2019-12

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE DEPARTMENT OF DEFENSE TO ENHANCE THE CONTRACTING PROCESS TIMELINE

Skots, Vladislav

Monterey, CA; Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE DEPARTMENT OF DEFENSE TO ENHANCE THE CONTRACTING PROCESS TIMELINE

by

Vladislav Skots

December 2019

Thesis Advisor: Raymond D. Jones
Second Reader: Thomas J. Housel

Approved for public release. Distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704-0188*

1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** December 2019	**3. REPORT TYPE AND DATES COVERED** Master's thesis

4. TITLE AND SUBTITLE APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE DEPARTMENT OF DEFENSE TO ENHANCE THE CONTRACTING PROCESS TIMELINE	**5. FUNDING NUMBERS**
6. AUTHOR(S) Vladislav Skots	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.	**12b. DISTRIBUTION CODE** A

13. ABSTRACT (maximum 200 words)

The procurement process of the Department of Defense (DOD) is often criticized for being too slow and complicated to meet warfighter needs at the speed of relevance. The multi-layered bureaucratic oversight that stalls the process is in place to ensure the awarded contract meets a myriad of requirements based in policy, feasibility, and good stewardship of public resources. With this in mind, the rate of technological advancement is outpacing the procurement process's ability to meet demand without exceptions to policy, which come with the risk of missed oversight, leading to problems after contract award. As technology is evolving on the battlefield, it may also be useful in addressing the relationship between appropriate procurement processes and speed of delivery. Artificial intelligence contract management software has been shown to increase efficiency and speed in the private sector, and is an appropriate tool for the DOD to adopt in its own systems.

14. SUBJECT TERMS artificial intelligence, machine learning, contracting, procurement, efficiency	**15. NUMBER OF PAGES** 103
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
Unclassified	Unclassified	Unclassified	UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89) Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release. Distribution is unlimited.

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE DEPARTMENT OF DEFENSE TO ENHANCE THE CONTRACTING PROCESS TIMELINE

Vladislav Skots
Major, United States Army
BBA, University of South Dakota, 2008

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

NAVAL POSTGRADUATE SCHOOL
December 2019

Approved by: Raymond D. Jones
Advisor

Thomas J. Housel
Second Reader

Glenn R. Cook
Academic Associate, Department of Information Sciences

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

The procurement process of the Department of Defense (DOD) is often criticized for being too slow and complicated to meet warfighter needs at the speed of relevance. The multi-layered bureaucratic oversight that stalls the process is in place to ensure the awarded contract meets a myriad of requirements based in policy, feasibility, and good stewardship of public resources. With this in mind, the rate of technological advancement is outpacing the procurement process's ability to meet demand without exceptions to policy, which come with the risk of missed oversight, leading to problems after contract award. As technology is evolving on the battlefield, it may also be useful in addressing the relationship between appropriate procurement processes and speed of delivery. Artificial intelligence contract management software has been shown to increase efficiency and speed in the private sector, and is an appropriate tool for the DOD to adopt in its own systems.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

AI	Artificial Intelligence
BBP	Better Buying Principles
CT	Counter Terrorism
CPARS	Contract Performance Assessment Reporting System
CRS	Congressional Research Service
DARPA	Defense Advanced Research Projects Agency
DCMA	Defense Contract Management Agency
DIU	Defense Innovation Unit
DFAR	Defense Federal Acquisition Regulation
DP	Decision Point
DOD	Department of Defense
DODIG	Department of Defense Inspector General
DHS	Department of Homeland Security
FAR	Federal Acquisition Regulation
FUE	First Unit Equipped
GAO	Government Accountability Office
GPC	Great Power Competition
IED	Improvised Explosive Device
IOC	Initial Operational Capability
IT	Information Technology
LRIP	Low Rate Initial Production
ML	Machine Learning
MRAP	Mine-Resistant Ambush Protected
NDAA	National Defense Authorization Act
NLP	Natural Language Processing
NSF	National Science Foundation
OTA	Other Transaction Agreement
OUSD(A&S)	Office of the Under Secretary of Defense for Acquisition & Sustainment
PALT	Procurement Administration Lead Time

PLA	People’s Liberation Army
R&D	Research and development
RAFT	Rapid Acquisition Facilitation Tool
RAND	Research and Development Agency
RFI	Rapid Fielding Initiative
RFP	Request for proposal
RPA	Robotic Process Automation
SF	Special Form
TSO	Third Offset Strategy
USDR&E	Under Secretary of Defense for Research and Engineering
VC	Venture Capitalist

ACKNOWLEDGMENTS

If I could give thanks to only one person for every wonderful thing that has happened in my life, it would be my amazing wife, Jill Skots. No one has had such a profound and meaningful impact on what my life means today than her, and I am forever grateful. She is my partner in every way, and blessed me with four miracles. I am thankful for their patience and curiosity throughout their time in Monterey. Greyer, Kinley, Callum, and Lochlann, thank you for reminding me every day why what I do matters, and to continue striving to be better.

Craig and Pam Doss, your support for our family has been instrumental in allowing us to be able to have the adventure of a life we have had so far. I am blessed to be able to call you family. Craig, you inspire me to be a better husband and father, and Pam, you always provide the kind of compassion and care I hope to one day emulate.

Natasha and Dell Towne, thank you for being our support from South Dakota; your commitment to our little Skots family has made our lives better. I could not have completed this study without you two worrying about our problems and ensuring good things happen on our behalf when we cannot be there.

My grandmother Darya Skots passed during my time at NPS. Words cannot express the meaning she had for not just me but everyone she has ever encountered.

Thank you, Mathew Norton, my writing coach, for the hours and days of making my original words on paper sound like a coherent person wrote them. Your patience is admirable.

I want to thank my advisor Professor Raymond Jones, who kept me on track and my mind out of the clouds. This study has been a unique and challenging journey for me, and the knowledge and guidance you gave me made all of this possible.

