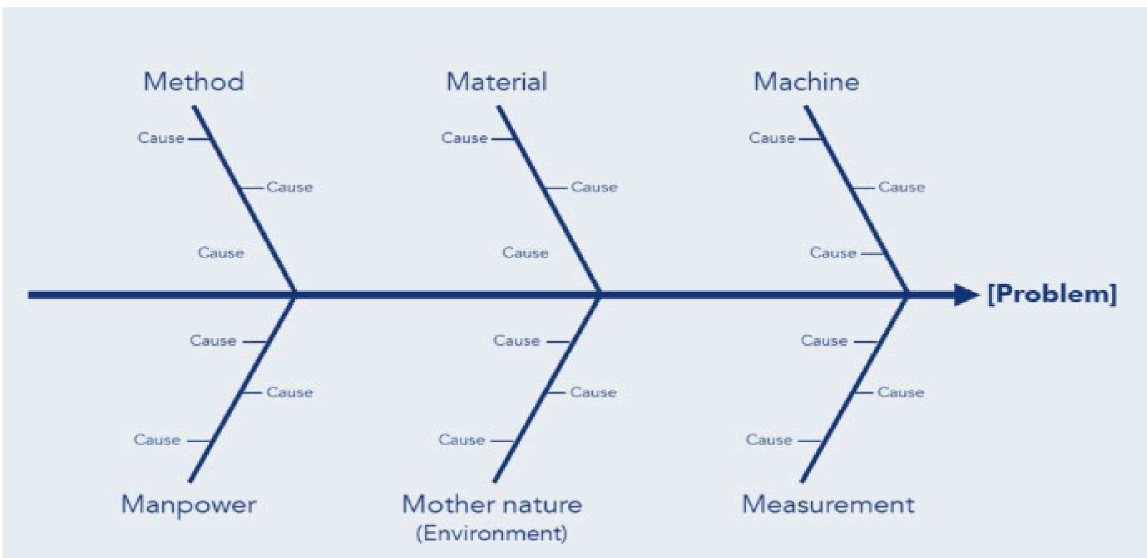
A. RESEARCH METHODOLOGIES

To better understand the issues that led to program failure, researchers must examine the outcomes and trace them back to their root causes. A root cause analysis (RCA) is defined by *A Guide to the Project Management Body of Knowledge* 7th edition as an "analytical technique used to determine the basic underlying cause of a variance, defect, or a risk. A root cause may underlie more than one variance, defect, or risk." (Project Management Institute, 2021, p. 177). Six Sigma (2024) states that a "root cause analysis (RCA) aims to uncover why issues arise by systematically evaluating contributing factors" (para.1). The company provides five steps for conducting an RCA: Define the problem, gather information and data, identify causal factors, pinpoint the root cause(s), and implement preventative solutions (Six Sigma, 2024).

When defining the problem, the research team must clearly identify the problem or issue that has happened, including the impacts thus far (Six Sigma, 2024). Software engineering organization Geeks for Geeks (2025) states that this steps "simply means to identify or determine defect if present in a system. It includes what exactly is happening, what are symptoms of it, what are issues that you observe, its severity, etc." (para.2). When defining the issue, research teams must clearly document the issues and, to the fullest extent possible, "quantify discrepancies between expected versus actual" (Six Sigma, 2024, para. 25). Doing this ensures the issues can be visualized and helps researchers understand the impacts of the intended goals.

Once impacts are identified and documented, the team must gather information and data. Creating a timeline of events is a logical first step in this process (Six Sigma, 2024). One way to do this is to identify key events from right to left, noting every defect and piece of data along the way, like "operational data, process logs, related audit records, and other artifact sources to reconstruct event sequences" (Six Sigma, 2024, para. 30). This can support the understanding of influences that caused the issues to arise, whether internal or external (Six Sigma, 2024). Businessmap states, "the more complete your picture, the easier it will be to spot patterns and contributing factors" (Krasteva, n.d., para. 5), articulating the importance of documenting issues and gathering facts from internal and external sources that may have contributed to the problem.

There are many tools and methods that research teams can use to determine causal factors. For example, teams can utilize the Ishikawa diagram, the 5 whys approach, affinity diagram, Pareto diagram, etc. (Department of Education, 2025). The research team uses the Ishikawa diagram for the M10 Booker analysis, as shown in Figure 6.



Source: Kaizen Institute (n.d.)

Figure 6. Ishikawa Example Diagram

According to the Kaizen Institute (n.d.), the Ishikawa diagram "simplifies root cause analysis by providing clear and organized visual representation of all potential causes of a problem" (p. 12). When using this tool, the problem being examined is placed on the right side, or the "head." of the diagram, and several broad categories are examined for potential causes (Kaizen Institute, n.d.). The most common categories are method (processes), material (raw materials), machine (equipment), manpower (people), mother nature (environment), and measurement (improper measurements collected; Kaizen Institute, n.d.). These categories are further broken down to examine causes within the categories that influence the main problem. This is done by brainstorming potential causes (Kaizen Institute, n.d.). The Ishikawa diagram is a simple visual tool that can show different causal factors influencing a problem (Six Sigma, 2024).

A crucial step in identifying causal factors is to analyze all interrelationships among factors to identify one or more root causes of a problem (Six Sigma, 2024). "Statistical, experiential, and consensus estimation techniques help qualify those key linkages for further root cause assessment" (Six Sigma, 2024, p. 49). The level of complexity of problems can be explained by one or more root causes. "Multiple root failure points may independently or jointly propagate deficiencies tied to the end observable defect" (Six Sigma, 2024, p. 52). To truly pinpoint the root cause of a problem, the research team determines if the issues are causal or a true root cause. "Causal factors directly contribute to the problem but are not the underlying deficiencies enabling the causal chain" (Six Sigma, 2024, p. 55). By conducting further analysis of the identified issues, the research team determines whether an issue is simply contributing to the problem or the point at which failure began.

The last step, according to Six Sigma, is to implement preventive measures to address the root cause of a problem. This means the team can identify and execute solutions to the current problem to prevent future occurrences (Six Sigma, 2024). This can be done by developing a plan, allocating resources, and assigning responsibilities, which gives team members ownership and helps ensure these problems are considered in the future (Six Sigma, 2024).

