ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

Evolving the Software Business of the Acquisition Workforce

June 2023

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ABSTRACT

Software acquisition efforts in the Department of Defense (DoD) continue to impact military services and the Acquisition Workforce (AWF). In 2020, OSD A&S released 5000.87 (*Operation of The Software Acquisition Pathway*), establishing key differences in the software acquisition process to include DevSecOps and Agile software development principles.

This project compared legacy contract-administration software with recent modernization efforts and highlights where progress has been made and where challenges continue to impact effective oversight, cultural norms, and AWF capabilities. Research methods and findings were conducted primarily from the perspective of a DCMA Contract Administrator (CA) and Administrative Contracting Officer (ACO).

Based on the results of this study, evidence exists that the DoD is making progress in software acquisition decisions and work force resources. However, current literature is limited on legacy systems such as MOCAS (Mechanization of Contract Administration Services) and why previous DCMA software modernization efforts were compromised by traditional waterfall models. Findings also suggested that the DoD's pursuit of a comprehensive audit may complicate the speed and messaging required to modernize the DoD and AWF.

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ABOUT THE AUTHOR

LCDR Ronald Parry was raised in Loudoun County Virginia and commissioned via Officer Candidate School (OCS) as a Navy Supply Corps Officer. He holds a B.A. in Psychology from San Diego State University, a M.S. in Contract Management from Naval Post Graduate School and is a recipient of the CDR Philip A. Murphy-Sweet Memorial Award for Excellence in Acquisition. His operational tours include Assistant Supply Officer onboard USS BUNKER HILL (CG 52) and Supply Officer onboard USS FITZGERALD (DDG 62). His ashore assignments include Logistics Support Officer at NAVSUP Fleet Logistics Center Yokosuka Site Marianas, Air Router at Commander Task Force Five Three (CTF 53), and he is currently serving as a Contract Administrator at DCMA Manassas.

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First, I thank God and my family for guiding me throughout my life and career. If I could dedicate this paper to one person, it would be my mother, who passed away in 2020. Mom, thank you for your unconditional love and support in this life, and the next.

To CAPT (Ret.) Jeffrey Dunlap, thank you for introducing me to key concepts and ideas that are central to Software Acquisition reform in the DoD. I look forward to encouraging U.S. Navy Sailors by noting how both Supply and Engineering Duty Officers are aligned in improving the state of DoD software acquisition. Also thank you Professor Robert Mortlock who also guided this project via numerous research efforts at NPS.

To CAPT Chris Kovack, who enabled me to learn the business of the DoD as a DCMA acquisition professional while ensuring I had the bandwidth to meet U.S. Navy education and training requirements in parallel. Also thank you to the countless DCMA workforce professionals whose corporate knowledge and expertise enabled me to seek answers to the right questions. Of course, thank you to General David Bassett, for giving a fresh LCDR the opportunity to shadow a three-star flag officer at DCMA HQ.

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TABLE OF CONTENTS

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LIST OF FIGURES

LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

4ENO	Fourth Estate Network Optimization
AAF	Adaptive Acquisition Framework
ACO	Administrative Contracting Officer
ADA	Antideficiency Act
AWF	Acquisition Workforce
AWS	Amazon Web Services
BA-8	Budget Activity 8
CA	Contract Administrator
CAC	Common Access Card
CAMS	Contract Administration Management System
CAS	Contract Administration Services
CI/CD	Continuous Integration, Continuous Delivery
COE	Common Operating Environment
COTS	Commercial-Off-the-Shelf
CR	Continuing Resolution
CRR	Contract Receipt and Review
DAAS	Defense Automatic Addressing System
DCASRs	Defense Contract Administration Service Regions
DCMA	Defense Contract Management Agency
DevSecOps	Development, Security, and Operations
DIB	Defense Innovation Board
DISA	Defense Information Systems Agency
DIS	Data Integrity Screenings

DFARS	Defense Federal Acquisition Regulation Supplement
DFAS	Defense Finance and Accounting Service
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPC	Defense Pricing and Contracting
DWCF	Defense Working Capital Fund
EDA	Electronic Document Access
FAR	Federal Acquisition Regulation
FDD	Final Delivery Date
FIAR	Financial Improvement and Audit Readiness
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
GEX	Global Exchange
GOTS	Government-Off-the Shelf
HQ	Headquarters
IaaS	Infrastructure as a Service
IDIQ	Indefinite Delivery Indefinite Quantity
IG	Inspector General
IL-5	Impact Level 5
IS	Industrial Specialist
IT	Information technology
IWMS	Integrated Workflow Management System
JCIDS	Joint Capabilities Integration and Development System

JPMO	Joint Program Management Office
KCR	Key Contract Requirement
KSD	Key Supporting Document
LOE	Line of Effort
MCC	MOCAS Contract Closeout
MDO	Modifications and Delivery Orders
MOCAS	Mechanization of Contract Administration Services
NAVSUP	Navy Supply Systems Command
NDAA	National Defense Authorization Act
NFR	Notices of Findings and Recommendations
O&M	Operations and Maintenance
OIG	Office of Inspector General
OSD	Office of the Secretary of Defense
P2P	Procure-to-Pay
PA	Property Administrator
PBIS	Procurement Business Intelligence Service
PCO	Procurement Contracting Officer
PIEE	Procurement Integrated Enterprise Environment
PM	Program Manager
PPBE	Planning, Programming, Budgeting, and Execution
PT	Procurement Technician
PWS	Performance Work Statement
QAR	Quality Assurance Representative
RDT&E	Research, Development, Test, and Evaluation
RFI	Request for Information

SDW	Shared Data Warehouse
SECDEF	Secretary of Defense
SMP	Strategic Management Plan
SOD	Segregation of Duties
SWAP	Software Acquisition and Practices
SWP	Software Acquisitions Pathway
TA	Trusted Agents
ULO	Unliquidated Obligated Funds
WAWF	Wide Area Workflow

I. INTRODUCTION

The Department of Defense (DoD) and Acquisition Workforce (AWF) continue to face challenges in the field of software acquisition and information technology (IT) modernization efforts. For decades, the DoD has struggled to integrate software acquisition efforts with congressional oversight that supports doing business at the speed of relevance. The DoD's "Valley of Death" is a phrased coined to reference to the arduous journey vendors must travel to generate a prototype or commercially available product for a DoD contract (LAndreth, 2022). The speed vs. oversight challenge is amplified by the size and complexity of the DoD which accounts for trillions in appropriated funds which are subject to Continuing Resolutions (CR) and complex Planning, Programming, Budgeting, and Execution (PPBE) relationships and regulations.

Nonetheless, modernizing the tools and resources of the AWF remains essential to supporting effective oversight and decision making within the DoD. However, the abundance of legacy systems withing the department remains a formidable challenge to progress. This study focuses on the resources and systems utilized by the AWF and the Defense Contract Management Agency (DCMA) and provides a good sample size of both legacy and ongoing software modernization efforts. This study also examines how overarching DoD strategies interact with current AWF priorities and performance goals. Finally, this study examines how the increased visibility of a comprehensive DoD audit complements initiatives to modernize legacy networks, infrastructure, and AWF resources. A major goal of this research is to provide objective visibility of current AWF software capabilities and limitations.

A. CONTRACT ADMINISTRATION AND DCMA

We begin by introducing the field of Contract Administration and the mission of the Defense Contract Management Agency (DCMA). Contract Administration focuses on the Post Award Phase of the Acquisition life cycle, which requires continuous surveillance of contract deliverables, appropriated funds, and government acceptance of contracted supplies and services. DCMA supports customers by administrating contracts that are awarded by buying commands (e.g., NAVSUP, DLA) to DoD contractors (e.g.,

Raytheon, Boeing, Lockheed Martin). It is worth noting that buying commands routinely award contracts via warranted Procurement Contracting Officers (PCO) while DCMA administers contracts via warranted Administrative Contracting Officers (ACOs). The Federal Acquisition Regulation (FAR) Part 42 further delineates the scope of PCO and ACO interactions in supporting Contract Administration Requirements (FAR 42, 2023). DCMA.mil writes,

> The agency manages 225,000 contracts, valued at more than $3.5 trillion, at 15,000 contractor locations worldwide. Each business day DCMA receives approximately 1,000 new contracts and authorizes more than $900 million in payments to contractors while providing a variety of contract administration services to the DoD. The agency provides contract administration services for the Defense Department, other federal organizations and international partners, and is an essential part of the acquisition process from pre-award to sustainment. (DCMA, 2023)

B.   PURPOSE AND METHODS

The goal of this research is to assess software acquisition efforts within the DoD with emphasis on the AWF. By comparing legacy contract administration tools with recent modernization efforts, this study illustrates why many software programs in the AWF remain problematic while others have made considerable progress. Cultural and fiscal factors within the AWF and DoD are also addressed. The data and resources examined in this study were conducted primarily via the perspective of a DCMA Contract Administrator (CA) and Administrative Contracting Officer (ACO).

C.   RESEARCH QUESTIONS

This study examined the following research questions:

1.   What factors impacted DCMA's ability to modernize contract administration capabilities via IWMS software?
2.   What efforts have been successful in modernizing DCMA contract administration software tools?
3.   What factors continue to limit modernization within the acquisition workforce?

The primary goal in answering these questions is increasing software acquisition competency within the DoD and AWF. By increasing visibility of current AWF system

capabilities and constraints this study seeks to align strategic goals of the DoD with current oversight authorities and modern software developers.

D.   FRAMEWORK

This study consists of five chapters. Chapter I introduced our research purpose, methods, and questions. Chapter II reviews existing literature on DoD software acquisition, DoD strategic goals, and how software modernization efforts correlate with Financial Improvement and Audit Readiness (FIAR) policies in support of a comprehensive DoD audit. Chapter III dives into current challenges with AWF software tools by analyzing the capabilities and limitations of current DCMA contract administration tools. Chapter IV shifts our analysis to successful AWF modernization efforts and what has enabled them. Chapter V summarizes research findings and offers recommendations to complement future DoD strategies and software acquisition strategies.

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II. BACKGROUND AND LITERATURE REVIEW

A. THE INTEGRATED WORKFLOW MANAGEMENT SYSTEM (IWMS)

In 2018 a DoD Inspector General (IG) report stated, "DCMA contracting officials did not properly administer IT service contracts for 13 of 14 contracts valued at $70.3 million" (DoD IG, 2018). The IG report listed problems in the development, award, and sustainment of the contract. The IG report found DCMA did not administer IT service contracts in the following areas:

- Properly define requirements that include measurable performance standards.
- Consistently train, appoint, or terminate Contracting Officer Representatives.
- Develop adequate or quality assurance surveillance plans.
- Properly accept and approve invoices for contractor services. (DoD, 2018)

The report asserted that DCMA should increase its surveillance efforts, as the agency did not substantiate it received the IT and software services paid for. The report recommended stricter internal controls, more definitive Performance Work Statements (PWS), and additional training across the DCMA workforce (DoD IG, 2018). The IWMS software modernization effort would also result in an Antideficiency Act (ADA) violation when a Research Development Testing & Engineering (RDT&E) appropriation was used in place of Operations and Maintenance (O&M) funding. DCMA reported the ADA violations for fiscal years 2013–2016 (GAO, 2021).

The software program Integrated Workflow Management System (IWMS) linked to the report was intended to modernize DCMA contract administrative tasks and improve workforce capabilities. In 2016, DCMA announced, "The Integrated Workload Management System is just over a year old and is already transforming the way the Defense Contract Management Agency does business. With the deployment of IWMS 3.0, new features and capabilities take the agency to the next level of automation and efficiency in contract administration" (DCMA, 2016). In the end IWMS would not achieve many of its desired outcomes and the current program represents another incomplete software modernization effort in the DoD. However, the challenges with

IWMS illustrate many factors to consider as calls to modernize software and AWF resources in the DoD gain traction.

B. THE SOFTWARE ACQUISITION PATHWAY RISES

We begin by noting DoD software acquisition challenges have existed for decades prior to DCMA's challenges with the IWMS. In 2019, the Defense Innovation Board (DIB) conducted the Software Acquisition and Practices (SWAP) study and released a report titled *Software Is Never Done: Refactoring the Acquisition Code for Competitive Advantage* (DIB, 2019). The report was generated pursuant to the 2018 National Defense Authorization Act (NDAA) and provided numerous recommendations to improve the DoD's record in software acquisition outcomes (DIB, 2019). The study referenced numerous reports that were published over the previous 37 years, shown in Table 1.

Table 1.   Prior Reports on DoD Software. Adapted from DIB (2019).

Date	Org	Title
Jul'82	DoD	Joint Service Task Force on Software Problems
Sep'87	DSB	Task Force on Military Software
Dec'00	DSB	Task Force on Defense Software
Feb'08*	NCMA	Generational Inertia: An Impediment to Innovation?
Mar'09	DSB	Task Force on DoD Policies & Procedures for the acquisition of Information Technology
2010a	NRC	Achieving Effective Acquisition of Information Technology in the Department of Defense
2010b	NRC	Critical Code: Software Producibility for Defense
Dec'16	CNA	Independent Study of Implementation of Defense Acquisition Workforce Improvement Efforts
Feb'17	SEI	DoD's Software Sustainment Study Phase I: DoD's Software Sustainment Ecosystem
Feb'18	DSB	Design and Acquisition of Software for Defense Systems
2018	NDAA'16	Section 809 Panel Streamlining and Codifying Acquisition.
Apr'19	DIB	Software Is Never Done; Refactoring the Acquisition Code for Competitive Advantage (this document)

Moving forward we will reference the 2019 DIB findings as the Software Acquisition and Practices (SWAP) report. A key finding of the SWAP report is that DoD systems that assess software like hardware ultimately compromise the relationship between oversight, speed, and security. The SWAP report writes, "A large amount of DoD's software takes too long, costs too much, and is too brittle to be competitive in the

long run" (DIB, 2019). Central to the SWAP report's urgency, is that the National Security and competitive advantage of the United States has been compromised due to antiquated software acquisition methods. The SWAP study proposed four primary lines of effort to improve software acquisition in the DoD, shown in Table 2.