My 870 program friends, Brian Bieber, Emily Bold, Eduardo Nicholls, and Puriphat (Sura) Surarujiroj: we did it together. Thank you for struggling with me. You are examples that all boats rise with the tide.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

The Department of Defense's (DOD) procurement system has been blamed as the cause of the United States' reduced status on the world stage. Members of Congress continually cite this process in budget arguments, and create task forces to solve this chronic impediment to the fielding of innovative technology to warfighters. This sentiment is explicitly stated in the most recent National Defense Authorization Act (NDAA) FY2020:

> The Pentagon's business operations provide the foundation for a responsive and innovative military. Building upon several years of reform, the NDAA continues to streamline operations—continuing acquisition policy reform, recalibrating contract reform, and strengthening program oversight. A more efficient bureaucracy will better utilize the full value of every taxpayer dollar spent on defense. (Inhofe & Reed, 2019, p. 4)

From 2016 to 2019, Congress requested an arrangement of experts called the 809 Panel, which was "tasked with identifying ways to streamline and improve the defense acquisition system, and has made a total of 98 recommendations, encompassing both evolutionary and revolutionary change" (Section 809 Panel, 2018). The introduction to volume 1 of 3 from the panel's recommendations specifically states that adversaries are adapting faster with innovative technology because they slowed by the same rules for procurement as the DOD (Section 809 Panel, 2018).

In response to this, one significant area of rework considered by the panel was the acquisition of emerging technologies such as artificial intelligence, communications, sensors, and advanced software, where commercial technology is evolving at a rate far faster than the DOD development cycle (Levine & Greenwalt, 2019). The panel's consideration was to reinvent rules to acquire commercial off-the-shelf products instead of following the standing DOD procurement rules that had 25 years of practice and precedent (Levine & Greenwalt, 2019). At the same time, the panel is recommending eliminating or revising mundane tasks rather than automating them. Such mundane operations, however, perform essential functions such as quality assurance and responsible spending.

Elimination of quality control measures can increase speed, but it also increases risk. The panel's assumption seems to be that, in order to achieve greater speed, greater risk is just something that needs to be accepted. However, there is a potential solution to increase speed without introducing extra risk, and that is application of artificial intelligence (AI) systems to the procurement process. The 809 panel did not recommend AI as a solution in its three volumes of recommendations. This research will look at which elements of the procurement system are commonly associated with needless lag, and whether currently available AI systems are a solution to the problem.

A. RESEARCH PROBLEM AND PURPOSE

The DOD's systems of acquiring and fielding emerging technology seems to be too slow for relevance to the warfighter, and policy workarounds appear to be the main tool for addressing the issue.

The purpose of this research is to determine if current DOD procurement policies and processes are appropriate to meet the requirements of speed and accountability to meet fielding demands; and if commercial off the shelf technology in artificial intelligence contract management is applicable in addressing opportunities or shortcomings in the findings.

B. RESEARCH QUESTIONS

Congressional attempts to resolve the gap between the rate of technological availability and procedural precedent has led to the following questions:

1. Is the DOD procurement process impeding the U.S. military from outpacing potential adversaries' technological development?

2. Is AI, in its current form, appropriate to be applied to supplement contracting officers and DOD contractors to make more informed procurement decisions, while increasing speed and mitigating risk?

C. METHODOLOGY

The methodology used in this research is a review of literature on the subject of accelerating the speed at which the DOD identifies and acquires a material capability that appears to be the solution to a current or future problem. The study will set forth a timeline of the origination of its policies and practices directed at the technological need, acquisition speed, and their outcomes. Furthermore, the review of the emerging practice of using AI in private industry contract management to address a similar problem will be analyzed to this study appropriateness for DOD application.

D. BENEFITS AND IMPORTANCE OF THIS RESEARCH, AND SCOPE

Findings from this research will be used to develop recommendations that seek to improve the DOD's contract process capabilities, enhance the competency of all process stakeholders, and strengthen internal controls.

Initially the study will offer an overall view of the DOD acquisitions process, and then examine how an individual contracting representative interacts with the process. These processes will be compared to private sector operations of a similar nature, and examine how technology is applied to remedy identified problems. The technology identified will be that which already exists in the private sector of the U.S. economy. The primary effort in this research is to identify professional grievances about the DOD procurement system, and assess whether private-sector use of AI to solve their issues are more appropriate as a remedy for DOD than current policy-based methods.

E. SUMMARY

Congress is concerned with the DOD procurement system not being able to keep up in its acquisition of militarily superior technology, to the point that potential adversaries can exploit the lag through their own innovation and adoption speed. AI, as applied in the private sector, could possibly deliver the speed and the diligence desired in the procurement process. This study examines if the DOD procurement process is indeed too slow, what may be causing it, and if current policy and technology can remedy the problem.

THIS PAGE INTENTIONALLY LEFT BLANK

II. LITERATURE REVIEW

Answering the question of whether the DOD procurement process takes too long to deliver warfighter needs, and evaluating the viability of AI in assisting the contracting process requires drawing upon and understanding efforts by researchers, government officials, and private industry practitioners. This section reviews grievances with the contracting process, both DOD and private industry, and past attempts to rectify them.

A. CONTRACTING

In general, contracting, as a function of procurement, is a tedious and complex process with a language of its own that causes ambiguity and misunderstanding in both the DOD and private sector (Burton, 2018; Section 809 Panel, 2018). Aside from the time spent on strict testing and compliance, certain subjective issues increase the length of time it takes to go through a full procurement cycle, particularly human interaction coupled with the complexity of the unique and pattern-like contracting language, which makes operators liable to miss key provisions and makes it difficult to translate terms into plain language that can be understood by all stakeholders (Burton, 2018; Gerding, 2013).