The research into the GCV, FARA, and M10 programs follows the same root cause analysis methodology and Ishikawa diagram to depict the research conducted. The six category branches on the Ishikawa are tailored based on broad areas of concern that could be applied across multiple defense acquisition programs, past, present, and future. These categories are the cost/budget constraints and limitations, the dynamic threat environment the military faces, technological maturity for materials and systems, requirements analysis, the acquisition strategy used for the programs, and any industrial base or contractor concerns.

B. THE ARMY'S GROUND COMBAT VEHICLE

This section focuses on the root cause of the Army's GCV failure. To accomplish this, the root cause analysis method determines why the program failed and identify the reasons for its cancellation. Furthermore, the outcomes of this root cause analysis inform a comparative analysis of the M10 Booker program's failure.

1. Define the Problem

The Army's GCV was developed to replace the cancelled manned ground vehicle under the FCS program (Feickert, 2014). The GCV was projected to replace the current platform, the Bradley Infantry Fighting Vehicle (IFV), which is used in the Army's armored brigade combat teams (ABCTs; Feikert, 2014). The GCV's program objectives were to produce a vehicle capable of protecting against 360-degree threats, operating after an attack, providing effective direct fire against an enemy, being mobile on and off roads, and carrying nine infantry squad Soldiers and a vehicle crew of three (Congressional Budget Office [CBO], 2013).

Enhancing survivability and increasing troop-carrying capacity drives vehicle designs toward greater size and weight. In contrast, objectives such as affordability and agility, particularly for operations in dense urban terrain, are easier to achieve with lighter, more compact platforms. The Army granted industry teams discretion in balancing these competing priorities. However, early design concepts suggested that the GCV would exceed the Bradley IFV's size and weight by a considerable margin (CBO, 2013). As a result, uncertainty remained regarding the platform's suitability across the full spectrum of anticipated future operations. The GCV focused on improved resistance to mines and improvised explosive devices, but senior Army officials raised concerns that a vehicle of this scale would be ill-suited for the complex, restrictive environments that characterized urban centers and would not be effective in future conflicts (CBO, 2013).

The design and stringent requirements were compounded by high programmatic costs. By the time of the program's cancellation, the Army had expended approximately $1.5 billion in research and development between 2010 and 2014, with no fielded capability to show for the investment (GAO, 2020). Moreover, long-term affordability concerns further undermined the program's viability. The CBO (2013) estimated that total GCV life-cycle costs were $28.8 billion for the development and procurement of 1,748 vehicles through 2030, which placed substantial pressure on the Army's modernization budget.

2. Timeline of Events

In April 2009, Secretary of Defense Robert Gates cancelled the Army's FCS program and directed the Service to pursue a new approach for developing a next generation GCV (Feickert, 2014). In February 2010, the Army released an initial RFP focused on a technology development strategy; however, by August 2010, the Service cancelled this solicitation after determining that both the requirements and the proposed acquisition strategy posed significant concerns (Feickert, 2014). A revised RFP aimed at recalibrating the program was issued in November 2010 (Feickert, 2014).

In August 2011, the DoD approved the GCV program's entry into the technology development phase, and the Army awarded two competitive contracts to General Dynamics and the BAE Systems-Northrop Grumman team (Feickert, 2014). Shortly thereafter, between August and December 2011, a protest filed by Science Applications International Corporation Boeing resulted in a stop-work period (Feickert, 2014). The GAO ultimately denied the protest, allowing the program to resume. In January 2013, the undersecretary of defense for acquisition, technology, and logistics directed major changes to the program, including restructuring actions intended to reduce near-term funding requirements (Feickert, 2014). Despite these adjustments, in February 2014, Secretary of Defense Chuck Hagel announced his intent to terminate the GCV program, a decision that the Congressional Research Service characterized as being driven primarily by budgetary pressures rather than by a discrete technical failure (Feickert, 2014). No funding for the GCV was requested in the fiscal year (FY) 2015 budget, effectively ending the program.

3. Ishikawa Diagram—Root Cause Analysis

The Ishikawa diagram for the GCV gives a visual representation of the potential causes of program failure, as shown in Figure 7.

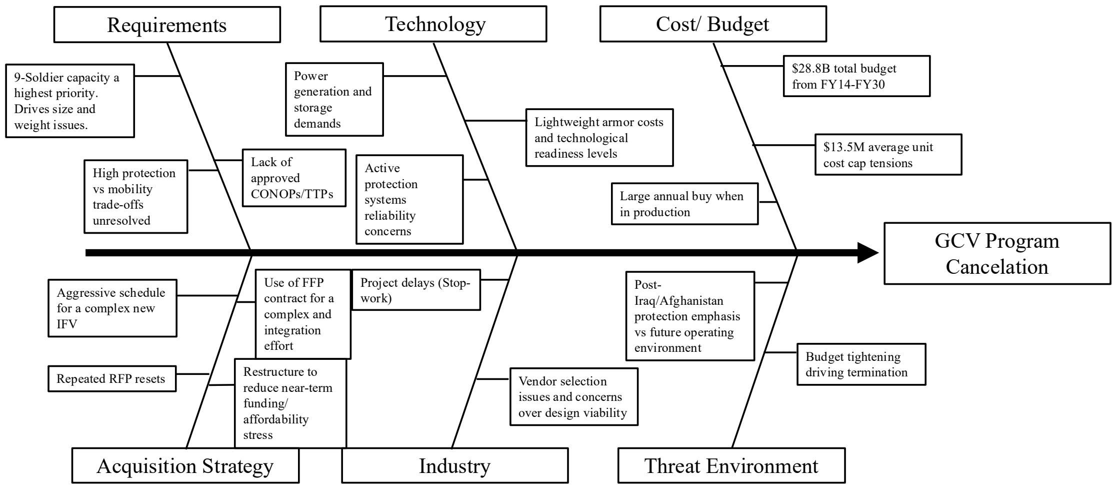


Figure 7. Ground Combat Vehicle Ishikawa Diagram

The official position on the cancellation of the GCV program was that it was due to budgetary constraints, not performance-related issues (Feickert, 2014). The Ishikawa diagram in Figure 7 outlines numerous factors that contributed to this program's scale and budgetary requirements. Although cost was not explicitly cited as the reason for cancellation, one can conclude that the issues noted in the diagram ultimately contributed to an inflated budget. When requirements, low TRLs, unrealistic budgets, and vendor selection do not align with the acquisition strategy, a major defense program is likely to fail or fail to deliver the desired equipment for the warfighter's needs.