Table 2.   SWAP Study Lines of Effort (LOE). Adapted from DIB (2019).

LOE (lead)	Description
A (Congress & OSD)	Refactor statutes, regulations, and processes for software
B (OSD & Services)	Create and maintain cross-program/cross-Service digital infrastructure
C (Services & OSD)	Create new paths for digital talent (especially internal talent)
D (DoD & Industry)	Change the practice of how software is procured and developed

The SWAP lines of effort addressed limitations with waterfall structured programs within the DoD. Traditional waterfall acquisition methods operate in a linear and sequential manner. Conventional acquisition methods are governed by Joint Capability Integration and Development System (JCIDS) requirements and program funding constraints that are subject to the Planning, Programming, Budgeting, and Execution (PPBE) procedures. Major DoD program performance is routinely assessed based on adherence to baseline milestones within the Adaptive Acquisition Framework (AAF). This ensures requirements are clearly defined and scheduled to support effective oversight and allocation of resources (e.g., appropriation categories). Traditional waterfall methods emphasize fixed contract scope but allow some flexibility in program cost and schedule. However, a serious limitation of traditional waterfall programs is the speed that they progress and their ability to correct initial mistakes. The SWAP report emphasized that speed and cycle time are vital in software development because software is fundamentally different from hardware. The SWAP report critiques the speed of traditional DoD waterfall structured programs and milestones because by the time waterfall software programs successfully test and deploy software, it is no longer relevant to the current user environment or needs. (DIB, 2019). Additional details illustrate why traditional DoD models are ill-suited for software. The SWAP study writes,

Over the years, Congress and DoD have established a sophisticated set of statutes, regulations, and instructions that govern the development, procurement, and sustainment of defense systems. This process evolved in the context of the Cold War, where major powers designed and built aircraft carriers, nuclear weapons, fighter jets, and submarines that were extremely expensive, lasted a very long time, and required tremendous access to capital and natural resources. Software, on the other hand, is something that can be mastered by a ragtag bunch of teenagers with very little money—and can be used to quickly destabilize world powers. Currently most parts of DoD develop, procure, and manage software like hardware, assuming that it is developed based on a fixed set of specifications, procured after it has been shown to comply with those specifications. (DIB, 2019)

As industry and commercial software requirements accelerated, waterfall software program management methods were discarded because they could no longer keep pace with the speed and complexity of modern software demands. As a result, modern approaches to software evolved to embrace methods known as Agile Software Development. Agile development requires flexible, iterative (i.e., continuous) means in developing software and requires developers to deliver working capabilities to users earlier than traditional methods. Agile methods integrate planning, design, development, and testing continuously throughout a program's life cycle, and have the capability to support deliveries within days (60 to 90 days at max). Each software iteration mitigates new challenges and improves capabilities based on continuous feedback from program stakeholders and users (GAO, 2023). Figure 1 illustrates the difference between traditional software development and agile software development models. Worth recognizing is the waterfall model is far more compatible with traditional DoD appropriations, oversight policies, and cultural norms.
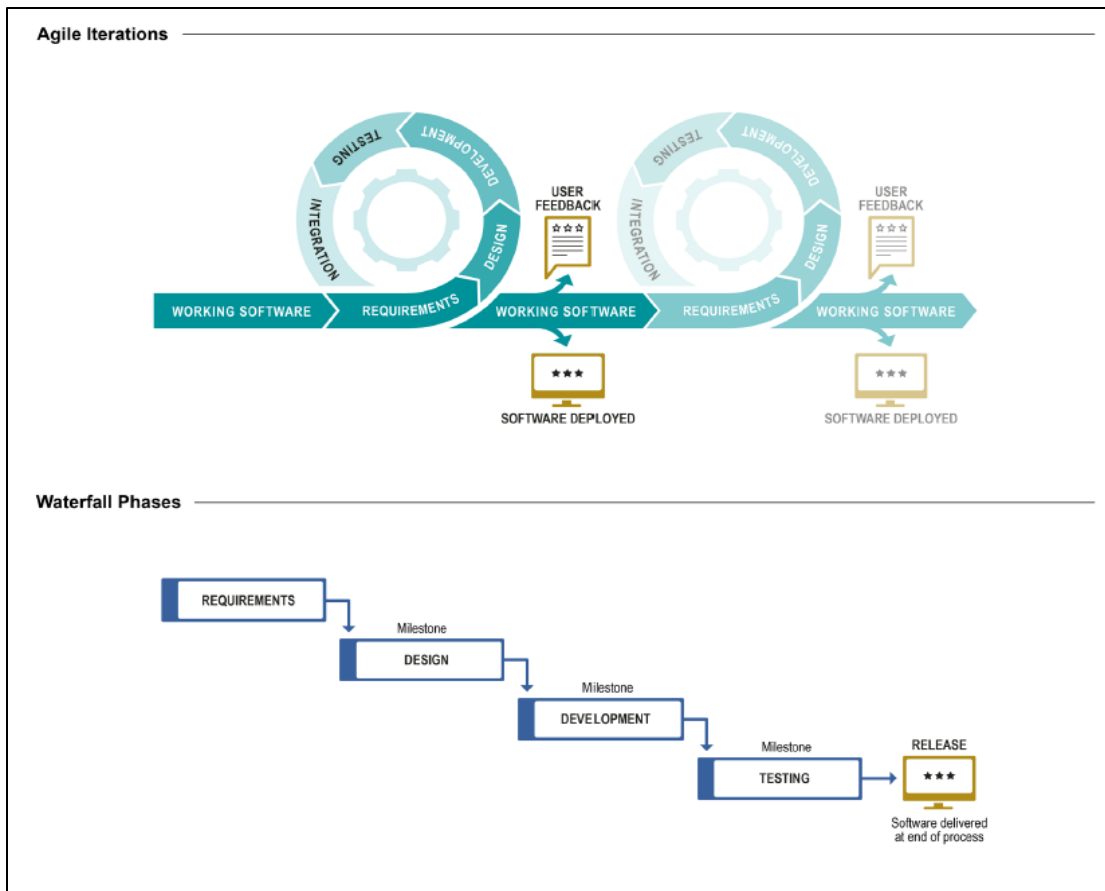
Figure 1.   Comparison of Agile and Waterfall Frameworks for Developing
Software. Source: GAO (2023).

Progress arrived in 2020 with the release of DoDI 5000.87, Operation of the
Software Acquisition Pathway. The 5000.87 created a software tailored pathway under
the Adaptive Acquisition Framework (AAF) as referenced in Figure 2. The Software
Acquisition Pathway (SWP) addressed many challenges that disrupted generations of
software acquisition programs and efforts throughout the DoD. First, the SWP is not
subject to the Joint Capabilities Integration and Development System (JCIDS). JCIDS is
designed to provide baseline requirements for program requirements across the DoD
while supporting oversight in a joint military environment (DAU, 2023). The 5000.87
states programs utilizing the SWP must not be categorized as major defense acquisition
programs, must demonstrate viability sooner, and must deliver new capabilities faster
(DoD, 2020).

Several fundamental concepts in modern software acquisition would also be
addressed in the SWP. The SWP reinforced that government and contractor software

efforts must utilize modern software development methods and techniques to the maximum extent possible. The SWP defines modern software development as "Practices (lean, agile, DevSecOps) that focus on rapid, iterative development and delivery of software with active user engagements. Small cross-functional teams integrate planning, design, development, testing, security, delivery, and operations with continuous improvement to maximize automation and user value" (DoD, 2020). There is a lot to unpack in that definition which is reinforced by recent AWF efforts in this study.
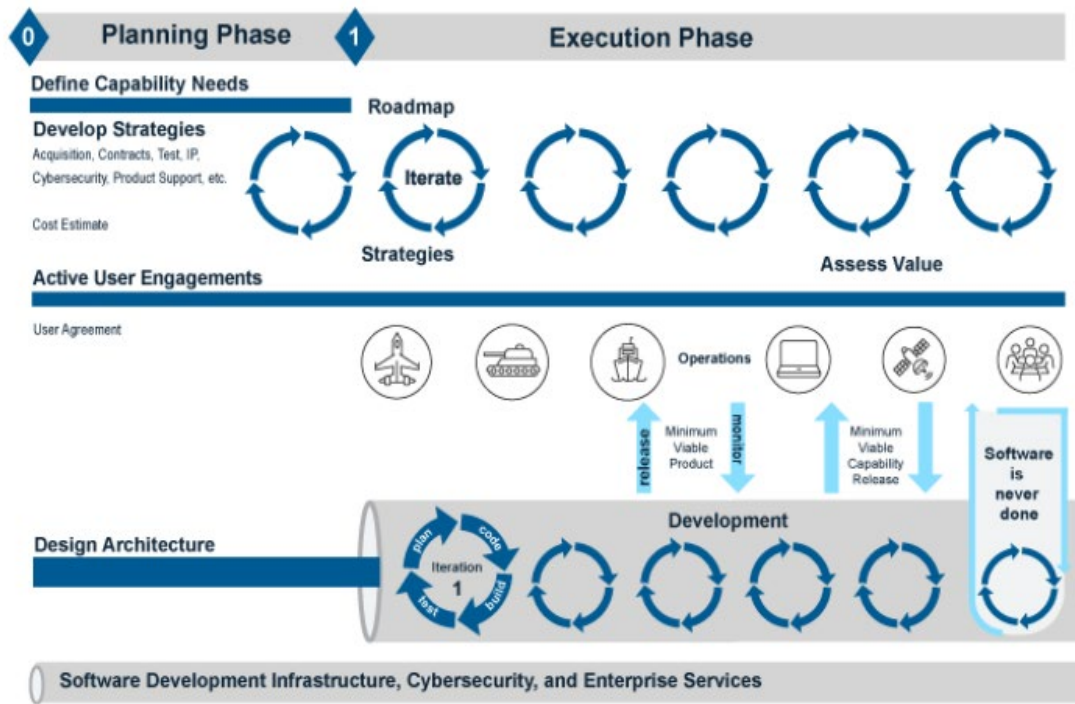
Figure 2.   Software Acquisition Pathway (SWP). Source: DoD (2020).

C.   DOD STRATEGY – FORCES OF MODERNIZATION

Research on DoD software acquisition and modernization benefits from a review of forces referenced in the FY22–26 DoD Strategic Management Plan. The latest document lists four primary strategic goals and objectives, which are illustrated in Figure 3. The range of topics in this document is vast, but we will focus on several key points that correlate with software modernization efforts in the DoD and AWF.

First the Strategic Management Plan (SMP) reinforces that achieving auditability is as a top priority of the DoD. Strategic Objective 4.3 states, "reducing outdated

regulations and policies, ensuring data integrity, increasing automation, and streamlining our standard system capabilities, so financial managers have total funds visibility and can resource defense mission capabilities faster and with agility" (DoD, 2022). The document emphasizes that every dollar matters in supporting our nation's national security efforts. Also relevant to our discussion is Strategy Goal 4, which includes efforts to reduce the number of legacy financial systems in the DoD in support of auditability (DoD, 2022).

Figure 3.   FY22–26 Strategic Goals and Objectives. Source: DoD (2022).

The performance targets underlying Strategic Goals 1 and 4 illustrate that audit readiness in the DoD intersects with efforts to consolidate DoD networks and services. Performance goal 1 states, "The current DoD consists of independently designed and managed network architecture in a resource constrained environment that operates without a Departmentwide strategic vision affecting substantial inefficiencies in cost, manpower, and overhead limited without a common platform" (DoD, 2022). Next, we'll examine initiatives to modernize DoD networks and infrastructure.

D.   DISA AND NETWORK CONSOLIDATION FORCES

Research on software acquisition and modernization also benefits from a brief analysis of current IT network resources and stakeholders. We begin by reviewing the capabilities of The Defense Information Systems Agency (DISA). Today DISA consists of over 7,000 military and civilian employees who support DoD networks and infrastructure (DISA, 2023). DISA provides the following budget information, "DISA has a total budget of $11.9 billion and receives funding through both congressional

appropriations of $3.4 billion and a Defense Working Capital Fund (DWCF) of $8.5 billion" (DISA, 2023).

This study examines intragovernmental business relationships between working capital funds (WCF) and mission funds relative to modernization efforts in the DoD. Unlike a direct appropriation of mission funds from congress to a service (e.g., Department of the Navy), WCF relies on revenue generated via intragovernmental agreements and transactions (e.g., DISA IT services provided to DCMA). Additional mission funding and WCF interactions will be reviewed later in this study.

In line with DoD consolidation efforts, DISA initiated the Fourth Estate Network Optimization (4ENO) effort. DISA provides the following overview of the 4ENO initiative, "DoD is looking for solutions to eliminate unnecessary complexity within the information technology space. The Deputy Secretary of Defense designated the Defense Information Systems Agency as the single service provider to optimize network capabilities for Fourth Estate Defense Agencies and Field Activities. This optimization effort will modernize the DoD IT architecture, reduce costs, improve business practices and mitigate operational and cyber risks" (DISA, 2020). A concise summary of 4ENO benefits and stakeholders is exhibited in Figure 4. Notable stakeholders referenced in this study include DISA, DCMA, DFAS and DLA.