B. ISSUES IN PRIVATE INDUSTRY CONTRACTING

The private sector has struggled with contracting complexities to the point of coining the term "value leakage" to describe their effect on the bottom line. Due to factors associated with contract management, all private sector companies lose between 5–40% of anticipated contract value during procurement (Rich, 2018; Cummins, 2019). As a result, in 2017, estimates from the International Association for Contract & Commercial Management stated that on average the time spent on the bureaucratic work associated with a contract costs a company $6,900 (Cummins, 2019). The cost drivers on a "typical contract involve 2.5 hours of legal time (costing the average business an estimated $500, assuming the use of in-house resources); around 18 hours of contract manager/procurement time (at a cost of $2700); around 12 hours of operations, engineering, or project management time ($1800); two hours in Finance ($300); up to six hours with compliance risk or regulatory functions ($1000) and $600 ('other' types of review or resource)" (Cummins, 2019).

The major areas identified as leading contributors "to leakage were disagreement over contract scope, weaknesses in contract change management, performance failures due to over-commitment, performance issues due to disagreement over what was committed, inappropriate contract structures, disputes over pricing, and issues with subcontractors" (Cummins, 2019). Further value loss is created in cost overruns, project delays, dispute settlements, and contract cancelations, all of which are non-technical issues (Cummins, 2019). Issues that are common in contracting delays are thus a result of the limitations of the humans in charge of their execution.

C. ISSUES IN DOD CONTRACTING

The DOD faces these issues as well. The Government Accountability Office (GAO) and DOD Inspector General (DoDIG) regularly report the problems with contract oversight. One such report from GOA concluded that "Surveillance varied on the 90 contracts we reviewed. Surveillance was insufficient on 26 of the contracts we reviewed but was sufficient on 64 contracts. Fifteen had no surveillance because no personnel were assigned such responsibilities; the other 11 had assigned personnel but could not provide evidence of surveillance due to incomplete documentation. Also, some surveillance personnel did not receive required training before beginning their assignments" (Cooper, 2005, p. 2).

Despite these findings, acquisitions professionals do receive extensive training on a myriad of procurement needs and how to accomplish them within the bounds of contracting regulations. To be considered proficient in one of the many fields of DOD contracting takes an average of ten years (Section 809 Panel, 2018). Contracting personnel are expected to understand the complexity of their own governing protocols as well as the human dynamic of managing contractors. However, a study from 2019 found that personnel responsible for monitoring contracts for fraud, waste, and abuse lacked fundamental training on the regulations they are meant to enforce (Tatum, 2018).

Moreover, contractors hoping to provide goods and service to the DOD experience an unusually strict environment when dealing with the government. Some law firms exist solely to advise contractors on DOD contracting in areas like the "dread of reviewing a

Request For Proposal (RFP)," filled with seemingly pointless pages of provisions and DOD jargon to the point that contractors are tempted to skim it and agree to a contract they potentially cannot actually source (Cassidy Law, 2018).

The RFP is the beginning of a process that can slowly build up entropy due to contractors inadvertently failing to attend appropriately to phrasing and provisions in the contract, which can end up in missed key terms and provisions completely out of innocent circumstances, which can end in either fraud or a failed program.

Thus, while humans, acquisitions officers and contractors alike, want to avoid the cumbersome and tedious work found organically in the ever-evolving procurement process, the results of this avoidance can be disastrous. Figure 1 identifies the complexity of DOD's acquisition process as a main driver of non-traditional companies' avoidance of working with DOD. Both the procurement officials and contractors that can provide innovative technology want to avoid the acquisition systems rules and regulations, which is disadvantageous for U.S. security.

Challenges identified by companies GAO contacted	Non-traditional companies											
	1	2	3	4	5	6	7	8	9	10	11	12
Complexity of DOD's acquisition process	√	√	√	√	√	√	√	√	√	√	√	√
Unstable budget environment	√	√	√	√	√	√			√	√		
Lengthy contracting timeline	√		√	√	√	√	√	√	√	√	√	√
Government-specific contract terms and conditions	√	√	√	√		√	√	√	√	√	√	√
Inexperienced DOD contracting workforce	√	√	√			√	√	√		√	√	√
Intellectual property rights concerns	√	√	√	√		√		√	√	√	√	

Legend: √ indicates challenges cited by each selected company.

The figure shows that a common reason, among others, that non-traditional companies cite as to challenges in working with DOD is the complexity of the acquisition process.

Figure 1. The DOD's Acquisition Environment Presents Key Overarching Challenges According to Selected Non-traditional Companies. Source: Sullivan (2017).

Despite these issues and others identified by the 809 panel in the contracting system, the DOD relies heavily on contractors to provide the U.S. military with goods and services needed to accomplish policy objectives around the world (Sargent, Gallo, & Schwartz, 2018). The DOD's relationship with contractors in Fiscal Year (FY) 2017

amounted to $320 billion in spending, which is more than all other federal agencies combined (Schwartz, Sargent, & Mann, 2018)—more, in fact, than the Gross Domestic Product (GDP) of Pakistan, which ranks 41st in the world in GDP (World Bank, n.d.). DOD procurement professionals will continue to rely on contractors to provide critical supplies for the security of the United States, so whatever solution comes about to solve speed issues needs to have the private industry contractor at its core consideration.

D. PROCUREMENT REGULATIONS AND SPEED OF PROCUREMENT

This section examines what aspects of DOD procurement policies are the perceived cause of the acquisition lag.

Most DOD contracting acquisitions are governed by procurement statutes and regulations found in Title 10 and parts of other select titles of the United States Code, the FAR, and the Defense Federal Acquisition Regulation Supplement (Congressional Research Service, 2018). The FAR sets the rules on how funds for contracts are spent; the FAR states that its vision "is to deliver on a timely basis the best value product or service to the customer, while maintaining the public's trust and fulfilling public policy objectives" (FAR 1.102, 2019). Contractors and contracting officials must adhere to over 2,000 pages of regulations in order to complete transactions necessary to fulfill warfighters' needs.