C. THE ARMY'S FUTURE ATTACK RECONNAISSANCE AIRCRAFT

This section focuses on the root cause of the failure of the Army's FARA Program. To find the reason, the root cause analysis determines why the program failed and identifies the reasons for its cancellation. Furthermore, the outcomes of this root cause analysis inform a comparative analysis of the M10 Booker program's failure.

1. Define the Problem

In 2009, the Army initiated the future vertical lift modernization to update its aviation portfolio. This new portfolio was developed to upgrade aviation assets developed in 1960, including the Black Hawk, Apache, and Kiowa (DiMascio, 2024). The overall goal of the future vertical lift was to create a "rotorcraft that could fly more supplies, faster, for longer distances, more reliably, and with less logistical support" (DiMascio, 2024, para. 3).

With this goal in mind, FARA was one of two programs announced alongside the future long-range assault aircraft program. FARA would focus on replacing the Apache and Kiowa helicopters and would be an armed reconnaissance and scouting platform. The Army was looking to see an improvement across the board which is currently composed only of Apaches, as the Kiowas were retired starting 2014 (Heckmann, 2024). Leading up to the FARA announcement, the Army had already made three failed attempts to replace the Kiowa (Heckmann, 2024).

The design for FARA included many stipulations, such as a "main rotor diameter no larger than 40 feet, a maximum speed of at least 180 knots, and a maximum gross weight of 14,000 pounds, and it must utilize the ITEP [Improved Turbine Engine Program] engine" (Hemler, 2023, para. 7). Bell and Sikorsky were both selected as contractors for the program, with the stipulation that following the prototype demonstration, the Army would down-select heading into awarding an EMD contract. However, both companies were at a standstill while awaiting delivery of the ITEP engine, resulting in a 21-month delay (Hemler, 2023).

2. Timeline of Events

The FARA program officially began in April 2019 with the awarding of initial design prototype agreements utilizing OTA contracts to five different companies—Sikorsky, Bell, Boeing, Karem, and AVX/L3—to kick off the development phase (Hemler, 2023). In March 2020, the Army announced its winners, Bell and Sikorsky, and each contributed $735 million to begin developing prototypes to be competed for selection (Hemler, 2023). Both companies were asked to have their prototypes prepared and ready for test no later than 2023, albeit in 2021, some Army officials "suggested that meeting FARA's requirements … could be difficult" (DiMascio, 2024, para. 11). During the development of the contractor's prototypes, there was a delay with the ITEP engine by 2 years, which pushed the timeline for EMD back to FY2026 (DiMascio, 2024). During this time, the war in Ukraine began officially in 2022.

With the war in Ukraine, many nations began to witness rapid technological innovations that refreshed every 2–4 weeks. This immediately began to affect U.S. warfighter requirements and doctrine. The use of drones for reconnaissance and payload delivery has since become one of the most discussed and prioritized topics to arise from the Russia-Ukraine conflict.

The battlefield innovations of the Russia–Ukraine conflict, as well as the delays and rising costs of the FARA program, led to the program's restructuring in 2024 (Roque, 2024). Army Chief General Randy George stated in a press release that "We are learning from the battlefield, especially Ukraine, that aerial reconnaissance has fundamentally changed" (Roque, 2024, para. 6). Others noted that "Sensors and weapons mounted on a variety of unmanned systems and in space are more ubiquitous, further reaching and more inexpensive than ever before" (Roque, 2024, para. 6), and some commented that the need to "free up billions of dollars to invest in unmanned systems was also a prime factor" (Roque, 2024, para. 8).

3. Ishikawa Diagram—Root Cause Analysis

The Ishikawa diagram for the FARA program gives a visual representation of the potential causes of program failure, as shown in Figure 8.

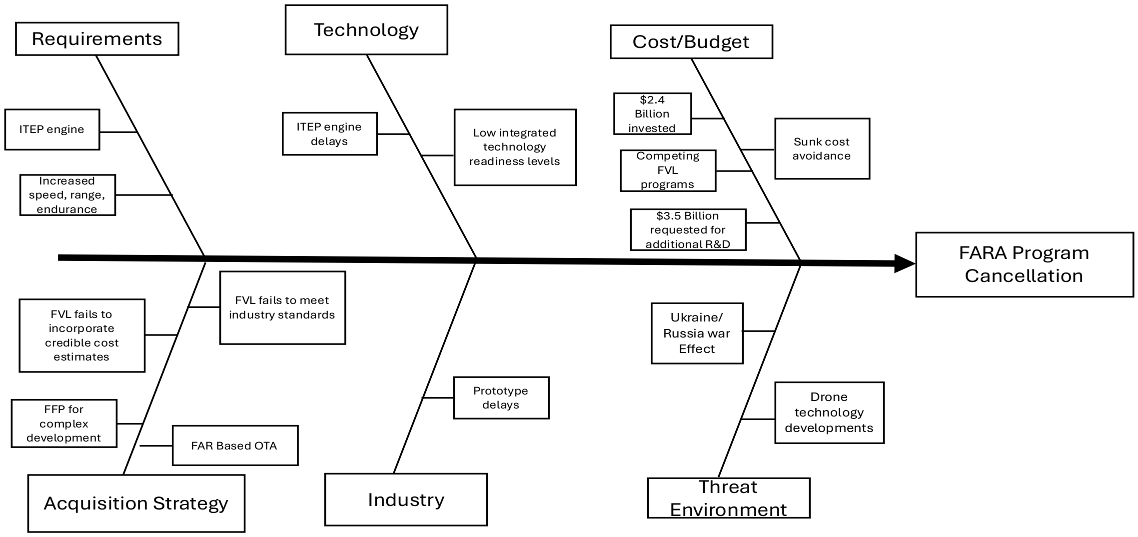


Figure 8. Future Attack Reconnaissance Aircraft Ishikawa Diagram

The official position on the cancellation of the FARA program was that the requirement was no longer needed based on the current state of the battlefield (DiMascio, 2024). The Ishikawa diagram in Figure 9 outlines numerous factors that contributed to the program's cancellation, including technological developments, budget concerns, and external influences. The FARA program continued to face delays due to low TRLs for the ITEP engine, which was a non-negotiable requirement. Coupled with a growing budget and the evolving battlefield in the Ukraine war, it was logical for the Army to reprogram funds to a relevant program, such as the future tactical unmanned aircraft system, and invest more in unmanned reconnaissance (DiMascio, 2024).