DCMA's transition from internally managed IT resources to DISA began in 2018. The 2018 DCMA director provided the following statement, "This move will bring our agency in line with the larger DoD construct, we will have enterprise level capabilities as the platform we use to conduct business, from communications via email and mobile phones, to DoD-approved applications" (Lewis, 2018). While the transition was necessary, there is still much progress to be made in providing sufficient network capacity for DCMA users. At the time of this study DCMA users continue to experience network bottlenecks relative to user demand. These effects are amplified for AWF professionals who routinely require continuous CAC authentication for multiple DoD systems and databases in parallel.

Figure 4.   Fourth Estate Network Optimization. Source: DISA (2020).

E.   FIAR INTERACTIONS WITH DOD MODERNIZATION

Before diving into specific software efforts at DCMA, recognizing the impact of Financial Improvement and Audit Remediation (FIAR) on the AWF provides valuable context to research findings. The purpose of DoD audits is to determine whether the DoD and its components present financial statements that are in accordance with U.S. Generally Accepted Accounting Principles (GAAP) (DoD, 2022).

The DoD Financial Improvement and Audit Remediation Report writes, "Fiscal year (FY) 2021 marked the fourth consecutive year the Department of Defense (DoD) completed DoD-wide financial statement audits, including standalone financial statement audits conducted by independent public accounting firms and the consolidated Agency-wide audit performed by the DoD Office of Inspector General (OIG). Although progress over these four years has been mostly steady, it must be accelerated to meet Defense leaders' needs for accurate and timely information on the Department's fiscal position"

(DoD, 2022). The FIAR report concludes that data integrity and acceptable audit opinions are the only measures of success in meeting financial management expectations of DoD strategic partners (DoD, 2022). FIAR compliance is central to comptroller support and oversight of AWF efforts.

Complementary to contracting officer decisions in the Acquisition workforce are audit findings and opinions. The FY2021 DoD FIAR report writes, "Nine DoD Components received unmodified opinions, one received a qualified opinion. Others other received a disclaimer of opinion, meaning the auditor was unable to obtain sufficient evidence to support an opinion. The DoD also received a disclaimer of opinion for its consolidated financial statement audit" (DoD, 2022).

After release of the FIAR report, the DoD Inspector General released a report titled, *Understanding the Results of the Audit of the FY 2021 DoD Financial Statements*. The report notes that while auditors do assess internal controls, they do not provide an opinion on their overall effectiveness. The report writes "auditors issue notices of findings and recommendations (NFRs) to help the DoD understand and address internal control deficiencies [preventing detection or correction of errors]" (DoD, 2022). Figure 5 lists the three classifications of audit deficiencies in internal controls and Table 3 provides a summary of various audit opinions. The FY21 FIAR report documented 28 material weaknesses, 3,340 notices of findings and recommendations (NFRs), and 2,600 corrective action plans (DoD, 2022).

Table 3.   Understanding Types of Audit Opinions. Adapted from DoD IG (2022).

Auditor Opinion	Description
Unmodified (Clean opinion)	Auditors express an unmodified opinion, sometimes referred to as a clean opinion, when they conclude that management has presented the financial statements fairly and in accordance with GAAP.
Qualified (Modified option 1)	Auditors obtain sufficient and appropriate evidence and conclude that material misstatements are not pervasive to the financial statements.
Qualified (Modified option 2)	Auditors are unable to obtain sufficient appropriate evidence to support an opinion but conclude that the possible effects of undetected material misstatements on the financial statements are not pervasive.

Adverse	Auditors express an adverse opinion when they conclude that misstatements are both material and most likely widespread in the financial statements.
Disclaimer of opinion	Auditors express a disclaimer of opinion when they are unable to obtain sufficient appropriate evidence to support an opinion and conclude that the possible effects of undetected misstatements on the financial statements could be both material and pervasive.

Deficiency in Internal Control	A deficiency in the design or operation of a control exists when it does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis.
Significant Deficiency	A deficiency, or a combination of deficiencies, in internal control over financial reporting that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.
Material Weakness	A deficiency, or a combination of deficiencies, in internal control over financial reporting that results in a reasonable possibility that management will not prevent, or detect and correct, a material misstatement in the financial statements in a timely manner.

Figure 5.   Three Classifications of Deficiencies in Internal Control. Source: DoD IG (2022).

A study titled, Evaluating the Impacts of Federal Improvement and Audit Readiness (FIAR) Compliance (Lucyshyn & Hunt, 2021) complements many findings in this research. The study explored how FIAR centered policies are applied in the DoD. Moving forward we will reference this paper as the FIAR study. The FIAR study discussed key differences between financial, budgetary, and managerial account practices which impact oversight of the AWF workforce and organizational efforts. Fundamental to the work of the AWF is the capability to document fiscal and material data (i.e., findings) in support of contracting officer determinations (i.e., decisions). As a result, many accounting concepts are routinely applied when assessing workload efforts within the acquisition community. Exploring the differences between financial, budgetary, and managerial accounting illustrates strengths and weaknesses of various accounting methods.

The FIAR study notes the objective of financial accounting focuses on documenting past events in support of oversight requirements. The study notes that public companies publish financial data as required and to assure interested parties (Lucyshyn & Hunt, 2021). While financial accounting is aligned with most audit requirements, government agencies depend on budgetary accounting via congressional appropriations, laws, and guidance from the Comptroller General. In effect, government spending prioritizes fiscal law and avoids ADA violations at all costs (Candreva, 2004). Managerial accounting is geared towards current operations and supports real-time decision making. This also gives Managerial accounting strategic value in planning and meeting future goals (Lucyshyn & Hunt, 2021). Table 4 from the FIAR study illustrates key differences between financial and managerial accounting.

Table 4.   Comparison of Financial and Managerial Accounting. Source: Lucyshyn and Hunt (2021).

	Financial Accounting	Managerial Accounting
Purpose	Communicate Financial Status to external Stakeholders	Assist Internal Management with decision making
Primary User	Investors, regulators, tax authorities	Management and internal decision makers
Focus	Historical perspective, past fiscal year	Emphasis on future decisions
External Review	Independent Auditors and or Regulators	None required
Regulatory Guidelines	Must follow procedures outlined in GAAP	Need not follow GAAP, can be tailored to needs
Scope	The entire organization	Narrow – single segment of the organization, a program, project, etc.

The FIAR study also confirmed the value of audits has been debated among experts. Former DoD comptroller and Harvard Professor Robert N. Anthony argued that emphasis on budget accounting with appropriation procedures is more relevant to than financial or expense-based accounting (Lucyshyn et al., 2021). The FIAR study cites Harvard professors (Kaplan & Cooper) who assert "financial accounting systems are

"completely inadequate [for cost analysis or business system improvements]" (Lucyshyn et al., 2021). Additionally, the value of financial audits in the DoD had been debated since government agencies do not follow a profit driven business model (Lucyshyn et al., 2021).

Despite the limitations of applying GAAP principles within the DoD, experts in the FIAR study do recognize an inherent value to audits. Despite any limitations, audits still engage organizations and management with current systems and workforce capabilities. The FIAR study cites research (Vanstraelen & Schelleman) that notes audits deter fraud and mismanagement by assessing workforce and managerial performance (Lucyshyn et al., 2021). The FIAR study also cites former DoD Comptroller, David Norquist, "The financial statement audit helps drive enterprise-wide improvements to standardize our business processes and improve the quality of our data" (Norquist, 2018). One of the most significant contributions that audits have provided the DoD is documenting the need to modernize DoD IT and business systems (Lucyshyn et al., 2021).

F.   SUMMARY

In Chapter II we reviewed the history of DCMA's IWMS software modernization effort and related DoD oversight agency findings. We reviewed the historical challenges with DoD software efforts and highlighted recent policy challenges that have yet to fully materialize. We assessed DoD strategies that seek to consolidate DoD resources to promote efficiency and auditability. We reviewed DISA's role in supporting the network infrastructure required for software programs within the AWF. Finally, we examined how FIAR compliance in central to oversight and support for programs within the AWF. Next, we will dive into the front lines of DCMA and AWF software challenges.

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III. DCMA ANALYSIS PART 1 – CHALLENGES

A. WHAT IS MOCAS?

This study finds the most important legacy system in DCMA contract administration is the Mechanization of Contract Administration Services (MOCAS). An article in MIT's Technology Review provides historical context on MOCAS, "In 1958, the United States Department of Defense launched a computerized contract-management system that it dubbed Mechanization of Contract Administration Services, or MOCAS (pronounced "MOH-cass"). The system was designed to use the latest in computation and output technology to track contracts in progress and payments to vendors. Fifty-seven years later, it's still going" (Fleishman, 2015). At the time of this study, no effort to replace MOCAS has been successful. DCMA summarizes MOCAS capabilities as follows:

- Financial data for buying commands, funding offices, and inventory managers
- Payment data to contractors or their designee
- Reports to the military departments for transmission to the Office of the Secretary of Defense (OSD), the Treasury, or General Accountability Office (GAO)
- Closed contract information, as prescribed by the Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS)
- Contract Schedule, Shipment, Modification, Disbursements, Quality Assurance, and Property Data. (DCMA, 2022)

What was revolutionary about MOCAS in 1958? Other than 16K central processing units and card readers/punchers, MOCAS was the only integrated contract administration and payment system; MOCAS data was stored on 11 mainframes across 11 Defense Contract Administration Service Regions (DCASRs). Figure 6 illustrates a recent model of the range of systems that exchange data with MOCAS. It quickly becomes evident that any effort at modernizing DoD business systems requires integration with MOCAS. A historical timeline of MOCAS efforts is provided in Table 5. As of this study JPMO sustainment efforts are ongoing, but modernization is delayed (DCMA, 2023).
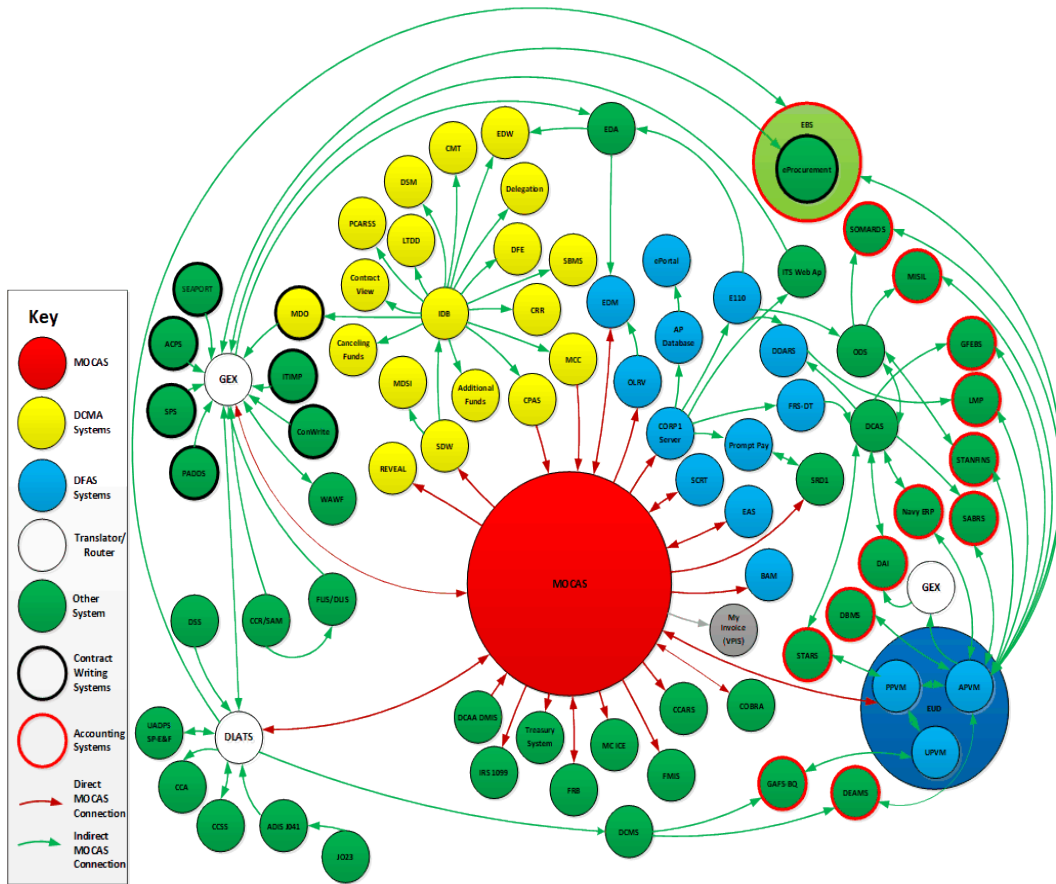
Figure 6.   MOCAS System Interfaces. Source: DCMA (2022).

Table 5.   History of MOCAS. Adapted from DCMA (2023).

Date(s)	Event Description
1958	MOCAS designed by planning group of Army, Air Force, and Navy Reps using Air Force data automation proposal for Project PIC
1985	MOCAS begins batch and online processing
1990-1991	Moved to single mainframe in Colombus OH, run by DISA, when DFC/DFAS stand up as payment authority
1990s	30 years into life cycle, MOCAS costs increase
2000	SECDEF memo announces MOCAS retirement date of Oct 1, 2002.
2002	MOCAS retirement not achieved. New systems unable to replace MOCAS
2005	MOCAS mainframe moved to DISA office in Ogden
2016	MOCAS designated as a target system (requires modernization) Life Cycle program stood up under DFAS/DCMA Joint Program Management Office (JPMO)
2017	Plan to invest in MOCAS modernization and sustainment over next 10 years
2023	JPMO sustainment efforts ongoing, modernization delayed

Despite its impact, discussion on MOCAS is relatively limited in contemporary

DoD oversight reports and strategic documents. Clearly, MOCAS is a prime target in the

DoD modernization debate considering the influence a program created in the 1950s has on the DoD in 2023. Interoperability with MOCAS and how DCMA and DFAS track and disburse trillions in DoD funds is a major component of the AWF software ecosystem. The MOCAS support contractor, Solutions By Design (SBD) writes, "MOCAS is an automated integrated contracts administration and entitlement system jointly managed DCMA (65%) and DFAS (35%). MOCAS supports DCMA Contract Administration Offices, DFAS Contract Pay, Procurement Offices and Funding Stations. MOCAS has been an enterprise solution supporting the management and payment of DoD contracts" (SBD, 2023). Solutions by Design currently supports MOCAS operations via the IDIQ contract S5121A-16-D-0005.