On top of the FAR, DOD has outlined further rules in the Defense Federal Acquisition Regulation Supplement (D.FARS), which further complicates the process for contractors and officials alike (Schlimmer & Brennan, 2018). Those regulations range from preserving the domestic supply of critical defense articles to dictating that contractors do not text and drive while performing contracted duties (Section 809 Panel, 2018). The complexity and comprehensiveness of these regulations led the Section 809 Panel to conclude that "The primary goal of acquisition regulations should be to promote the mission of the agency, not to impede it. Many of the current regulations taken as a whole, and sometimes even individually, impede DOD's ability to acquire the goods and services it needs when it needs them and to maintain technological superiority on the battlefield" (Section 809 Panel, 2017). Speed of contract award appears to be a common complaint—not just by the advisory board but by contractors, contract officials, and warfighters alike.

Formerly, this slowness did not matter because not only were disruptive technologies developing at manageable pace, but DOD owned the fringe technology development environment (Sargent et al., 2018). For the past 70 years, the DOD has enjoyed a technological advantage over adversaries and was the leader of the global technological landscape (Sargent et al.., 2018). However, development of disruptive technology is accelerating faster than in the previous decades, and the DOD is no longer the leading innovation sponsor. The advantage of being a research sponsor is access to the technology being researched, and with the DOD no longer outpacing other investors, others are filling that void. Private industry has managed to outpace investment in militarily advantageous technology outside of DOD's control, primarily in "fields such as artificial intelligence, computer processors, robotics, software, and advanced materials—fields of substantial importance to 21st-century military applications" (Sargent et al., 2018, p. 6).

As small businesses began to develop innovative technology at a more desirable rate than traditional larger companies, DOD took notice. In the 2011 National Defense Authorization Act, section 1073 set aside funding for rapidly acquiring military technology deemed critical for national security. This new program does not follow the traditional acquisition path that would normally be required of small business because the traditional procurement system is not designed to work well with them (Sargent et al., 2018). The program appeals heavily to small business, as they make up 90% of the awarded contracts although large businesses are not excluded from participating (Office of Small Business Programs, n.d.).

Still, when DOD wants to invest in certain companies, the companies do not want to work with DOD. "Many commercial companies hesitate to work with federal agencies because they perceive government contracting as a labyrinth of regulatory requirements and rigorous compliance obligations that are too costly and time-consuming to meet" (Pickens & Alvarado, 2018, p. 18).

A Research and Development Corporation (RAND) study on fielding cyber security software for the Navy stated "it is often the case that major acquisition systems take more than ten years to progress from statement of need to operation. Given that such systems are dependent on state-of-the-art technologies that evolve at rapid rates, a system

could quickly become obsolete and no longer provide the superior warfighting capability necessary for success" (Porche et al., 2012, p. 53). Technology, such as cyber security software, is at the greatest risk of being procured just as it becomes obsolete if following traditional contracting pathways. The "DOD's slow acquisition system and ineffectiveness in engaging with small, innovative businesses, puts the DOD at risk of losing the race to obtain advanced capabilities as potential adversaries such as China work aggressively to acquire U.S. innovations and new technology" (Section 809 Panel, 2018).

E. PROCUREMENT ADMINISTRATIVE LEAD TIME

This section looks at a self-recognized problem of acquisition lag due to procurement officials' need to follow acquisition processes by procurement officials.

In recognition of certain processes taking longer based on complexity, Congress, through NDAA, directed the DOD to provide transparency on how long the contracting process should take. The NDAA defines Procurement Administrative Lead Time (PALT) as "the amount of time from the date on which a solicitation is issued to the date of an initial award of a contract or task order of the Department of Defense" (DOD, n.d.). Procurement Action Lead Time and Procurement Acquisition Lead Time are often also used interchangeably by DOD officials and government agencies to define the same metric despite being technically incorrect terms as defined by the NDAA. In a memo to all U.S. Army Contracting Command organizations, Major General Simpson defined the anticipated PALT times to be as shown in Table 1.

Table 1. The Procurement Administrative Lead Time Reference Table. Source: Simpson (2018).

Dollar Value	Acquisition Type	PALT
<$25K	All	45
>$25K-<$1M	Competative	65
>$25K-<$1M	Non-Competative	90
$1M-<$10M	Competative	150
$10M - <$50M	Competative	190
$1M - <$50M	Non-Competative	200
$50M - $100M	Competative	400
$100M - $250M	Competative	425
$50M - $100M	Non-Competative	475
$100M- $250M	Non-Competative	400
$250M- $1B	Competative	575
$250M- $500M	Non-Competative	550
>$500M	Non-Competative	550
>$1B	Competative	700

The PALT table gives contractors an estimated number of calendar days they should anticipate to wait between having their offer accepted and when the contract is awarded. It is broken up in million-dollar increments and according to whether other companies compete for it, which adds days due to issues such as protests by the losing bidders.

It is important to recognize that PALT is an estimation for how long it takes the bureaucratic contracting process to complete its cycle and issue a contract after all potential suppliers have filed their bids. This is not a timeline from submitting a bid to First Unit Equipped (FUE), which is when the item is fielded in its Initial Operational Capability (IOC), as in, when a warfighter can use the capability acquired. It is rather a timeline of choosing someone to build the capability (Hagan, 2009).

F. SYSTEMIC COMPLEXITY AND SPEED

This section examines if complexity is indeed a hinderance in the DOD acquisition process.

The 809 Panel's recommendations focus heavily on making the procurement process less complex. In their Roadmap, they state that "The complexity of the federal acquisition process has resulted in regulations that are challenging to navigate and

understand for most government and industry acquisition team members" (Section 809 Panel, 2019). The process in the Appendix, Defense Acquisition Life Cycle Compliance Baseline, lays out multiple steps that need to be taken in order to effectively field a DOD system. This is what is referred to when speaking about the over burdensome procurement process that affects the speed of acquisition.

However, the complexity has been created for a reason, and is not necessarily a bad thing. Complex systems are created to guard against risk, abuse, and incompetence of an ever-rotating cadre of professionals meant to keep the system running despite the loss of experienced senior practitioners while providing a safe environment to train newcomers (Cook, 2000). Based in laws, regulations, executive orders, and best practices, the FAR and D.FAR mandate hundreds of clauses for contracts in order to mitigate risk (Section 809 Panel, 2019).