D. SUMMARY

This section has outlined the methodologies for research and creating a framework to conduct analysis of cancelled programs. Taking this research methodology, the research team applied it to the GCV and FARA programs and identified where these programs have succeeded and where they have failed. Going forward this methodology is applied to the M10 Booker and identifies its failures leading to cancellation and compare them to other programs to see if there are commonalities that can be carried forward as lessons learned.

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IV. M10 BOOKER ANALYSIS

This chapter focuses solely on the determinations and findings from available documentation on the M10 Booker program, using the M10 Ishikawa diagram depicted in Figure 9, to conduct a root cause analysis. The Ishikawa category areas were determined through a brainstorming session among the researchers. Each category is further explained in subsequent sections. The M10 program areas that the researchers examined were the cost and budget of the program, the complex and changing threat environment, the technology utilized to develop the system, the requirements that guided the program, and the acquisition strategy used by the program office; the researchers also conducted an assessment of the industry base and contractor used to develop the M10.

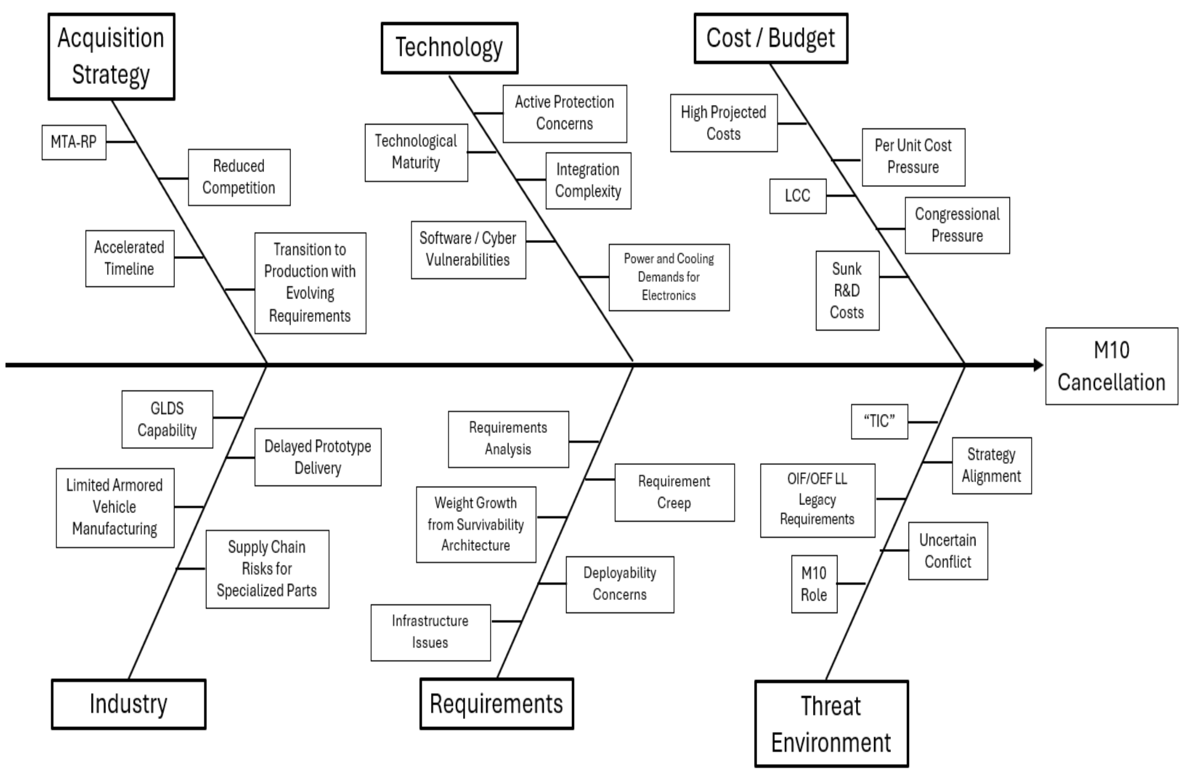

Figure 9. M10 Ishikawa Diagram

A. COST AND BUDGET

The M10 program's first full estimated cost was $6.96 billion, with a unit cost of $18 million, as of 2022 (GAO, 2024). This amount increased in 2023 to a total of $7.39 billion and a unit cost of $19.6 million, which reflects a 4% increase. The total number of quantities did not change, nor did the cycle time (GAO, 2024). By 2024, this number reflected a 1% decrease, with a total acquisition cost of $7.35 billion and a unit cost of $19.5 million (GAO, 2025). The program reported that the total cost decreased due to reduced contractor testing and software maintenance (GAO, 2025). While this decrease in testing was done to control spending and remain as close to baseline as possible, the program accepted additional risk, which may later increase life-cycle costs. This indicates that, despite the program office reporting that the program is currently operating within cost, there could be problems if it continues to face additional delays (GAO, 2025).

Leading up to its cancellation, it was reported that the program had already spent over $1 billion on the light tank between its development and LRIP production, resulting in the production of 26 light tanks (GAO, 2025). In the eyes of Army Secretary Dan Driscoll, the M10 program had fallen victim to the "concept of sunk cost fallacy" where the Service has become "anchored to things that are suboptimal for the future" (Judson, 2025, para. 7). Under the Army transformation initiative, the Army cut multiple programs that it no longer felt would benefit the Service in the long term and stated "The Army will request to reallocate the remaining funds in fiscal year 2025 to accelerate fielding of war-winning capabilities and anticipates additional significant savings to be fully realized within the next 18–24 months" (Judson, 2025, para. 20).