A DCMA Request for Information (RFI) titled Mechanization of Contract Administration Services (MOCAS) Legacy System Modernization provides additional background and urgency for future modernization efforts. The RFI reinforces the scope and impact has MOCAS on many contract administration functions across the DoD (DCMA, 2022). Table 6 and Figure 7 illustrate FY21 and FY22 data from the MOCAS modernization RFI.

Table 6.   MOCAS Magnitude of Operations. Source: DCMA (2022).

	Fiscal Year (FY) Ending: 2021	Fiscal Year (FY) To Date: 2022
Active Contracts	279,827	279,874
Active Contractors	17,148	17,043
Dollars Obligated	$2.50 Trillion	$2.55 Trillion
Invoices Processed	711,587	263,042
Disbursements	$219.75 Billion	$86.89 Billion
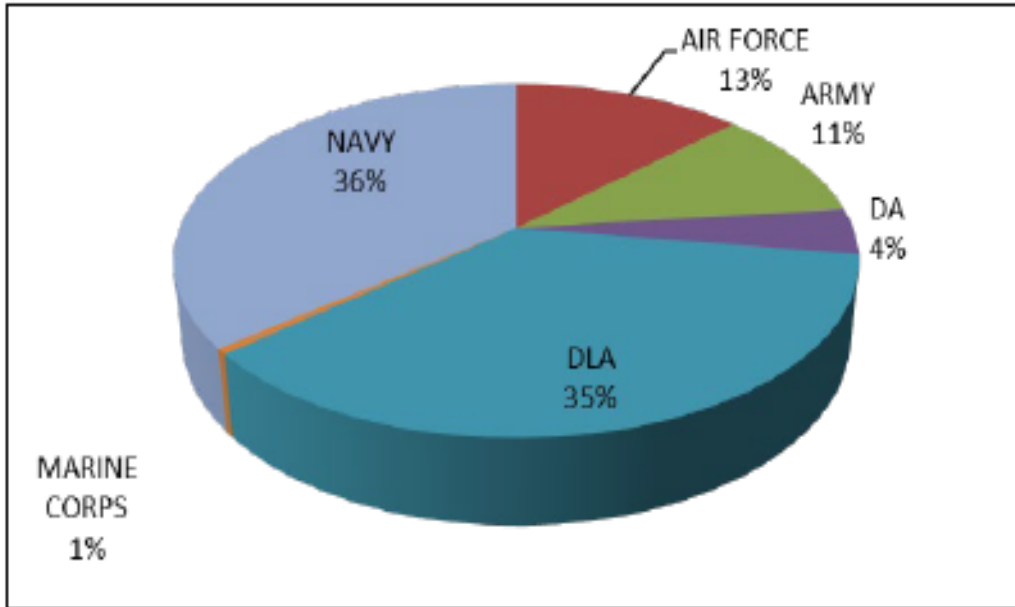
Figure 7.   MOCAS Active Contracts by Service, FY22. Source: DCMA (2022).
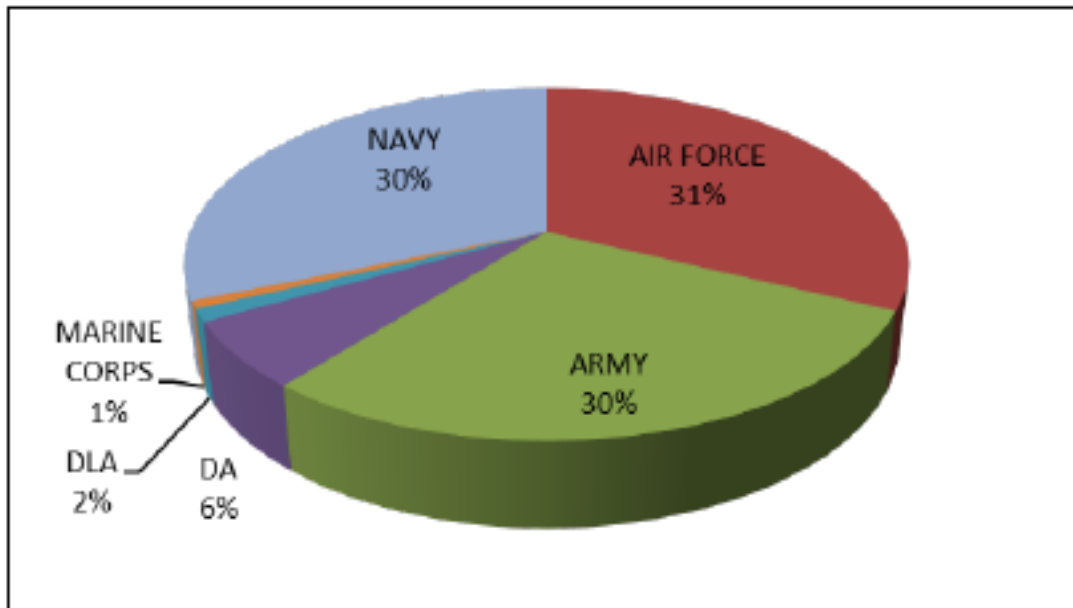

Figure 8.   MOCAS Obligations by Service, FY22. Source: DCMA (2022).

The RFI provides MOCAS coding details writing, "MOCAS consists of both interactive on-line and batch system processing programmed primarily in the mainframe languages of COBOL and MANTIS to the extent of roughly 2 million lines of code. There are other interfaces, mid-tier and desktop modules coded in various other

languages that also contribute to the collective functionalities of MOCAS. These are referred to as eTools or Sidecar Applications" (DCMA, 2022).

The RFI explains the history of MOCAS database storage, "In the mid-1990s, an Oracle based, Shared Data Warehouse (SDW) was developed by DCMA to remove limitations due to geographic boundaries in MOCAS created by the many databases. SDW mirrors the data in all three Mechanization of Contract Administration Services (MOCAS) regional database subsystems (referred to as MOCs) in a single data source" (DCMA, 2022). Access to MOCAS data via SDW will be illustrated in Chapter IV.

The RFI also discusses MOCAS life cycle support writing, "MOCAS is designated a Legacy System, and was provided for maintenance funding only. More recently the system has been reevaluated and designated as an active system. MOCAS' earlier Legacy designation led to no pro-active technology refresh or forward-looking investment strategy over the last several decades" (DCMA, 2022). DCMA's RFI lists several significant challenges with MOCAS:

- MOCAS is now understandably very difficult to maintain.
- Code has become highly coupled and fragmented.
- MOCAS is shielded from new technology and standards via complicated external gateways and filters.
- Documentation is out of date and not current.
- Upcoming changes to align to various mandated data standards and regulations are very invasive and represent risks in terms of cost, schedule, and mission success. (DCMA, 2022)

To illustrate the MOCAS user experience in 2023, Figures 9, 10, and 11 illustrate routine user screenshots of MOCAS queries and functions. The RFI reinforces that MOCAS software modernization risk remains high while consensus on MOCAS modernization methods still eludes DCMA and the DoD. In later sections we will examine how MOCAS is central to many contract administration efforts at DCMA and the limitations of DCMA's previous IWMS modernization effort. Next, we assess how additional AWF networks and systems exchange data with DCMA.
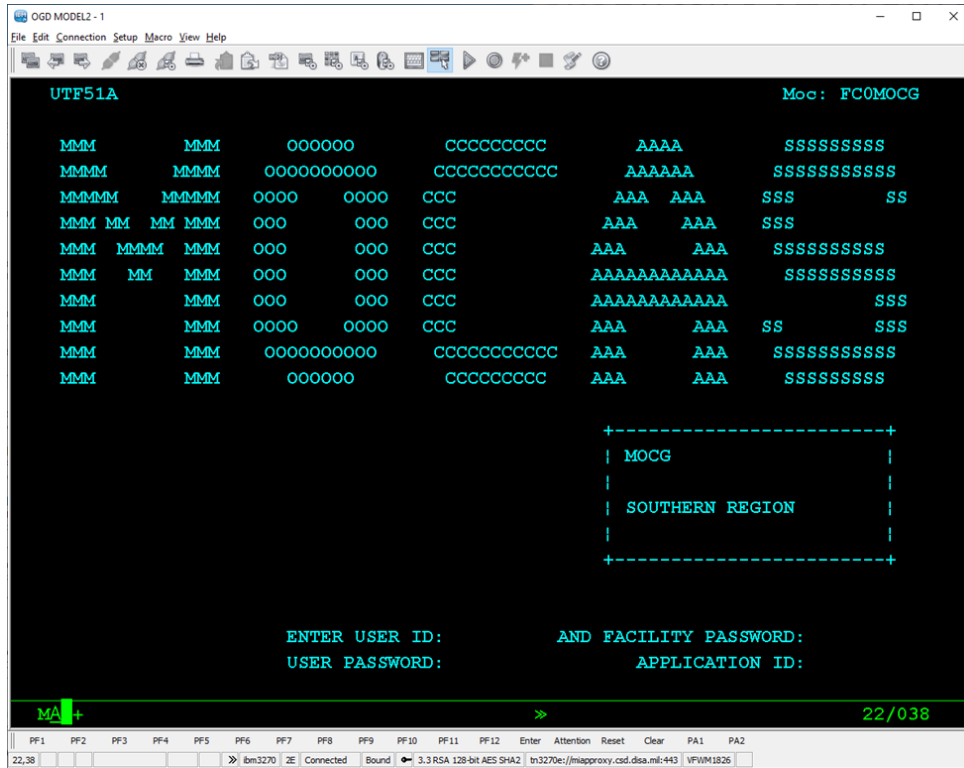
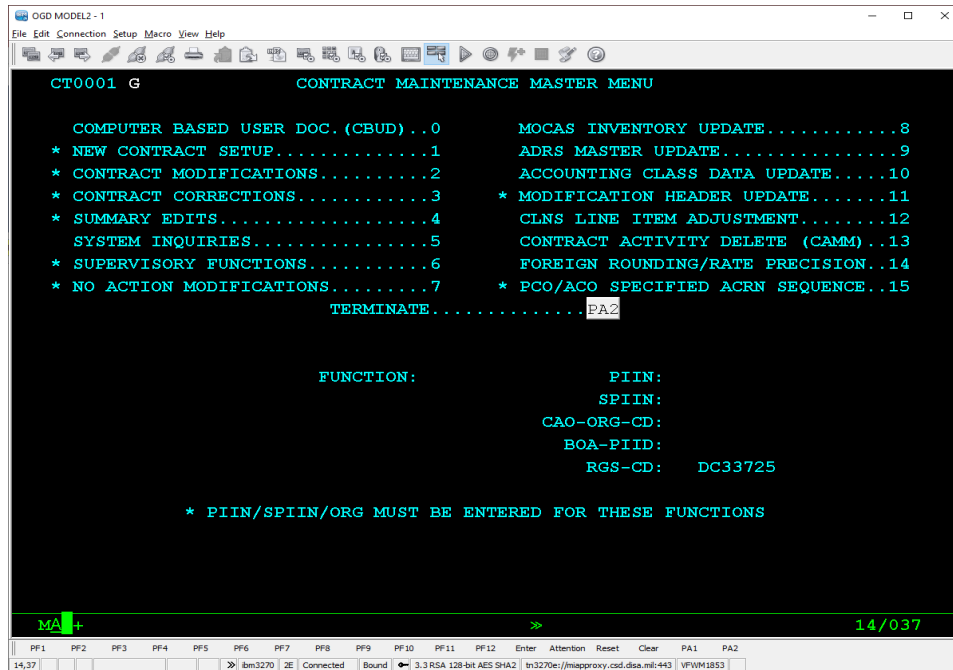Figure 9.   MOCAS Login Screen. Source: MOCAS (2023).

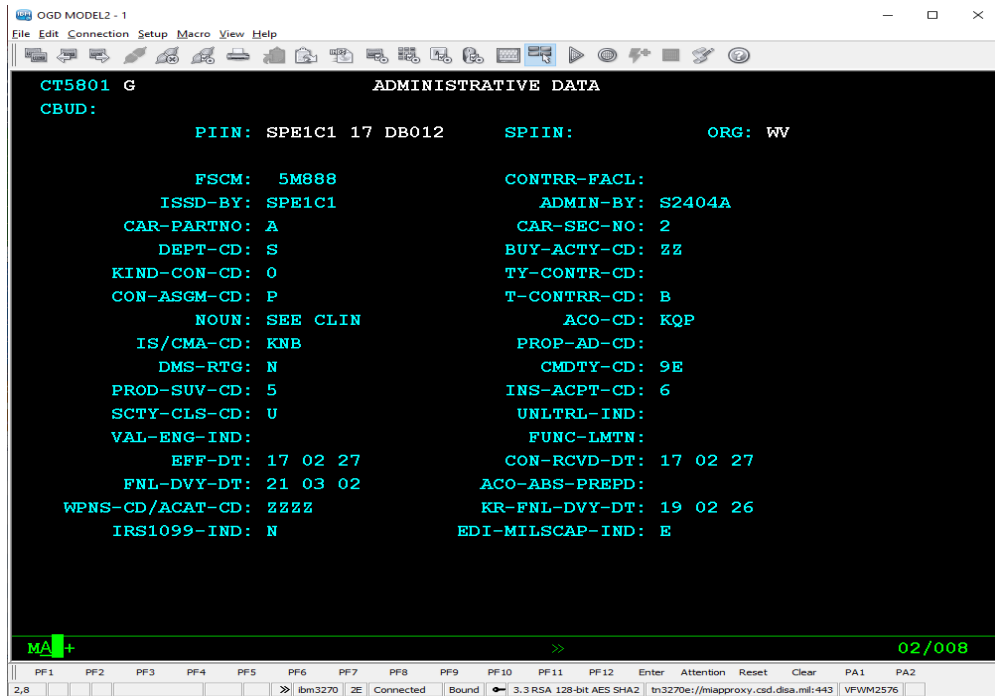Figure 10.   MOCAS User Function Screen. Source: MOCAS (2023).