G. RAPID FIELDING INITIATIVE

Acquiring things faster is possible with current systems when needed.

The procurement process, from request for proposal to execution, is not so rigid as to ignore the urgency of lifesaving technology for active war zones. Exceptions to policy and temporary policy override rules exist to deliver immediate needs to combatant commanders (McCain, 2015). The Rapid Fielding Initiative (RFI) was created for this very reason. As a spokesperson for the U.S. Army's Program Executive Office, the organization behind RFI, said "The Army's RFI is a program that ensures our soldiers receive the finest individual and unit equipment the Army can provide—as rapidly as it can be procured and fielded" (Gourley, 2012).

RFI may serve a purpose for equipping Soldiers in an active war zone, but the system is designed to be an emergency measure, not a supply chain solution. When something is done as an emergency measure, it becomes expensive and may need funding not allocated to in the budget. This is evidenced in 2007, when the RFI program needed to request and additional unplanned $221 million in supplemental operations and maintenance costs, as they did the year before (Scott, 2007). To meet DOD requirements

outside of RFI's combat related scope, such as prototype and standard operational items, other avenues need to be available.

H. THIRD OFFSET STRATEGY

This section looks at why policy workarounds have been a favored "solution" to produce rapid acquisitions.

The RFI process was created during America's War on Terror, also referred to as counter terrorism (CT), when innovative efforts were focused on defeating insurgents who were able to use relatively cheap means to defeat multimillion-dollar military systems, such as the $75 billion spent on the now no longer desirable Mine-Resistant Ambush-Protected (MRAP) vehicle (Zoroya, 2013; Kendall, 2018). With the primary focus of U.S. strategy waning from CT, new threats to security began emerging with the newly world power assertive China, and reemeergence of Russian aggression in Europe, made DOD desire new ways of fighting. As the U.S. began divesting from the CT focus, the new era of Great Power Competition (GPC) was declared in the 2016 National NDAA. The DOD's expectation to continue rapidly acquiring warfighter needs prevailed, despite not having a war to justify the urgency.

In 2014, the Secretary of Defense, Chuck Hagel, identified that America's military dominance was eroding because the DOD was full of institutional barriers that needed to be overcome in order to rapidly integrate concepts and capabilities (Hagel, 2014). He coined the term "Third Offset Strategy," (TOS) as a way to keep American military technological superiority as a deterrent to possible adversaries through the development of novel capabilities and concepts (Walton, 2016). The following Secretary of Defense, Ashton Carter, continued Hagel's vision by proposing a $3.6 million in the 2017 budget to go towards "small bets" in the pursuit of innovative R&D to go toward the TOS (Walton, 2016).

The concern was now the accelerated global ambitions of China, bolstered by its rapidly growing economy, and Russian nostalgia for a bipolar world where it could negotiate from a mutually assured destruction platform (McCain, 2015). Table 2 shows the world's share of R&D expenditure.

Table 2. Nations with the Largest Gross Expenditures on R&D, 2016. Source: Sargent et al. (2018).

(in billions of current purchasing power parity (PPP) U.S. dollars)

Nation	Amount	Share of Global Total
United States	$511.1	28.4%
China	451.2	25.1%
Japan	168.6	9.4%
Germany	118.2	6.6%
South Korea	79.4	4.4%
France	62.2	3.5%
United Kingdom	47.2	2.6%
Russia	39.9	2.2%
Taiwan	35.8	2.0%
Italy	29.9	1.7%

China and Russia have been declared potential U.S. adversaries, with China being considered a near-pear potential adversary. China is spending almost as much on R&D.

The new GPC would not be fought with IEDs and defended with armored vehicles, the state actors had much more innovatively destructive means to wage war. The traditional battle spaces of land, sea, and air have expanded to space, cyber, and information, which Russia's Chief of General Staff, Valery Gerasimov, referred to as Hybrid Warfare (Baig, 2019). China and Russia have shown great interest to out innovate the U.S. in terms of military advantage, and congress wanted to make sure that innovation in this new GPC would always belong to the U.S. DOD (McCain, 2015).

China officially announced the 863 Program with the purpose being a world class competitor in strategic aims. The 863 Program states that the

> Objectives of this program during the 10th Five-year Plan period are to boost innovation capacity in the high-tech sectors, particularly in strategic high-tech fields, in order to gain a foothold in the world arena; to strive to achieve breakthroughs in key technical fields that concern the national economic lifeline and national security; and to achieve "leap-frog" development in key high-tech fields in which China enjoys relative advantages or should take strategic positions in order to provide high-tech support to fulfill strategic objectives in the implementation of the third step of our modernization process. (People's Republic of China Ministry of Science and Technology, 2018)

China's and Russia's stated goals would lead to a significant increase in funding in non-traditional areas, with non-traditional partners, and with non-traditional acquisitions methods.

In a report to Congress, speed of acquisition was blamed for the rapidly declining supremacy of the United States compared to potential near-peer adversaries (Congressional Research Service, 2018). The need for gaining the best unmanned vehicles, most secure and capable satellite equipment, and artificial intelligence systems lead the DOD to start thinking more like venture capitalists (VC) than traditional bureaucrats (Cross, 2019). The type of VC that DOD admired were at the heart of Silicon Valley's rapid success, and so they imitated their guiding principles of embracing risk to accelerate innovation gains.

I. FRANK KENDALL'S 5 MYTHS OF ACQUISITIONS

Rapid acquisition through removal of safeguards is not a uniform perspective amongst experts in the field.