B. THREAT ENVIRONMENT

The M10 program's mission statement was "to procure a light armored vehicle that is capable of providing light Infantry Brigades a protected, long range, precision direct fire capability to neutralize enemy prepared positions and bunkers and defeat heavy machine guns and armored vehicle threats during offensive operations or when conducting defensive operations" (PEO GCS, 2023, p. 5). While the program was on its way to producing a vehicle that met this mission, it faced heavy skepticism about whether it could meet the requirements of the current battlefield. While the United States had spent over 20 years executing counterinsurgency operations, the Army is looking toward the future of large-scale combat operations against military peers. Using the Russia–Ukraine conflict as a model, the light tank was no longer meeting the needs of warfighters. The M10 was challenged for being too light to survive against peer enemy weapon systems and engage medium-to-heavy tanks. Within the ever-changing threat environment and finite resources, the M10 was reevaluated alongside all ongoing programs to determine its place in the future of the military. With the inability to make the platform air-droppable, easily air-moveable, and faster, the program was trapped and could not be reimagined to meet any potential purpose in future operations (Latham, 2025). With the growing threat and capabilities of drone technology, there were also arguments that, with the M10's thinner armor, the vehicle would be unable to combat drone payloads and its cost asymmetry against a swarm of loitering munitions capable of disabling it was not sustainable (Latham, 2025). Thus, the Army has chosen to spend its resources on something that meets current and future needs rather than continuing to fund a program meant to fight the war of "yesteryear" (Latham, 2025, para. 14).

C. TECHNOLOGY

The M10 IOT report results showed only a few areas where the system's requirements were sufficient. The sufficient requirements included the lethality-based KPPs and the key system attributes of neutralization of an enemy bunker and conducting a wall breach (Army Operational Test Command [AOTC], 2025). Other testing areas in which the M10 succeeded were its ability to tow another M10 for easy recovery operations, the ease of tactical integration at the unit level, and the "base to combat configuration" transition in less than 12 minutes after exiting the C-17 (AOTC, 2025, p. 13).

Early assessments of the M10 program attributes were determined to be sufficient in terms of system protection, net-centric capabilities, force support, logistics, and force application (PEO GCS, 2023). According to PEO GCS (2023), the intent was to use non-developmental item solutions, and all technological capabilities were tested and assessed at a TRL eight or higher (PEO GCS, 2023). The vehicle software package would provide the necessary functionality to deliver the required system capabilities (PEO GCS, 2023).

According to the GAO (2020), “Neither MPF nor OMFV [Optionally Manned Fighting Vehicle] held a systems engineering design review before beginning system development due to the prioritization of rapid development” (p. 30). The GAO (2024) determined that two key technical issues that were identified during developmental testing could be resolved by the contractor through redesign and retrofit solutions. The M10 program office also stated, “throughout the development and test process, the program was structured to continue to utilize user feedback to provide technical support and system integration expertise” (GAO, 2024, p. 104). Due to the successful practices of other companies, the program office “used an iterative design approach for development in addition to the program being designed to be rapidly fielded by integrating existing, mature subsystems” (GAO, 2024, p. 104). The GAO (2024) also identified cybersecurity vulnerabilities that the contractor was responsible for fixing. The GAO (2024) determined that the MPF program continued under low technological maturity levels, issues that were previously identified in older programs and acknowledged by the DoD.

The IOT results also revealed several issues and failures with the M10 system. For the purposes of this research, these issues are further broken down into the general categories of maintenance-type issues, technological failures, and low-quality material used.

During IOT, the M10 experienced numerous maintenance-related issues that required attention. Figure 10 shows failures with the center guide, as it is prone to bending instead of feeding into the vehicle’s track system (AOTC, 2025). The center guide feeds into the road wheel from the track, allowing the wheel to pull the track system and move the M10. Another maintenance issue area is the bore evacuator. Testing produced numerous results of fumes flowing back through the turret and into the crew area rather than being expelled outside the system (AOTC, 2025). The crew experienced multiple health concerns, including “difficulty breathing, eye irritation, and nausea” (AOTC, 2025, p. 8). The M10 also experienced turret issues as expended 50-caliber shell casings became wedged between the turret system and the hull of the M10 (AOTC, 2025), depicted in Figure 11. This issue causes the turret to cease, rendering the system to become inoperable (INOP).

Source: Army Operational Test Command (2025)

Figure 10. M10 Center Guide Damage

Source: Army Operational Test Command (2025)

Figure 11. Casing Wedged between Turret and Hull

The test results highlighted other maintenance-type faults that would cause the M10 to become INOP. The transmission control module had reports of fault codes that would cause the engine to stop working during use (AOTC, 2025). This issue required the manufacturer to assist with the transmission control module and determine the reason for the faulty codes. While the M10 was being driven at set speeds, vibrations would cause the driver's hatch to open (AOTC, 2025). The driver's smart display unit did not register the open hatch, and this failure renders the turret INOP while the hatch is open (AOTC, 2025). Finally, testing revealed issues with both internal and external communications (AOTC, 2025). Crews reported instances of intermittent or total loss of communication ability while operating the M10, an issue that must be examined at the unit level.

Technological issues that affected the M10's lethality and maneuverability were also reported during testing. The gunner's primary sight reticle did not appear at all magnifications. The primary and binocular sights could view targets from a range of near to far magnification levels, but the gunner's reticle only appeared at further distance magnifications (AOTC, 2025). This limited the gunner's ability to properly acquire targets at various distances. Also, the M10 system's fire control solutions provided inaccurate data for different round types, and around half of the rounds were assessed as being over-target (AOTC, 2025). One major safety concern dealt with the rear camera causing blind spots when reversing (AOTC, 2025). Blind spots that affected the crew members' ability to see their surroundings while operating the vehicle and without external ground guides limited tactical operations capabilities. Finally, the enhanced laser range finder was frequently reported as INOP due to faulty cables (AOTC, 2025). These faulty cables required field service representative assistance.