Figure 11.   MOCAS Contract Admin Screen. Source: MOCAS (2023).

B.   SYSTEM INTERFACES AND INTEROPERABILITY

Examining the relationship between MOCAS and IWMS requires review of two systems critical to the AWF. The Defense Automatic Addressing System (DAAS); and The Global Exchange (GEX). DCMA-MAN 4301-05 provides definitions for each. DCMA-MAN 4301-05 writes, "The Defense Automatic Addressing System (DAAS) receives, edits, and routes logistics transactions for military services and federal agencies. DAAS enables interoperability between disparate DoD networks and systems through an interactive network of gateways and databases for supply, distribution, and information reporting" (DCMA, 2019). DCMA-MAN 4301-05 writes, "The Global Exchange (GEX) supports DAAS with broker or mediation services that enable the exchange of transaction data between DoD entities and private sector commercial industry. GEX facilitates integration between government eBusiness systems and industry trading partners. Figure 12 illustrates the scope of DAAS and GEX interactions between DoD agencies, services, and industry partners" (DCMA, 2019).
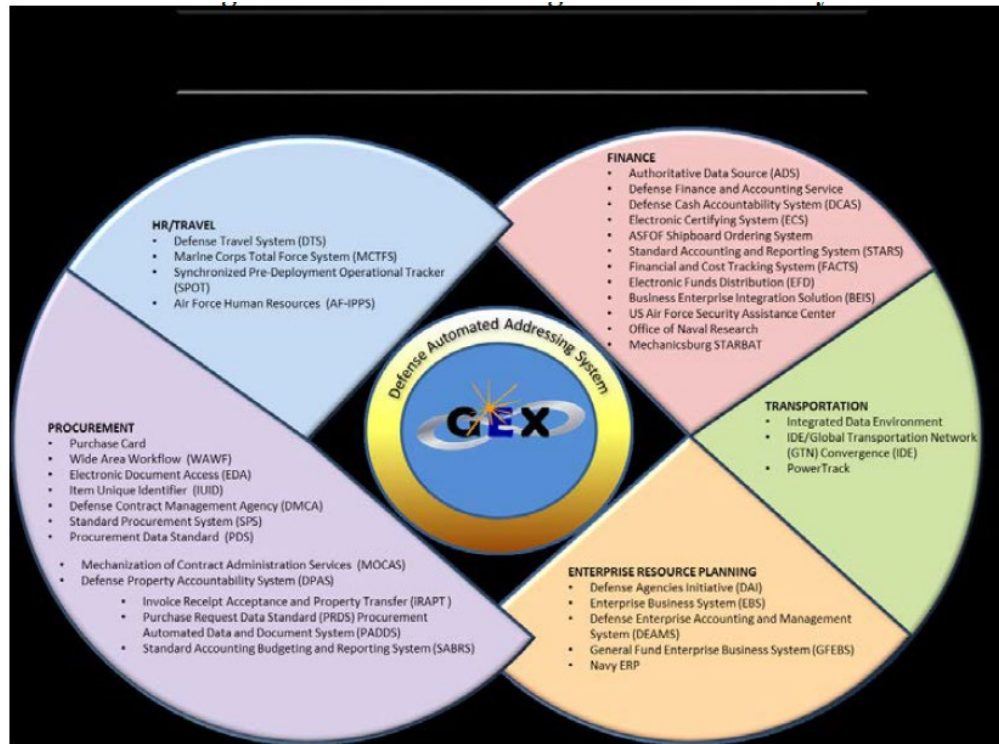
Figure 12.   GEX Global Exchange User Community. Source: DCMA (2019).

C.   THE LIMITS OF IWMS AND DCMA CONTRACTING TOOLS

The antiquated state of MOCAS and complexity of current AWF networks represent formidable challenges to contract administration efforts at DCMA. These challenges are amplified by requirements that manually mitigate contract and audit risk. MOCAS data integrity is directly related to financial outcomes of contracts endorsed by DoD contracting officers and acquisition team stakeholders. Today the effort can be an arduous process prone to human and system errors spanning compartmentalized DoD networks and business systems.

Of note, DCMA's IWMS and MOCAS contract administration efforts are significantly influenced by DLA's Procurement Integrated Enterprise Environment (PIEE). For example, contract files posted in Electronic Document Access (EDA) and Wide Area Workflow (WAWF) are the source of many database updates in MOCAS and IWMS. DCMA-MAN 4301-05 writes, "Wide Area Workflow (WAWF) is the main system used to send vendor invoices, material, and service receipts" and "Electronic Document Access (EDA) is an online repository for contractual instruments and

supporting documents and is DoD's primary tool for electronic distribution of contract documents and contract data" (DCMA, 2019). Currently, A routine step in verifying DCMA contract administration data is verifying all contract orders and modifications posted in EDA are properly accounted for in MOCAS and IWMS.

DCMA contract surveillance depends greatly on the capability to leverage clear and accurate contract data. In contrast to MOCAS, IWMS provides DCMA's workforce with a modern means to track, assess, and store contract data and files. DCMA contract administrators also use IWMS to align functional specialists known as the Contract Management Team (CMT) with contract requirements. Examples of DCMA functional specialists are listed below:

- Contract Administrator (CA)
- Industrial Specialists (IS)
- Procurement Technician (PT)
- Quality Assurance Representative (QAR)
- Property Administrator (PA)

The process Contract Receipt and Review (CRR) is key to engaging DCMA functional specialists with contract data and updates. DCMA Manual 2501-01 defines CRR as, "the process by which DCMA receives and reviews contracts and modifications to identify customer requirements for contract administration support" (DCMA, 2022). Functional specialist skill sets are activated when a new contract or update (e.g., modification) is successfully tracked by IWMS. When IWMS successfully receives updates, the system triggers functional specialists to validate key contract requirements (KCRs). For example, Contract Administrator KCRs trigger a review of contract clauses (e.g., FAR 52.245-1 – Government Property) which complements other CMT efforts (e.g., Property Administrator). Worth recognition is that IWMS gives DCMA Contract Administrators a user-friendly means to review contract data in MOCAS. Data once accessed via cumbersome MOCAS search queries can be illustrated quickly via IWMS's enhanced contract view; example shown in Figure 13. IWMS also provides contract file storage and sharing capabilities within DCMA.
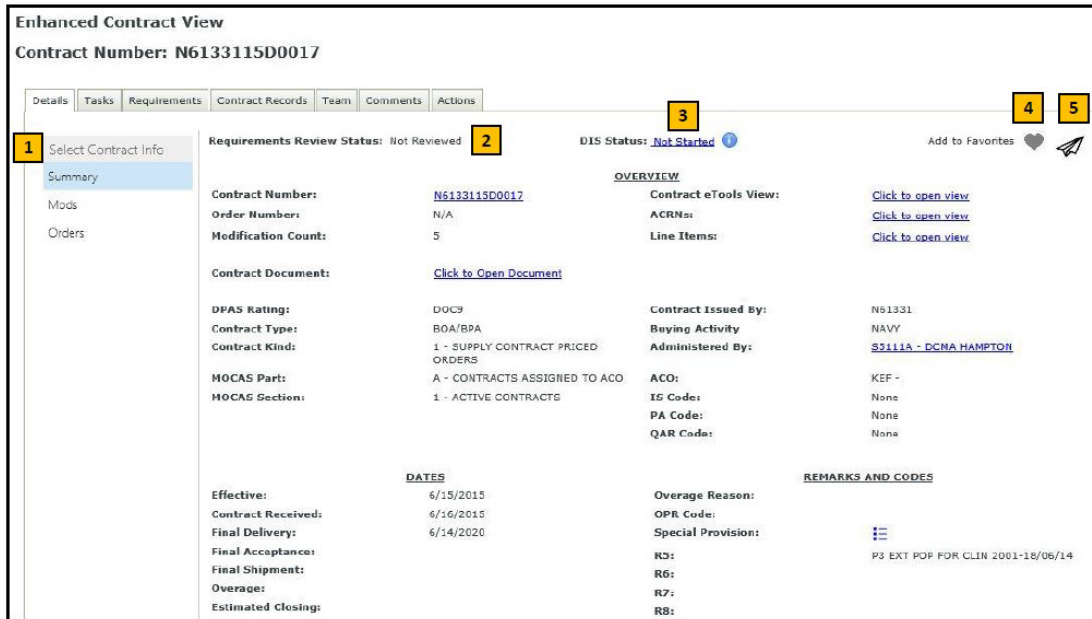
Figure 13.   IWMS Enhanced Contract View. Source: DCMA (2019).

While IWMS has many useful capabilities, it is limited by the frequency and quality of data received. Since MOCAS data is fundamental to the utility of IWMS, all IWMS Contract Receipt and Review Efforts (CRR) are complemented by MOCAS Data Integrity Screenings (DIS). DCMA Manual 2501–05, defines MOCAS DIS as, "the administrative process that matches contract data to payment and administration system data. MOCAS DIS begins with Contract Receipt & Review (CRR) and continues through the Contract Life Cycle until the contract is physically and financially complete and administratively closed" (DCMA, 2021). When properly configured, contract oversight benefits from IWMS aligning the DCMA functional specialists with contract administration requirements. However, there are limits to what IWMS can do.

First, IWMS must receive contract data and updates to support surveillance efforts. A system discrepancy DCMA contract administrators learn to anticipate is when contract modifications posted in EDA do not update in MOCAS and IWMS. That said, when IWMS aids users in identifying contract data discrepancies, correcting them involves a series of manual efforts independent of the program. Thus, IWMS generated CRR and DIS procedures remain prone to human error, conflicts of interest, and time management constraints. IWMS efforts that identify and document discrepancies (e.g., signed audit checklists), remain detached from the systems that correct database errors.

Because IWMS/MOCAS data maintenance requires documentation of manual efforts, data corrections are regulated via an auditable Segregation of Duties (SOD) structure. MOCAS user access is designated as: Routine, Direct Input and Trusted Agent (TA). The highest level of MOCAS user access is granted to Trusted Agents (TA). Users who lack access to make identified MOCAS discrepancies submit requests to third parties utilizing a DCMA Form 1797 (Request for MOCAS Action/Information). This form is used to document/request adjustments to MOCAS as shown in Figure 14. Low risk MOCAS corrections (e.g., Final Delivery Date, Provision Codes, Inspection/Acceptance Codes) can be processed by a DCMA agent known as a Procurement Technician (PT). Higher risk corrections requests such as corrections to financial and obligation data normally require submitting a 1797 to DFAS via email. Whether a 1797 is submitted to a DCMA or DFAS TA, processing times vary since the demand for 1797 requests can exceed the supply of Trusted Agents. Each 1797 requires supporting documentation which can result in communication challenges based on personal preferences and experience with AWF systems. How many MOCAS corrections a contract administrator should request via a single 1797 also requires a degree of personal judgement. The process can quickly frustrate inexperienced, entry level, AWF members.

REQUEST FOR MOCAS ACTION/INFORMATION			DATE:

TO: TA NAME:

Purpose:
The purpose of this form is to submit simple adjustment requests caused by short pays, shipments paid incorrectly, corrected DD250, etc.

Instructions:
1. Please complete all sections as accurately as possible.
2. Only one contract/delivery order per form.
3. Explain in detail in the Notes section payments/errors which cause the need for this adjustment.
4. Please attach any supporting documentation. (Corrected DD250, Spreadsheet, Reconciliation spreadsheet, Disbursement history, Modification log, Etc. [5 MB Max.]

NAME:	CMO/DoDDAC:	EMAIL:	TELEPHONE:
CONTRACT NUMBER:		CONTRACTOR (INCLUDE CAGE CODE):	

Attachments included? List file name(s):

Check box if this request been previously submitted? [ ]   Date(s):

Check box if this request impacts current year canceling funds? [ ]

Payment system:	MOC: G	Other:

I. CONTRACT ADMINISTRATION REPORT (CAR)

a. [ ] Move contract to Section:
b. [ ] NLA problem. Explain:
c. [ ] Need Final Pay NLA. Reason for excess funds:
d. [ ] Reopen. Reason:

II. RECONCILIATION

Shipment/Invoice Number	CLIN	ACRN	$ AMOUNT	REMARKS

COMMENTS (Clearly explain the reason and justification for the adjustment):

III. CONTRACT DATA INPUT

e. [ ] Correct Final Delivery Date (FDD) to _____ / _____ / _____
f. [ ] Add/Delete Special Provision Contract Code(s)
g. [ ] Add/Delete the following R9 Code(s)
h. [ ] Change Inspection/Acceptance Code to
i. [ ] Add/correct Facility Code to
j. [ ] Correct contract line item/schedule data in accordance with attached marked-up abstract/screen print.
k. [ ] Other. Specify:

IV. MATERIAL INSPECTION AND RECEIVING REPORT (WAWF RECEIVING REPORT/DD FORM 250)

l. [ ] Correction required. Specify:
m. [ ] Request Final Ship Indicator be removed.