The Section 809 panel recommendations are intended "to change defense acquisition from an outdated, industrial-era bureaucracy to a more streamlined, agile system able to evolve in sync with the speed of technology innovation" (Section 809 Panel, 2019). One of the areas identified in the report that needed "evolutionary and revolutionary" change was the DoDI 5000.01, and a recommendation that DoDI 5000.02 could also use the same scrutiny, which was written under the direction of Frank Kendall, who served as Under Secretary of Defense for Acquisition, Technology, and Logistics from 2011–2017 (Kendall, 2017). Other than his contributions to the offices he oversaw, he is also noted as having a sign above his office that said, "In God We Trust; All Others Must Bring Data" (Kendall, 2017). He recognized that the organization he was responsible for was being blamed for the faltering status of the U.S. as an unmatched leader in global security. On the topic of Better Buying Principles (BBP), which is the concept of how to acquire systems as responsibly as possible with the consideration of need and risk reduction, he recommended acquisitions experts consider the following principles:

- Principle 1: Continuous improvement will be more effective than radical change.
- Principle 2: Data should drive policy.
- Principle 3: Critical thinking is necessary for success; fixed rules are too constraining.
- Principle 4: Controlling life-cycle cost is one of our jobs; staying on budget isn't enough.
- Principle 5: People matter most; we can never be too professional or too competent.
- Principle 6: Incentives work—we get what we reward.
- Principle 7: Competition and the threat of competition are the most effective incentives.
- Principle 8: Defense acquisition is a team sport.
- Principle 9: Our technological superiority is at risk and we must respond.
- Principle 10: We should have the courage to challenge bad policy. (Kendall, 2017, pp. 10–14)

Principles 9 and 10 directly address the criticism directed at his office with regard to technological superiority challenges and cumbersome regulations. By these principles he also argues against the popular notions in modern acquisitions discourse, which he refers to as myths. Seemingly referring to efforts made by such organizations as the 809 Panel and other endeavors, he says, "most attempts to direct or legislate acquisition 'magic' in some form have been counterproductive and often only increased the system's bureaucracy and rigidity or led to excessive risk taking—neither of which is helpful" (Kendall, 2017, p. 7). He states the myths are as follows.

1. The Defense Acquisition System Is Broken

The DOD acquisition system creates never-before-seen, next-generation, weapons that are sought or imitated by every powerful military in the world, so some risk will be inherent, and cost overruns, schedule slips, and canceled programs are a result. This does not mean the system is broken, in fact, the results are proof that it works.

2. Excessive Bureaucracy Is the Core Problem with Defense Acquisition

Poor planning and congress are the problem. The DOD bureaucracy mitigates risk and ensures programs follow through to responsible completion. Congress keeps passing more rules and regulations in the NDAA, creating more bureaucratic hurdles. There is too

much bureaucracy, and attempts to reduce the cost of it should be pursued, but the mechanisms for implementing and reviewing program planning, monitor performance, and supporting sound program decisions are valuable. Bureaucracy prevents lone individuals from committing the government to erratic obligations.

3. Innovation Is Stifled by the Acquisition System

The acquisition system reacts to budgets and operational requirements. It does not dictate what budgets get passed or how operational units adopt the acquisition. DOD has in its abilities to provide any reasonable request to warfighters that require, but the problem does not reside in getting the request, rather full integration and adoption of the needs is what causes a lack of capability.

4. Stronger "Punishments" for Cost Overruns and Schedule Slips Will Lead to Better Performance

This goes directly against the effort to get innovative companies to work with DOD. Using non-commercial practices like firm-fixed-price to have companies risk bankruptcy and other unbounded risk is counterproductive. The idea that being a program manager exposes someone to public firing over uncontrollable circumstances dissuades qualified people from pursuing that as a professional route.

5. There Is Some New Form of Undiscovered "Acquisition Magic" That Will Fundamentally Improve Results

Rapid acquisition, agile development, looser constraints, and quick-to-fail philosophies appear to be the target of this criticism. Things like this should be saved for operational urgency, and not in the sense that everything is an emergency, because if everything is an emergency, nothing is. Emergencies require the acceptance of high risk, wasteful expenditure, expensive workarounds, and unfinished capabilities to be fielded that may not necessarily help except in the short term, which is used to justify the cost. He mentions the MRAP as an example, and compares it to the much more deliberate Light Tactical Vehicle that he predicts will serve the DOD for decades, while DOD considers scrapping MRAPs in theater to be more cost-effective than shipping them back.

Likewise, Ellen Lord, the current leader in the position that Mr. Kendell had, stated that the system itself is not broken or slow, it's the interference of too many redundant stakeholders that causes delay. According to her,

> The more leaders (both executive and legislative branch), executives, managers, reviewers (both civilian and military) involved, the longer everything takes. The more decision responsibility is diffused, the longer it takes. The more complicated the process is designed to be, the longer it takes. The more unstable or unknown the budget is, the longer it takes. The more users involved in deciding what it is they want, the longer it takes. Acquisition is a leadership, bureaucratic and people issue; not a contracting, statutory or regulatory one. (Fischetti, 2018)

She appears to agree more with Mr. Kendall's assessment of the procurement system than with the congressional view.

J. THE CHINESE PROCUREMENT PROCESS

The primary reason that policy makers are demanding that the DOD acquisition system augment their rules is out of fear that China can out-procure the U.S. in military aiding technology, when that is not the case.

Kendall and Lord do not think the procurement process is what is surrendering the United States' security advantage to the Russians and Chinese. The political discourse on GPC involves ambitions of the nearest military peer, China, through the People's Liberation Army (PLA). The promises and ambitions of the Chinese government are often quoted as to explain why the DOD procurement process is going to be the cause of failure in a potential future war, and lack of ability to contribute to the TOS. It is therefore important then to examine if China can actually deliver on its threats, as they too have to go through a procurement process. A report titled "China's Military Procurement Approach in the Early 21st Century and its Operational Implications" by Yoram Evron states:

> China's military procurement process can be expected to reduce the actual military value of the newly developed weapon systems. First, the production of advanced systems can be expected to involve significant impediments related to inefficiency, over-ambitious targets and inadequate quality assurance processes, which inevitably will affect the supply of systems and spare parts. Second, the operational utility of the newly acquired weapon systems will probably be limited, performance might not comply with the