Additionally, the IOT results revealed several material-related concerns that caused failures and excess damage to the M10. The final drive bolt had to be disengaged prior to the system being towed by another vehicle; however, when crew members were conducting final drive disengagement, the final drive bolt continuously sheared off (AOTC, 2025). This final drive bolt is shown in Figure 12. Maintainers also had to consistently replace stripped skirt bolts, costing additional time and resources (AOTC, 2024). Other, weaker materials were used for the outer portions of the vehicle. The infantry phone case and bustle rack were damaged after contact with "light brush" in the field environment (AOTC, 2025, p. 11), which can be seen in Figure 13 and Figure 14. Another safety concern was that the side skirt mesh step loop was prone to failure, which could injure Service members as they attempt to climb onto the M10 (AOTC, 2025). The mesh step is shown in Figure 15.

Source: Army Operational Test Command (2025)

Figure 12. M10 Sheared Final Drive Bolt

Source: Army Operational Test Command (2025)

Figure 13. M10 Infantry Phone Case Damage

Source: Army Operational Test Command (2025)

Figure 14. M10 Bustle Rack Damage

Source: Army Operational Test Command (2025)

Figure 15. M10 Side Skirt Mesh Step Failure

D. REQUIREMENTS

The M10 was initially conceived as a mobile, light armored vehicle that could provide IBCTs enhanced protection and firepower against threats that were previously considered overmatch for light infantry units. This new vehicle would provide organic, precision, direct-fire effects against enemies' improved positions and bunkers and could defeat heavy machine guns and armored threats during offensive and defensive operations (PEO GCS, 2023, p. 5). One of the most consistent requirements found during research was that two M10 systems must be transportable by C-17 to "enable initial entry operations" (GAO, 2024, p. 103). Though as the program continued, "the Army Requirements Oversight Council took a look at the 2015 requirements submission and said, never mind, it doesn't need to be loaded onto a C-130, and actually, don't worry about airdropping either" (Myers, 2025, para. 10).

One of the requirements was that the system must support and have sufficient protection for a crew of four Service members against small arms, overhead artillery, and underbelly and side improvised explosive device blasts (AOTC, 2025). The M10 must also use ammunition already in use by the DoD that could neutralize an enemy bunker and conduct a wall breach (AOTC, 2025). The system was to be capable of matching the speed of other vehicles in an IBCT while operating under day, night, and all-weather conditions (AOTC, 2025). Other KPPs and key system attributes included the ability to provide internal and external communications, use established Army logistics and maintenance structure, maintain a 90% or higher operational readiness rate, and have sufficient size, weight, power, and cooling to facilitate integration of tactical network modernization (AOTC, 2025).

After conducting the IOT, results determined the M10 was only capable of successful lethality-based tests such as bunker destruction and wall breach (AOTC, 2025). The M10 had difficulty with many maintenance-based capabilities and technical issues that are described in the previous Technology section of this research. The most regarded reason for the program's cancellation is the excessive weight of the M10 systems, with two M10 systems exceeding the 5,000-pound capability of the C-17 (AOTC, 2025). This increase in weight was explained as requirement creep, in which evolving requirements led to additional weight being added, exceeding initial weight requirements that would have made the M10 a light tank or transportable by air (Buckby, 2025). Buckby (2025) states that the program "failed to deliver a platform that could meet the Army's evolving requirements" (para. 14). New requirements led to an incoherent concept of operations and purpose, which did not allow the M10 to fully integrate into any existing system (Buckby, 2025).

Another source determined that the M10 had a "disconnect between acquisition requirements and operational realities" (Balish, 2025, para. 6). Balish (2025) continues to explain that the Army validates a requirement before any prototyping and "these requirements harden into fixed assumptions, creating bureaucratic momentum that is nearly impossible to halt – until strategic conditions render the system obsolete before it's even fielded" (para. 7). Balish (2025) further explains the system "didn't fit into how infantry brigade combat teams deploy – by truck, rail, or rotary wing, not by C-17 Globemaster III assault drops" (para. 6). The M10 program showed a lack of planning for other important considerations; for instance, "the doctrine, training, facilities and other considerations required to onboard a new system hadn't been finished yet" (Myers, 2025, para. 19). This lack of planning can lead to damage to the infrastructure at installations or the system itself. When the M10 was delivered to warfighters, it was discovered that "8 of the 11 bridges at Fort Campbell would crack under the weight of the 'light tank'" (Myers, 2025, para. 1).

Table 2 provides a summary of the operational effectiveness and suitability for each of the performance KPPs listed in the M10 Modernization Selected Acquisition Report (MSAR). Operational effectiveness is determined based on the individual attributes' ability to support mission effectiveness. Operational suitability is the attributes' ability to sustain performance over the system life cycle.

Table 2. Operational Effectiveness and Suitability for M10 Key Performance Parameters

KPP / Performance Attribute	Effective	Suitable
KPP 1: Force Protection	✓	✗
KPP 2: System Survivability (Kinetic)	✓	✓
KPP 2: System Survivability (Cyber)	✗	✗
KPP 3: Net Ready	✗	✗
KPP 4: Sustainment (Operational Availability (Ao))	✓	✗
KPP 4: Sustainment (Materiel Availability (Am))	✓	✗
KPP 5: Training	✓	✓
KPP 6: Energy (Fuel)	✓	✓
KPP 7: Lethality (Munitions)	✓	✓

E. ACQUISITION STRATEGY

The Army chose the MTA pathway for the M10 to rapidly produce and field a capable vehicle into operational units. The MTA approach may have enabled relatively quick prototyping, but it also brought about risks associated with developing a complex armored vehicle without stable supply chains and mature technology. The GAO (2020) stated that the decision to move into the MTA pathway was intended to "enable rapid prototyping and prioritize getting to production and timely delivery of capability to the field" (p. 13). Subsequently, the Army awarded two firm-fixed-price contracts in December 2018 and required both vendors to operate within the 5-year prototyping timeline (GAO, 2020). The MTA approach did accelerate development but, in turn, reduced the time available for requirements refinement and design stability.