V. ATTACHED COPY OF CONTRACT/MOD FOR INITIAL INPUT

CONTRACT NO.:	MODIFICATION NO.:

COMMENTS:

VI. ADDITIONAL COMMENTS

PRINTED NAME AND TITLE:	REQUESTOR SIGNATURE

DCMA Form 1797 JUNE 2015

Figure 14.   DCMA Form 1797 Request for MOCAS Action/Information.
Source: DCMA (2023).

If routine DCMA contract administration and surveillance seems convoluted at this point, there are more systems to cover. Additional software programs are provided by DCMA's eTools suite that provides additional functions (see Figure 15) to include DCMA's contract writing program – Modifications and Delivery Orders (MDO). DCMA contract administrators also manage and document workload efforts via a program called the Contract Administration Management System (CAMS). Figures 16 and 17 illustrate

additional CAMS functions and the Funds at Risk coding screen (discussed again later). A single illustration of all DCMA systems required to closeout a contract is difficult, but the DD Form 1597 – Contract Closeout Checklist provides a good snapshot (see Figure 17). DCMA-MAN 2501-07 states, "The Contract Closeout Checklist is used to ensure all closeout actions have been satisfactorily accomplished. The DD Form 1597/ MOCAS Contract Closeout (MCC) 1.5 eTool, Contract Closeout Checklist is required to be periodically updated and is required to be signed by the Administrative Contracting Officer (ACO)" (DCMA, 2019). What becomes evident with experience is that documenting oversight can become as labor intensive as performing it.
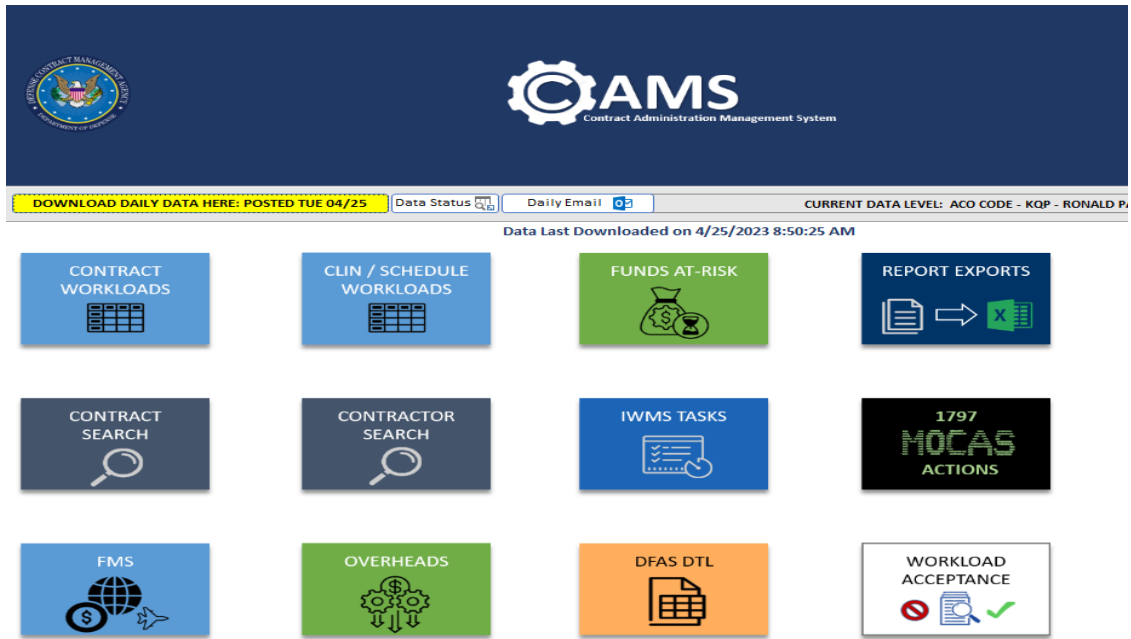

Figure 15.   DCMA eTools. Source: DCMA (2023).

Figure 16.   CAMS Functions Screenshot. Source: DCMA (2023).

Figure 17.   CAMS Funds At-Risk Coding Screen. Source: DCMA (2023).

CONTRACT CLOSEOUT PACKAGE REVIEW SHEET					Page 1 of 1	

Request ACO endorsement of DD1597 for contract closeout COST TYPE

CONTRACT / DO			TYPE		KIND	
NLA BATCH NUMBER						
CONTRACTOR						

INITIATOR		TELEPHONE	DATE
REVIEWERS (APPROVAL IS REQUIRED PRIOR TO WARRANTED ACO PACKAGE SUBMISSION)		**APPROVED** INITIAL	**DATE**

	ATTACHMENTS / SUPPORTING DOCUMENTS	✓	
		Attached	N/A
1.	DD1597 – Contract Closeout Checklist – E-Tools – MCC Contract Closeout	☐	☐
2.	Final Voucher, 1034/1035, WAWF/iRAPT Printout / MOCAS Invoice Inquiry shows Paid – YINV, 2, "F"	☐	☐
3.	Final Release of Claims / "Contractor's Closing Statement"	☐	☐
4.	Assignment of Refunds, Rebates, and Credits	☐	☐
5.	DD882 – Report of Inventions and Subcontracts *(for contracts with patents)*	☐	☐
6.	Final Patent/Patent Clearance Letter *(if needed)*	☐	☐
7.	SDW Line Item (LISSR) Balance – Admin, Contract Line Item Status / MOCAS – YCU2, 5, 11	☐	☐
8.	SDW Obligation & Disbursement History	☐	☐
9.	Section 2 – Physically Complete	☐	☐
10.	Property Cleared – If "E" provision code is present check R9 line for "55", if missing contact Property Administrator	☐	☐
11.	DD Form 1593 completed *(FOR CONTRACTS WITH DD 254)* and Email requesting release from DSS.mil (for applicability check for FAR 52.204-2 and "C" in MOCAS on Admin screen in SCTY-CLS-CD field)	☐	☐
12.	Admin Data- MOCAS – YCU2, 5, 12	☐	☐
13.	Remarks Data- MOCAS – YCU2, 5, 12	☐	☐
14.	Provisions Data- MOCAS – YCU2, 5, 12	☐	☐
15.	Accounting Data- MOCAS – YCU2, 5, 12	☐	☐
16.	Applied Modifications – MOCAS – YCU2 – 5, 7	☐	☐
17.	Contract (indicating estimated cost and fee)	☐	☐
18.	Cumulative Allowable Cost Worksheet (CACWS)	☐	☐
19.	Cost Contract Closeout Worksheet	☐	☐
20.	Update ACO Notebook (R2, R5, and R9 remarks)	☐	☐
	Upload closeout package into IWMS		

Figure 18.   DD 1597 Contract Closeout Checklist. Source: DCMA (2023).

D.   MODERNIZATION COMPETITORS – AUDITS VS. METRICS

We have discussed many of the software and technical challenges involved in contract administration. Next, we examine how metrics and auditability interact via contract performance assessments. The DCMA Regional Command Organizational Plan (OCP) provides a means to contrast contract performance metrics with systems we have discussed thus far. Like many activities within the DoD, navigating the messaging required to incentivize performance and auditability can dichotomize workforce priorities.

The Region OCP aims to unify overarching strategies of DoD with workforce efforts at DCMA. The document intro states, "This FY23 OCP will be used by Commanders/Directors to establish organizational performance priorities and goals for themselves and their subordinate commands. The Performance Priorities identified below are derived from the DCMA Strategic Plan or policy and are organized in accordance with the DCMA Business Capability Framework" (DCMA, 2023). Many of the software tools and contract efforts we've discussed are assessed via the OCP. Next, we focus on the section titled, "Contract Maintenance Fulfilled and closed contracts with auditable fiscal controls," as summarized in Table 7. Key performance metrics in this section can be summarized as:

- CRR Completion
- IWMS Configuration/Task Routing
- Reduction of Contracts Past FDD
- Contract Closeout
- Funds Life Cycle

These metrics provide some points worth reviewing. First, they confirm that contract maintenance and closeout are centered in audit readiness. Second, they reinforce that DCMA contract administration and auditability is an extraordinarily manual effort (e.g., 30-day standard for an initial CRR). We know many solutions to contract discrepancies operate outside the capabilities of IWMS yet documenting CRR findings in IWMS maintains a direct link with FIAR compliance. This application of FIAR can lead to an emphasize on the audit trail of CRR, more than desired results (e.g., correcting a discrepancy vs. documenting a discrepancy with a signed & dated checklist). Therefore,

it can be difficult to leverage CRR audit efforts via internal systems of record (e.g., IWMS) since the CRR lacks the speed and value of real-time data via a joint network. In effect, CRR and data integrity audits reinforce current limitations within DoD networks and contract administration software tools.

The Funds Life Cycle metric also provides additional context in contrasting contract performance with auditability. DCMA-MAN 2501-03 describes the funds life cycle procedure as, "the responsibility of performing payment administration and ensuring all funds appropriated against a contract are obligated accordingly or any excess funds are de-obligated and returned to the DoD buying activities. Settling obligations and disbursements to a zero balance prior to funds canceling contributes to accurate financial statements for our customers" (DCMA, 2022). Contract funds life cycle phases span current, expired, and canceling years for the different appropriation categories as illustrated in Figure 19. While DoD appropriations involve many stakeholders and controls, DCMA ultimately assists by verifying obligation data and de-obligating unliquidated obligations (ULO) which can then support other requirements. Audit messaging appears to impact desired financial outcomes within the DoD. Some examples will help illustrate how.

Successful contract closeout is an event that represents many cumulative efforts in contract maintenance and surveillance. When done right, it highlights the value of routine communication and overcoming system limitations faced by all members of the acquisition team (government and contractors). That said, audit procedures and reporting requirements appear to conflate goals within the fund's life cycle process. DCMA-MAN 2501-07, states, "After contracts are physically complete and ready to be closed, Unliquidated Obligated Funds (ULO) remain on the contract. In these instances, a review must be accomplished to determine if the funds are "excess" or "remaining" relative to contract requirements" (DCMA, 2023). Because DCMA contract administrators cannot leverage one financial system or software program, how determinations are reached and documented varies. As a result, a variety of checklist centered efforts have emerged which routinely document logical database values with pages of signed and dated KSDs (Key Supporting Documents). The proliferation of DCMA audit checklists and determination resources appears to have evolved in response to both internal and external

audit evolutions over time. It is plausible that many other organizations within the DoD have experienced a proliferation of manual audit templates and formats in attempts to mitigate audit risk within the DoD.

The DCMA CAMS tool also helps illustrate how formal reporting evolutions (e.g., coding funds at risk status throughout the fiscal year) can compete with pragmatic efforts (e.g., communication within an acquisition team). For example, formal funds at risk correspondence, and CAMS coding efforts (documenting funding status) can last for months, but fundamentally require agreement between PCOs, ACOs, and contractors to act. In the end, routine invoicing, and de-obligation mods (bilateral concurrence) can receive less emphasis than audit centered metrics and baseline performance goals. The speed and messaging of the process appears to be its primary limitation.
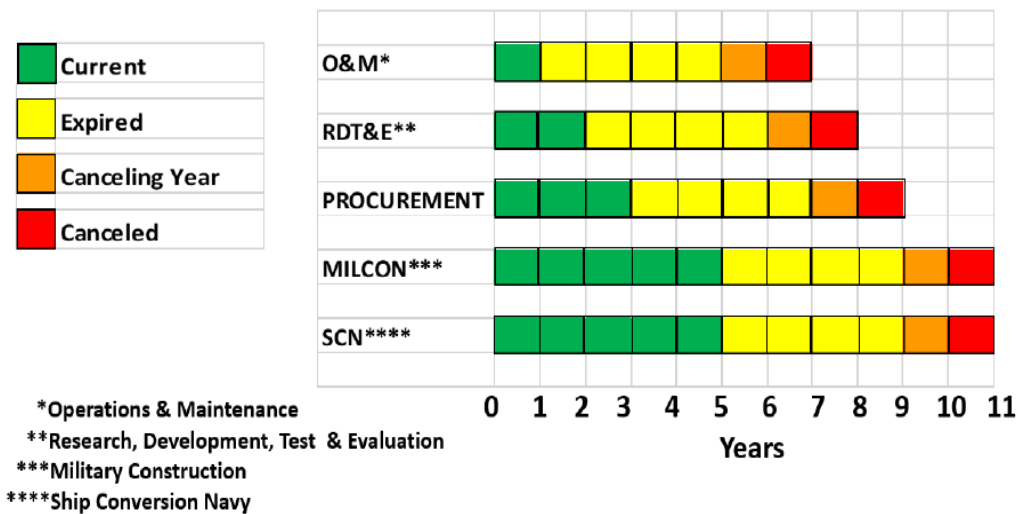
Figure 19.   Funds Life Cycle Phases. Source: DCMA (2019).

FY23 Region OCP – Contract Maintenance Fulfilled and Closed Contracts with Auditable Fiscal Controls. Adapted from DCMA (2022).

Metric	Description
Contract Receipt & Review (CR&R)	Perform timely review of contracts and contract modifications to track, assign, and disposition. Ensure CR&R and Post Award Recommendations are performed within 30 days. Document deficiencies in the Agency System of Record and issue Contract Deficiency Reports as required.