> military demands, and their deployment and assimilation process will be incomplete. Third, given that the production and supply of systems and spare parts might be imperfect, and that the new weapons are not necessarily being deployed in large numbers, the PLA's new weapon systems are likely to encounter support problems. (Evron, 2012, p. 89)

The author found that the poor procurement practices of the PLA make their rapid innovation environment, the threat considered so pressing by current policy makers, is impractical. The current PLA commander in chief, Xi Jinping, has identified this weakness and is mandating reforms to better modernize the military, and bolster military innovation, but has not yet been able to overcome the obstacles inherent in China's military industrial complex and dearth of regulatory frameworks (Char & Bitzinger, 2016). President Xi is also interested in Civil-Military Fusion, whereas the Chinese industrial and innovative base will be used to support PLA activities, logistically and technologically (Kania, 2019). This is often quoted as the reason that DOD needs to reach out to the private sector, which is out innovating the DOD, in order to not lose that innovative edge that China is apparently gaining. Surprisingly, however, China considers what the DOD procurement system has already been doing as Civil-Military Fusion, and they are imitating the DOD system as a superior model in order to procure advanced and reliable military capability (Kania, 2019).

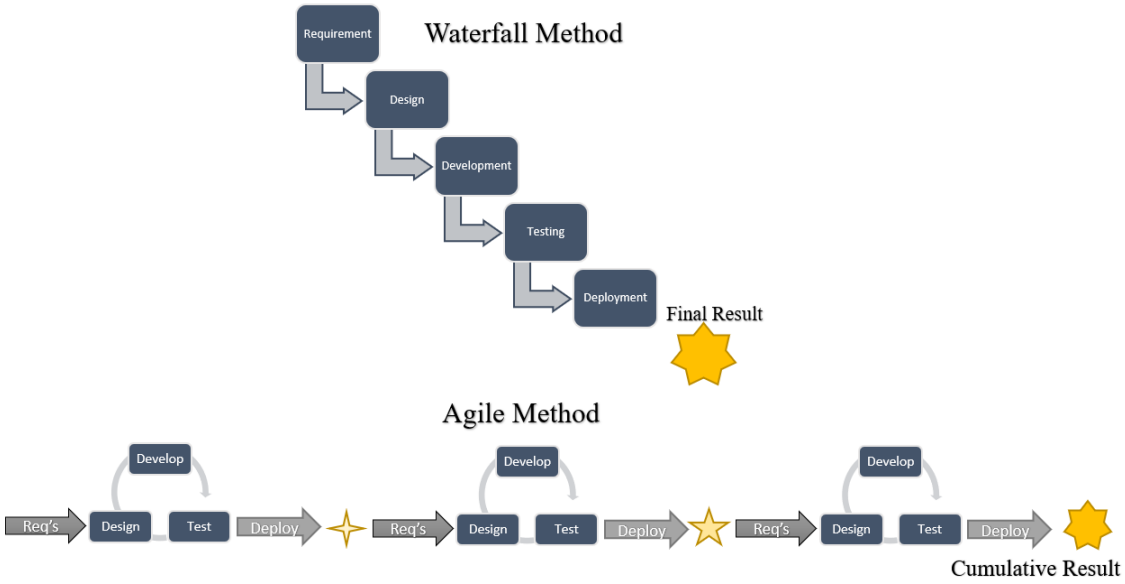
K. FAIL FAST, FAIL OFTEN, FAIL CHEAP, FAIL FORWARD

The result of fears of China's perceived fielding capability has prompted a new way of addressing failure in DOD acquisitions.

According to researchers from the Congressional Research Service, "recognizing that potential military adversaries may have access to the same suite of commercially available technologies as DOD does, the NSS places a premium on speed in the development, adaptation, and acquisition of technologies, as well as in bringing them to the warfighter in the form of new tools and weapons" (Sargent, Gallo, & Schwartz, 2018, p. 15). The point being made here is that technological advancement is an inevitable achievement by any world power, due to the ease of reproducing technological advancement, therefore any technology that the United States is relying on for security will be fully replicated or defeated in a matter of time. So instead of investing heavily on an

unbreakable technology, the suggestion is to focus on expecting that current technology will be obsolete within a six-month window and that the security posture in place should reflect that time span. According to the NSS, “the United States must regain the element of surprise and field new technologies at the pace of modern industry. Government agencies must shift from an archaic R&D process to an approach that rewards rapid fielding and risk taking” (Sargent et al., 2018, p. 15).