The MTA strategy was carried into the program's transition to production. After the Milestone C decision, the M10 entered LRIP, and the program then transitioned into the MCA pathway (DA, 2022). Army leadership emphasized that the program reached this point in just under 4 years (DA, 2022). Although the program produced prototypes and entered LRIP earlier than anticipated, major test events had not been completed. The Director, Operational Test and Evaluation (DOT&E; 2023), confirmed that testing continued beyond this milestone, with developmental and operational testing extending into FY2024 and FY2025 to support a future full-rate production decision. This indicates that the Army accepted a level of concurrency because production began while testing and evaluation were still ongoing (DOT&E, 2023). In this instance, the concurrency of production and testing increased the likelihood that design changes, performance issues, or sustainment challenges would emerge after production decisions had been made.

The MTA-to-MCA strategy also deliberately reduced competition at a critical decision point in the program's timeline. BAE Systems and General Dynamics were each required to deliver 12 prototypes for evaluation (DoD, 2018). These prototypes informed a down-select to a single vendor, with General Dynamics selected as the contractor for LRIP (PEO GCS, 2023). Although this approach aligned with the MTA's competitive prototyping practices, it led to a loss of competitive pressure during the transition to production. The contract moved away from an environment where competition between two vendors could have driven down prices and enhanced design effectiveness; instead, a sole source was selected to produce a vehicle in which many design and budgetary issues were prevalent. The transition to a sole vendor reduced the government's leverage in cost control and contract negotiations during the program's most expensive phase. In summary, the decision to transition from MTA to MCA Milestone C increased development performance risk, and the use of fixed-price contracts for a complex integration effort was inappropriate given the program's level of uncertainty.

F. INDUSTRY

The industrial base supporting the M10 Booker program was limited from the onset and became concentrated as the program progressed. Although three bids were submitted, only two vendors were chosen (DoD, 2018). This highlights the constrained nature of the U.S. industrial base for tracked armored combat vehicles. The limited competition indicates that even at program initiation, the Army had few viable industry partners capable of delivering the required capability. The concentration had direct implications for program risk. While production activities were distributed across multiple locations, including Lima, OH, Saginaw, MI, and Anniston, AL, all work remained under the direction of a single prime contractor (Office of the Assistant Secretary of the Army [Financial Management and Comptroller], 2024). General Dynamics was responsible for execution and had limited flexibility to address cost, schedule, or production challenges.

The limited depth of the industrial base becomes clearer when looking at later contract activity. A DoD (2024) contract announcement for M10 Booker technical support noted that one bid was received. This action does not automatically determine that there are no other capable producers, but it does show the program is operating in a narrow industrial space. When one pairs that with the original two-vendor competition and the shift to a single producer, it suggests the M10 program faced a concentrated supplier base and was prone to supplier disruptions and reduced flexibility in responding to production or sustainment challenges.

G. SUMMARY

The traceability matrix in Table 3 identifies areas of program success and failure across the three programs analyzed by using common categories derived from each Ishikawa diagram. The research highlights recurring trends across multiple programs. For example, both GCV and FARA experienced significant budgetary challenges that contributed to their cancellation. An evolving threat environment created performance and relevance issues for both M10 and FARA.

Table 3. Program Traceability Matrix

Areas of program success	M10	GCV	FARA
COST / BUDGET	✓	✗	✗
THREAT ENVIRONMENT	✗	✓	✗
TECHNOLOGY	✗	✗	✗
REQUIREMENTS	✗	✗	✓
ACQUISITION STRATEGY	✗	✓	✓
INDUSTRY	✓	✓	✓

Further analysis of the available data indicates a shared root cause across all three programs: low TRLs. Immature technologies introduce compounding risk across cost, schedule, and performance dimensions and drove unfavorable program outcomes. Programs reliant on low-TRL technologies require additional development time, which increases costs and delays reduces a system's ability to remain aligned with a rapidly evolving threat environment. Requirements and acquisition strategies must be adjusted over time to account for the maturation of critical technologies.

The final chapter provides a total summary of findings of the research conducted. This includes lessons learned and recommendations for DoD moving forward on future programs. Additionally, areas of future research are provided for other research teams to explore other avenues or apply the RCA methodology used for the M10 and use it for other programs.

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V. CONCLUSION

This chapter summarizes the analysis conducted on the M10 program using the RCA methodology. The summary covers key takeaways from each M10 category depicted in the M10 Ishikawa diagram to derive lessons learned from the program. Additionally, this chapter presents study limitations arising from data availability and outlines potential paths for future research in areas of interest.

A. SUMMARY OF FINDINGS

The research team identified six primary areas of concern that ultimately influenced the program's cancelation. The six categories analyzed were the acquisition strategy, industry constraints, technology, requirements, cost/budget, and threat environment. These categories enabled the research team to identify the factors that influenced the Army's decision to cancel the program.

The rising program and per-unit costs contributed to the program's cancellation. The program did cut costs, but to the detriment of testing and software maintenance (GAO, 2025). For an unproven vehicle design, in which only prototypes had been developed, the decision to reduce contractor testing inflated the program's risk profile. Although these financial cuts helped keep the program near its cost baseline, the additional risk introduced by reducing testing and software maintenance could have created higher expenses later in the system's life cycle. Furthermore, concerns from Army senior leadership grew about the vehicle's long-term performance and overall value to the force (Judson, 2025). In the end, the Army leadership concluded that continuing the program was not a sound investment because the platform was unlikely to meet future operational needs (Judson, 2025).

The M10 was designed to provide IBCTs with a protected, mobile, direct-fire platform capable of defeating bunkers and light armored threats (PEO GCS, 2023). During the program's timeline, the Army was shifting its focus from counterinsurgency to large-scale conflict against peer adversaries. Concerns grew that the M10 no longer matched the demands of the modern battlefield. At the forefront of the issues was the fact that the system lacked the protection, mobility, and firepower needed to survive against tanks, drones, and precision weapons (Latham, 2025). Furthermore, as the M10's weight increased, the vehicle could no longer meet the requirement of being air-droppable or easily air-transportable (Latham, 2025). This further limited its usefulness in future operations. These factors were among the criteria Army leadership considered when they chose to cancel the program and redirect resources toward capabilities better suited for current and emerging threats.