Integrated Workload Management System (IWMS)	Ensure IWMS is configured properly for task generation and routing. Ensure tasks are monitored for timely completion and that contracts listed on the Unassigned Contract Report are adjudicated appropriately. Ensure CAGE Codes have at minimum ENG, ACO, QA, and IS roles mapped at Level 7 in the Contract Management Team Tool. Target ZERO IWMS tasks > 30 days overdue.
Reduction of Contracts past Final Delivery Date (FDD)	Develop, document, and execute a multifunctional plan to identify root cause(s) and implement CAP(s) to resolve all contracts past FDD. The goal is to reduce the MOCAS Section 1 baseline of contracts with FDD > 180 days by at least 5%. The FY23 Baseline is the number of contracts with FDD > 180 days and delinquent schedules on 1 October 2022.
Contract Closeout	Closure of contracts IAW with the Agency Business Rules for On-Time and Overage Contract Closeout Mission to maximize the full value of at risk funds. The measure is being truncated due to a 9 month performance period (January – September). Percentages marked with an asterisk (*) will be utilized for the purposes of a 12 month measure.
Funds Life cycle	Surveil program funds to ensure excess funds are de-obligated and returned to the appropriate trust fund. Ensure 90% of funds at risk of canceling greater than $1,000 within DCMA's control are resolved by 1 September 2023 as measured in the Contract Administration Management System (CAMS). ACO actions throughout the FY include processing contractor payment requests, notifying PCO/contractor of excess or replacement funds requirements, reconciling funds, and de-obligating funds when delegated by the PCO.

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IV. DCMA ANALYSIS PART 2 – SOLUTIONS

A. DCMA'S CALL TO MODERNIZE

Next, we assess how modernization of contract administration has been received by DCMA senior leaders. At the highest level, DCMA director General David Bassett, is fully onboard with calls to modernize and innovate. In lock step with the DoD's document, General Bassett recently released DCMA's FY22–26 Strategic Management Plan. His message is tailored into four lines of effort, as shown in Table 8. Each line of effort expands into various objectives, performance goals, and initiatives that address challenges and recent accomplishments within DCMA and the AWF.

Table 7.   DCMA Strategic Plan FY22–26 Lines of Effort. Adapted from DCMA (2022).

Line of Effort (LOE)	Description
LOE #1	Improve warfighter capabilities by influencing timely delivery of quality and affordable products
LOE #2	Expand DoD contract administration capabilities to allow for flexibility and enhanced acquisition decision making
LOE #3	Drive enhanced value and affordability through modern, adaptive, and responsive cost and pricing capabilities
LOE #4	Innovate the Agency's approach to how and where we work to better adapt to the workplace of the future.

Line of Effort 1 objectives state, "modernize surveillance business practices to be agile and data driven, leverage agency's access to data to provide acquisition insight to make informed decisions" (DCMA, 2022). Line of Effort 2 objectives state, "Modernize contract administration services (CAS) tools to improve DCMA processes, enable support based on program/contract risk and value to the DoD, and Enhance engagement with buying commands to increase contract administration business integration across the Enterprise" (DCMA, 2022). The latter introduces the value of enterprise solutions into a joint contract administration platform. This platform will be discussed in greater detail in the next section. Lines of Efforts 3 & 4 reinforce core values that emphasize

modernization, automation, and ensuring DCMA's AWF is empowered to generate value and adapt to challenges within the DoD (DCMA, 2022). DCMA's FY23 Performance Plan also highlights recent MOCAS modernization progress.

> DCMA Deployed the Standard Financial Information System/Standard Line of Accounting into the MOCAS system. Established and executed an improved Release Planning model to increase the efficiency of MOCAS deployments. The legacy MOCAS sustainment model was designed to accommodate only one major system change at a time. In achieving these results, this enabled a joint DCMA/DFAS team to deploy SFIS/SLOA and additional minor system releases in parallel. Resulted in a Common Data standard, End to End transaction traceability, and improved interoperability and linkage between core DoD financial and accounting systems representing a significant sustainment cost avoidance within MOCAS and improved interoperability between MOCAS and DoD financial systems. (DCMA, 2022, p. 17)

The FY23 Performance plan also introduces software efforts that are key to modernizing DoD business systems and enabling contract administration that is both agile and data driven. Central to modern software and business systems is developing capabilities within a common enterprise environment. DoDI 5000.87 defines enterprise services as, "automating business processes in enterprise computing, networking, and data services. Enterprise services include technical services such as cloud infrastructure, software development pipeline platforms, common containers, virtual machines, monitoring tools, and test automation tools" (DoD, 2020). Next, we discuss the Procurement Integrated Enterprise Environment (PIEE) platform which has evolved as the conduit to modernize contract administration software and capabilities.

B. THE PIEE REVOLUTION

In 2023, DCMA provided the following update on the Procurement Integrated Enterprise Environment (PIEE) modernization initiative, "The Procurement Integrated Enterprise Environment (PIEE) modernization initiative which has successfully modernized software administration tools and leveraged data connections with MOCAS. A recent DCMA article states, "One of the four pillars of agency modernization, PIEE is a centrally accessible information technology platform of acquisition—contracting, finance and logistics—and related applications, capabilities and systems designed to

streamline electronic business transactions between the various services and agencies from DoD, federal government and industry" (DCMA, 2023). Almost all legacy CA tools discussed in this study are scheduled to transition to PIEE. MOCAS continues to be an exception.

The 2023 DoD Procure-to-Pay (P2P) and Financial Audit Training Symposium provides an unclassified means to review the latest developments in PIEE products and services. OSD's website writes, "The symposium is jointly hosted by Defense Pricing and Contracting (DPC) and the Office of the Secretary of Defense (Comptroller) and is designed to provide contracting, logistics, finance communities, and industry partners a better understanding of standardized data processes, use of enterprise systems, and related internal controls that support audit requirements and ensure efficient government management of P2P activities and taxpayer funds" (DoD, 2023). A P2P PIEE brief writes, "PIEE is an information technology platform of enterprise services, capabilities, and systems grouped into modules with the objective of seamlessly supporting the end to end Procure to Pay (P2P) business processes for the Department of Defense (DoD). Leveraging role-based access, PIEE provides users with the access to many of the critical enterprise capabilities used every day by hundreds of thousands of users spanning all Services, Defense Agencies, and Industry such as the Department's e Invoicing, contracts repository, and contract surveillance tools" (Schmidt et al., 2023). Figures 20 (Knepper, 2023) and 21 (Williams et al., 2023) were presented at DoD's 2023 P2P Symposium and illustrate a historical PIEE timeline and module (note PIEE initially began as WAWF/ EDA software efforts).
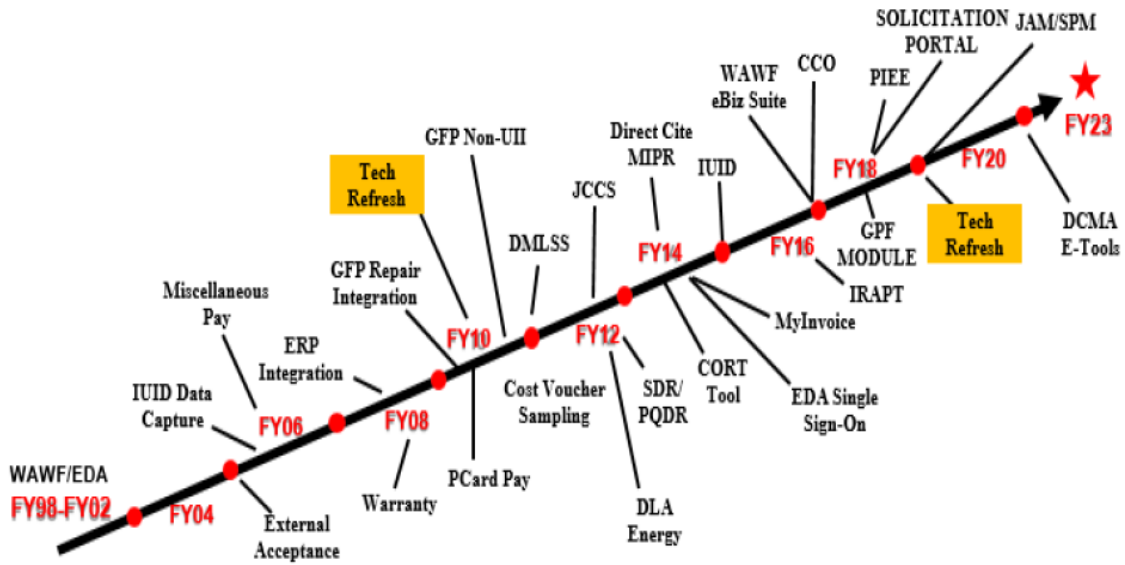
Figure 20.   Historical PIEE Development Timeline. Source: DoD (2023).

Figure 21.   Current and Future PIEE Applications. Source: DoD (2023).

Because PIEE leverages cloud technology via a common DoD platform, it addresses many challenges associated with developing and integrating legacy contract

administration software tools. For example, contract administration data that was previously limited to localized server environments (e.g., MOCAS) can now be accessed via PIEE's Shared Data Warehouse (SDW) module. Contract modifications previously released via DCMA's legacy MDO eTool can be released via PIEE's MDO module then viewed via PIEE's EDA contract database. Even IWMS and CMT functions discussed earlier are scheduled to transition to PIEE in future fiscal years.

PIEE's common development environment also vertically integrates user access and development under a common security framework. PIEE's shared Authority to Operate (ATO) framework decreases administrative burdens on both government and software developers. PIEE cloud-based infrastructure also increases functionality and speed for program users and stakeholders. Also worthy of recognition is the PIEE platform is a Government Off-The-Shelf (GOTS) software solution while PIEE modules are deployed via COTS software methods. DLA issues and administers the majority of PIEE contracts through the DoD contractor CACI Enterprise Solutions, LLC who also works with small businesses partners (e.g., Tritus Technologies Inc.). PIEE sustainment and development support can be referenced in complete detail via IDIQ contract: SP4701-21-D-8002. The IDIQ contract is broken into 4 task areas: Program Management Support, Sustainment Services, System Enhancements and Development, and Transition-Out. The contract's Performance Work Statement (PWS) and scope details are shown below and align with many recommendations in the 2019 SWAP study.

- The contractor shall deploy the systems and Capabilities solutions in PIEE COE and/or IL-5 GovCloud environments.
- The PMO will provide development environment infrastructure in the Amazon Web Services (AWS) cloud with adequate access.
- This effort must meet evolving requirements while leveraging agile best practices in software development
- The Contractor shall use Continuous Integration/Continuous Delivery capability (CI/CD) pipeline and tools to facilitate code being deployed in production and test environments (DLA, 2021).

Successfully integrating DoD requirements with modern software development methods is a major achievement of the PIEE platform. Its speed and reliability have also made it the premier conduit for modernizing additional contracting tools and capabilities within the DoD. Future modernization efforts briefed at the 2023 P2P Symposium in

Figure 22 (Mims & Schmidt, 2023) illustrate many legacy contractor administration tools that are scheduled for sunset or transition to the PIEE platform. Next, we'll examine how current fiscal policies interact with software modernization efforts.
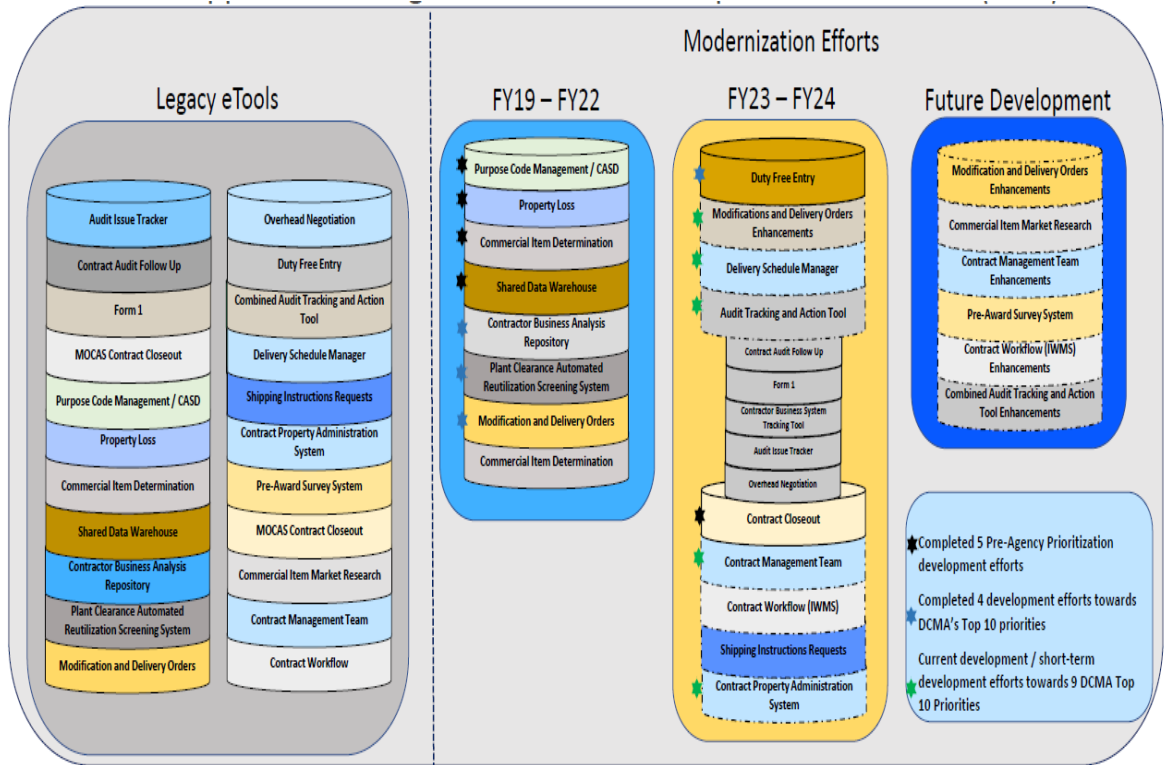
Figure 22.   DCMA Legacy eTools and Future Modernization Plans. Source: DoD (2023).