Initial assessments of the M10's TRL levels determined that all technologies used were at TRL eight or higher (PEO GCS, 2023). The use of high-TRL components was necessary due to the MTA approach and the program's schedule constraints. The program could not afford, in time or money, to develop new technologies to integrate into the platform. The vehicle did see issues with design and technology during IOT. The vendor would have addressed these issues in future iterations (GAO, 2024). The main flaw in the program was not conducting system engineering reviews, such as preliminary and critical design reviews (GAO, 2024). These critical reviews allow the program office and vendor to determine if the architecture is credible, producible, and testable. By foregoing the preliminary design review, the program risked committing to a flawed architecture, as evidenced by the integration of immature, critical technologies, including the level of protection, survivability integration, and net-ready integration (AOTC, 2025). Without the critical design review, the program risked producing an unverified design that would fail to meet KPPs during operational testing. The researchers concluded that these design reviews are the primary mechanisms for risk burn-down and enable programs to shift and fix issues early before they are too expensive and operationally consequential.

The requirements for the M10 changed throughout the system's development. C-17 air-transportable and air-droppable were initial requirements that were disregarded as the system grew in scope, size, and weight (Myers, 2025). Since the protection KPP was necessary, the weight grew to an unfeasible amount for the initial requirements. The research team determined that of the nine KPPs stated in the MSAR, only four were suitable and seven were effective. The M10 program shows that when requirements change and begin to creep beyond their original scope, the program can no longer keep pace with the initial design's intent or operational concept. As protection and survivability were prioritized, requirements grew and had cascading effects on weight, mobility, and deployability. The M10 began to lose its purpose as a value-added asset to light infantry formations.

The chosen acquisition strategy was the MTA pathway, with a transition to the MCA at Milestone C (DA, 2022). In practice, the MTA pathway is intended to have a 5-year prototyping phase and a 5-year fielding phase. This is meant to deliver capability to the warfighter within a shorter timeline than most MCA programs can achieve. In the case of the M10, choosing the MTA pathway limited the amount of research, development, and testing that normally occurs in an MCA program, which has longer time horizons for development. The program was time-constrained, and the issues with the prototype vehicles were a direct reflection of this constraint. The vendor down-select at the transition from MTA to MCA most likely occurred to save money and avoid carrying two vendors into production. Although this is a common tactic in this type of transition, the ultimate result was that the M10 was not fully formed to meet the warfighter's requirements and needs. If two vendors were carried through LRIP and competed up to the FRP decision, the program would have preserved competitive pressure. This action could have led to design maturation and reduced technical and performance risks before committing to a single production solution.

The industry in the United States for developing and producing complex armored vehicles is limited. As with the M10, the government received only three initial bids, and two vendors were selected to provide prototypes (DoD, 2018). From program onset, the industry was a limiting factor. With such a concentrated production base, the risk of these vendors encountering issues was amplified because there were no other options for flexibility. In this case, industry competition and collaboration would have reduced technical and programmatic risks and ultimately benefited the M10.

B. ANSWERING THE RESEARCH QUESTIONS

The research team addressed two primary and one secondary questions regarding the M10 Booker, successfully answering all three using available data.

(1) What are the root causes for the failure of the M10 Booker Program?

While various factors contributed to the program's termination, the decisive cause was the platform's perceived inability to meet the demands of future combat. By canceling the program during LRIP, the Army avoided the sunk cost fallacy, allowing funds to be redirected toward transformation into contact initiatives.

(2) What lessons from past failures like the Future Attack Reconnaissance Aircraft and Ground Combat Vehicle were ignored or repeated in the M10 Booker Program?

Looking at other programs that have been cancelled, such as FARA and GCV, some similarities can be gleaned. While FARA and the M10 shared a similar timeline, FARA was cancelled 1 year before the M10, citing similar reasons for cancellation, such as the evolving battlefield (DiMascio, 2024). Once this issue was identified, the M10 program office should have also undergone requirements review to see if the program was still valid and could have potentially been cancelled before LRIP, which would enable additional resources to be shifted sooner. The GCV program's cancellation provided important financial lessons. At the time of its cancelation, the M10 was operating at baseline and its cost had not grown out of control, but once it became clear that requirements had not been fully met during testing, the cost for rework could have led to cost growth projections and may have become a significant contributing factor to its cancellation.

(3) What lessons can be learned from M10 and implemented across other Army acquisition programs?

Based on lessons learned from the M10 program cancellation, all programs should continue to undergo scrutiny by acquisition decision-makers, with user feedback, to ensure that requirements have not lapsed into obsolescence. To do this, a cyclical and systematic review of all current acquisition programs should be held to ensure that the requirements are validated and meet the needs of the warfighter on the current and future battlefield. Programs must validate the intended tactics, techniques and procedures during these reviews in line within the proposed concept of operations. If programs continue to wait only for milestones or reviews that are based on progress rather than time, programs can go on for years before being identified as obsolete. Additionally, incentivizing professionals to speak out and acknowledge when programs have become irrelevant to the modern battlefield will help ensure that money is not wasted on products that should not be produced. Lastly, it is recommended that requirements are consistently validated and revisited. Had the M10 program been doing this, it could have been identified sooner that the weight of the M10 had exceeded the air transportability requirements and the infrastructure limitations of different military installations.

C. STUDY LIMITATIONS AND AREAS OF FUTURE RESEARCH

The data collected and analyzed for this research was obtained from government open-source databases and unclassified documents. These sources included defense-related news agencies, GAO reports, congressional reports, and available budgetary and initial testing data. Due to the classification levels of the ICD and CDD, the requirements analysis was derived from a conglomeration of the listed sources. The information gathered was entirely interpreted by the research team, and no interviews or surveys were conducted to gain other perspectives on the specifics of the M10 program. The scope of the research is limited due to how recently the M10 program was canceled, and the researchers were unable to find other studies conducted on the M10 post-cancellation. With the cancellation of the program prior to FRP, maintenance data was unavailable to determine the suitability of KPP 4 for sustainment.

Further analysis could be conducted under the CUI classification to gain access to the ICD and CDD documentation from the appropriate program office to determine the alignment of initial and refined requirements throughout the M10 program life cycle. This would help determine if capabilities were aligned with approved requirements or if new requirements were added that shifted away from the baseline. Under higher classification-level documents, future researchers can determine the suitability of the detailed specifications (size and weight) relating to the deployability requirement of the M10 system.

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