C.   HOW WILL THE AWF PAY FOR MODERN SOFTWARE?

Today PIEE is primarily funded by the services and defense agencies via the WAWF service level bill (Working Capital Funds Memo). PIEE illustrates how Working Capital Fund (WCF) models can effectively consolidate service and agency resources to achieve mutual DoD software goals. The FY2023 Defense-Wide Working Capital Fund (DWWCF) budget estimate report writes, "Defense-Wide Working Capital Fund (DWWCF) consists of five activity groups. Defense Logistics Agency (DLA) operates three of these activity groups, Defense Information Systems Agency (DISA) operates one activity group, and Defense Finance and Accounting Service (DFAS) operates one activity group" (DoD, 2022). Figure 23 shows DLA Information Operation funding estimate for WAWF (Here used interchangeably with PIEE) and illustrates a shared cost

structure between services and agencies. This study finds that software modernization and resources have benefited from WCF intragovernmental business transactions within the DoD. However, WCF methods have not yet solved the massive resource needs to modernize all AWF systems. Incentivizing the funding and expertise required to achieve comprehensive MOCAS modernization is the most significant example relevant to this study.

Wide Area Workflow (WAWF)			
(Dollars in Millions)	FY 2021	FY 2022	FY 2023
Army	$7.913	$10.447	$11.056
Navy	$6.081	$6.618	$7.049
Marine Corps	$1.348	$1.474	$0.980
Air Force	$5.741	$7.316	$8.677
DLA	$9.120	$4.397	$6.012
DCMA	$4.343	$3.448	$2.085
DFAS	$0.000	$1.477	$1.053
Total	$34.545	$35.177	$36.912

Figure 23. FY23 DLA PIEE Funding Estimates. Source: DLA (2022).

Despite recent achievements, software modernization efforts still face previous fiscal challenges that limited legacy software program efforts. Evidence exists that traditional DoD appropriation constraints continue to compromise speed and capability of current software modernization efforts. A 2023 P2P Symposium PIEE brief acknowledges that budget constraints continue to impact PIEE development at full capacity (Mims & Schmidt, 2023). A consequence of the previous IWMS software ADA violation may be a reluctance to commit significant RTD&E and O&M mission funds to PIEE. However, the SWAP report, 5000.87, and GAO have acknowledged that traditional appropriations for software are inadequate and modern software development and RDT&E and O&M constraints compromise DoD software outcomes. Commandment # 3 of the SWAP study discusses the impact of traditional appropriations on software in detail,

> The acquisition process for software must support the full, iterative life cycle of software. Software does not age well. It must be constantly maintained and updated, ideally in an automated fashion. The PPBES

process is nominally a two (2) year timeline to request and receive funding, with initial planning occurring five (5) years prior to actual receipt, and funding must be requested by intent of use (RDT&E, procurement, and O&M). But this fiscal separation does not match the process of software development, where all creation of code is "development," whether it falls within the fiscal law definition or not. As an alternative, the DoD should make use of "level of effort" (or capacity) constructs to allow continuous development and testing. Assume that low criticality software that is routinely used will require 10% of the development cost to maintain (per year) and more critical software will likely require more resources. This funding must be planned for at the time of initial development, not as an annual allocation that could be interrupted. Enhanced software capability should never be considered ahead of need. (DIB, 2019)

The acceptance of traditional appropriation constraints in modern software acquisition has led to efforts which seek to create a new software appropriation. The SWAP study writes, "Components should program, budget, and execute for information and technology capabilities from one appropriation throughout the life cycle rather than using RDT&E, Procurement, or O&M appropriations, which are often applied inconsistently and inaccurately" (DIB, 2019). Recently, DoD's software modernization strategy has reinforced the need to make acquisition more agile via a Congressionally approved Budget Activity 8 (BA8) Software Research, Development, Testing and Evaluation Appropriation (DoD, 2022).

GAO recently recognized efforts to develop a new software appropriation within the DoD. GAO noted the Consolidated Appropriations Act of 2021 established the Software and Digital Technology Pilot Program with support from DoD and Congress. Figure 24 lists DoD pilot programs that were proposed for FY21. While a comprehensive software appropriation method has yet to be achieved, BA-8 does show promise in providing additional funding flexibility for software programs (GAO, 2023). This study could not assess BA-8 pilot programs relative to AWF software but finds a software appropriation could benefit the software efforts we've discussed (e.g., PIEE, MOCAS).

Service	Program
Army	**Defense Cyber Operations (DCO)**
Navy	**Maritime Tactical Command and Control (MTC2)**
Navy	Risk Management Information (RMI)
Space Force	Space Command and Control (Space C2, aka Kobayashi Maru)
DHA	Joint Operational Medicine Information System (JOMIS)
DISA (DCSA as of 1 Oct 20)	**National Background Investigation Service (NBIS)**
DISA	Global Command and Control System-Joint (GCCS-J)
OSD	Acquisition Visibility
OSD	Algorithmic Warfare Cross Functional Team (AWCFT) / Project Maven

KEY: **FY18 NDAA Sec 874 'Software Development Pilot Program Using Agile Best Practices'**

Figure 24.   FY21 BA-8 Pilot Programs. Source: DoD (2020).

D.   FUTURE RESEARCH OPPORTUNITIES

While this study addressed many findings there were a few areas that would benefit from additional research. While resource consolidation benefits exist within the DoD, this study did not address many underlying factors in sufficient detail. Consolidating AWF resources under agencies such as DLA and DISA might make funding and auditing the DoD easier, but it was not clear if overall DoD resource consolidation is inherently more efficient.

The first area that would benefit from additional research pertains to ongoing network consolidation efforts in the DoD. DISA's *FY23 DWCF Operating and Capital Budgets report* writes, "The Computing Services component of DISA's DWCF activities operates the DISA data centers, which provide mainframe and server-processing operations, data storage, production support, technical services, and end-user assistance for command and control, combat support, and enterprise applications across the DoD" (DISA, 2022). One factor this study did not sufficiently address is why DCMA users still experience significant network capacity constraints despite turning over IT infrastructure support to DISA. The first of the DIB's Ten Commandments of Software – Make computing, storage, and bandwidth abundant to DoD developers and users, was difficult to correlate with the modernization efforts referenced in this study. At present, it appears increased DCMA user demand can routinely exceed current DISA server capacities resulting in significant performance degradations. Since the DWCF business units are not

profit-oriented, current WCF methods may not adequately incentivize networks that can handle a routine increase in DoD users. If DoD still has trouble incentivizing adequate server capacity in a CONUS environment, the effects are likely amplified for operational units. More research is recommended on funding DoD networks that align with the SWAP study's recommendations.

The second area that warrants additional research is assessing the impacts of Human Resource (HR) consolidation outcomes within the DoD. While workforce retention and program continuity are recognized as ongoing challenges within the DoD, HR consolidation efforts appear to have created hiring bottlenecks within the AWF. If DoD hiring efforts have been adversely impacted by HR resource consolidation, then DoD software and modernization efforts will also be compromised. At the time of this study, DLA provides HR services for the following DoD customers shown in Table 9 (DLA, 2023).

Table 8.   DLA Human Resources Services. Source: DLA (2023).

DoD Customers – DLA Human Resources Services
Defense Advanced Research Projects Agency (DARPA)
Defense Contract Management Agency (DCMA)
Defense Counterintelligence and Security Agency (DCSA)
Defense Commissary Agency (DeCA)
Defense Human Resources Activity (DHRA)
Defense Media Activity (DMA)
Defense Security Cooperation Agency (DSCA)
Defense Threat Reduction Agency (DTRA)
Defense Threat Reduction Agency (DTRA)
Joint Chiefs of Staff (JCS)
Missile Defense Agency (MDA)
National Reconnaissance Office (NRO)
Space Development Agency (SDA)
U.S. Transportation Command (USTRANSCOM)

Finally, this study recommends additional research on how the Advana initiative can support the AWF and related software modernization efforts. Although references to critical AWF software tools such PIEE and MOCAS are limited in DoD strategic and financial reports, Advana is routinely emphasized as vital to DoD modernization efforts. The DoD SMP writes, "DepSecDef outlined a plan to transform the Department into a data-driven organization and designated Advana as the Department's primary, authoritative, and enterprise-wide data analytics and visualization platform" (DoD, 2022).

The DoD FIAR report writes, "The audits demand IT system improvements and data consolidation that is arming decision makers with real-time Department-wide views and advanced data analytics capabilities. The Department's Advancing Analytics platform, Advana, builds on the standard data warehouse concept by consolidating large data sets for analytics, visualization products, and data tools for both military and DoD business decision makers" (DoD, 2022). While consensus on the value of Advana appears unanimous among DoD senior leadership, this study did not assess Advana's impact on AWF workforce efforts and systems. That said, the 2023 P2P Symposium does provide recent updates on how Advana efforts are progressing via Procurement Business Intelligence Service (PBIS) dashboards and data licensing efforts (Wolanske & Ford, 2023). Additional research that aligns Advana capabilities with AWF requirements (and vice versa) is recommended. Future research will also benefit from the Advana PIEE module that is scheduled for release in FY24.

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V. CONCLUSION

A. EPILOGUE

This research effort began by questioning routine user interactions with DoD software and IT resources. The SWAP study illustrated similar questions have endured for decades yet a software acquisition pathway would finally arrive in 2020. Ten years into a career as a Navy Supply Officer, the opportunity to assess DoD software as a new member of the AWF was irresistible. What became evident is that AWF professionals are experiencing the same challenges as operational units and military services. While questioning status quo messaging on federal acquisition policies and fiscal law can be difficult for members of the DoD, the words of Admiral Grace Hopper provide context moving forward, "The most dangerous phrase in the English language is we have always done it this way" (Hopper, 1976). Next, we'll review research questions and findings.

B. RESEARCH ANSWERS

(1) What factors impacted DCMA's ability to modernize contract administration capabilities via IWMS software?

At first, the most severe consequence of the IWMS software effort appeared to be an ADA violation that reported a misapplication of RTD&E and O&M appropriations. While this fiscal law application is well documented in the DoD and the AWF, the SWAP report and release of 5000.87 recognized limitations in applying this area of fiscal law to software development and maintenance. This research identified many other factors that contributed to IWMS oversight challenges.

Inadequate contract surveillance was documented as a primary weakness of the IWMS software effort. While the 2018 DoD IG report emphasized deficiencies in traditional surveillance doctrine, this study identified fundamental program constraints not discussed in previous oversight reports. A primary limitation of the IWMS software effort is the program's dependency on MOCAS data and functionality. While the IWMS effort intended to modernize numerous contract administration tools it remained a stand-alone agency effort that blended workload and contract management functions internally to DCMA. Platform limitations of IWMS were also reinforced by DCMA's dependency

on numerous independently developed and maintained contract administration tools (e.g., eTools, CAMS). Lack of a common software platform and network reinforced the limitations of IWMS and corresponding oversight goals.

(2)   What efforts have been successful in modernizing DCMA contract administration software tools?

The most successful contract administration software effort this study identified is the Procurement Integrated Enterprise Environment (PIEE). PIEE's common development framework has enabled legacy software tools to migrate to a single DoD approved environment accessible by DoD components and industry partners. What began as an invoicing and contract file tool (WAWF & EDA) is now positioned to replace or integrate numerous contract administration tools at DCMA. PIEE's functionality and reliability has benefited from Infrastructure as a Service (IaaS) which currently enables cloud-based support via Amazon Web Services (AWS) backed resources. Today, PIEE illustrates what is possible when a DoD enterprise platform enables joint acquisition and oversight capabilities. PIEE also illustrates how services and defense agencies have consolidated WCF intragovernmental funding transactions to achieve mutually beneficial modernization goals. This study found improving a single enterprise platform has significant advantages to developing and maintaining several.

(3)   What factors continue to limit modernization within the acquisition workforce?

Consensus on MOCAs modernization remains a significant challenge to modernizing contract administration tools at DCMA. Despite everything PIEE has achieved, the scale that MOCAS integrates payment and contract admin functions has yet to be replaced or adequately examined by DoD stakeholders. PIEE's capability to reduce dependency on MOCAS as a contract administration tool represents progress, but MOCAS still tracks and disburses trillions in DoD appropriations. Increased visibility on the age of MOCAS in government oversight reports and DoD strategic efforts is vital to achieving modernization goals. Consensus on the value of enterprise data and modern analytic tools (e.g., Advana) will benefit from increased awareness of legacy systems such as MOCAS.

If MOCAS modernization is the greatest technical challenge to software modernization within the AWF, then traditional doctrines on auditability may represent its greatest cultural barrier. Across the DoD a push for audit readiness to manually patch and certify business systems may be aligning sound judgement with the capability to circle, sign, and date, pages of checklists and KSDs. Because systemic software and database challenges remain, these behaviors may mitigate personal liability more than program risk. While audits have inherent value in engaging all levels of the DoD and AWF, audit strategies cannot compete with routine business sense and working relationships across program offices, contracting agencies, and functional specialists. There is simply limited value in audit behaviors that reorganize and certify explicit data.

Better business systems and increased automation offer invaluable benefits to the AWF and DoD yet a historical dependence on manual efforts routinely exercised via determinations & findings may compete with acceptance of modern software tools and capabilities. Avoidance of adverse audit findings may deter AWF members from pursuing forward looking performance goals in favor of baseline metrics and audit evolutions that manually certify data as means to achieve FIAR compliance. AWF efforts that conflate audit findings, opinions, or disclaimers may be counterproductive. It appears when a workforce is trained to manually document every data point, observation, and step forward, the intuition that empowers a sense of direction and purpose is compromised. Ironically, what usually follows adverse audit findings in the DoD and AWF is not less audit requirements and manual efforts, but more. The value of audits relative to future organizational performance and modernization goals must be continuously reassessed to prevent hindsight skewed efforts and policies. Modern software developers discarded waterfall program methods long ago.

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