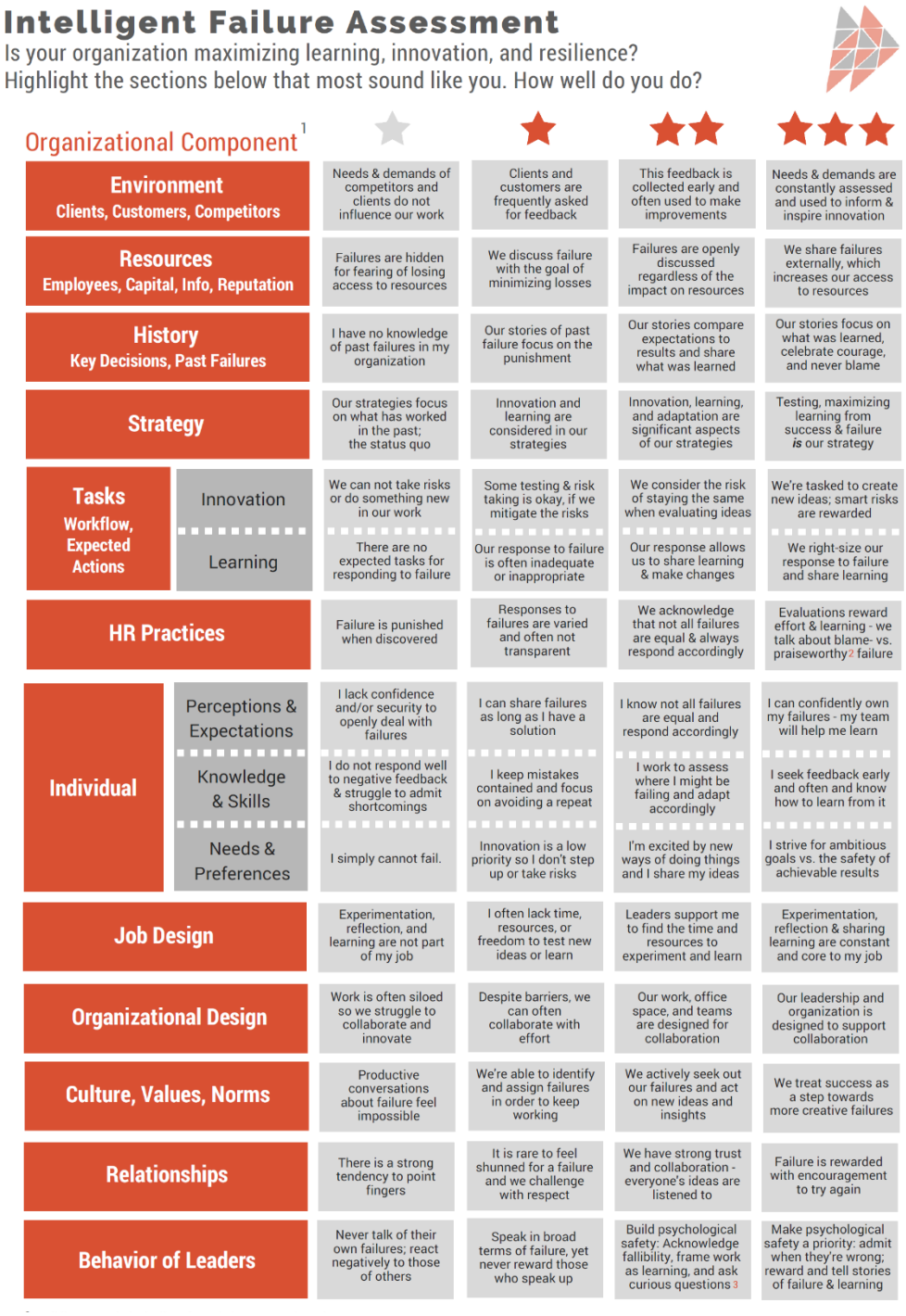
“Experience is the best teacher” is an idiom often used to justify poor performance, and why someone should keep trying despite of it. Robert Burns wrote that “The best laid schemes o’ Mice and Men often go awry,” and is this generally the thought why the VCs of Silicon Valley are so successful. The idea is to have a level-headed approach to failure, which means instead of giving up on an idea, the most successful entrepreneurs are committed to assessing, refining, repurposing, and reintroducing the systems that make things work (Alton, 2018). Originally intended for software development, the term “Agile Development” is used to describe an iterative approach to development rather than the “waterfall” method of step by step processes (Schaeffer, 2016). Figure 2 demonstrates the difference. This is where the fail fast idea comes from. If someone can recognize faults in requirements phase and scraps the whole project because of it, then the subsequent steps would not have had resources wasted on them as they would have been working on a failing project. Naturally, if you fail at the beginning, you fail cheap, and failing often means that you have identified problems often.



The first example, Waterfall, shows the traditional method of creating a product that flows in sequential steps where testing happens towards the end. Agile development treats each subset as its own individual product that gets regularly tested before moving on. In Agile method the entire project can be shut down if the first iteration proves to be a failure, where Waterfall development identifies failure when all the work has already been completed.

Figure 2. The Agile vs. Waterfall Method. Adapted from Schaeffer (2016).

The concept of fail forward is to not fear failure, but to pursue goals with resilience. It is even possible to make an organizational assessment of how intelligent your failure is as shown in Figure 3.



The Intelligent Failure chart allows an organization to score themselves on how well they fail, and what they can do to improve their processes.

Figure 3. Intelligent Failure Assessment. Source: Good (2019).

With the need to get innovative technologies faster, DOD embraced Silicon Valley's relationship with a new kind of failure.

L. DEFENSE INNOVATION UNIT

The DOD has restructured itself to address faster acquisition of emerging technology.

One solution is the creation of the Defense Innovation Unit (DIU), which has a 23% success rate of contracted projects making it into the hands of warfighters (Maucione, 2019b). DIU is meant to accelerate adoption of commercially available innovative technologies into warfighters hands to stay ahead of the looming threat of peer and near-peer competition from countries like Russia and China. These particular countries have taken measures to challenge the military advantage the U.S. has worldwide with innovation of their own to threaten current combat systems (McCusker, 2019).

In order to deliver innovation at a rapid rate, DIU had a goal of delivering cutting-edge technology in 60 days but on average takes 187, which it sought to address with greater use of Other Transaction Agreements (OTA) (Maucione, 2019b). The OTAs allow a greater workaround of the rules and safeguards enshrined in the FAR, which is easier for smaller innovative companies, and could be a reason for the 23% success rate. DIU has an important mission to ensure that U.S. warfighters have a technological advantage over their adversaries, and would be more effective if burdensome government safeguards could be executed at a faster rate at the technological maturation phase, to ensure achievement of both compliance and need of the technology. OTAs have their limitations as solution however, as they limit transparency and provide opportunities for misuse. Since they avoid the traditional rules and regulations outlined in the FAR, they also lack a template and precedent, leaving the awarding officer to negotiate the right amount of risk is appropriate between accountability and delivery of the technology with little to base it on (Pickens & Alvarado, 2018). As demonstrated by the decision in 2018, when GAO sustained Oracle America Inc.'s (Oracle's) protest of an Army cloud contract awarded as a follow-on to a prototype OTA, the relaxed rules may have sped up one process, but opened up the DOD

to mired in an increased amount of future protests from companies (Pickens & Alvarado, 2018).

The increased use of OTAs are a sign that the bureaucracy and safeguards of the procurement system are considered a weakness for national security. Congress continued to respond with policy measures to address the problem. One such response in the 2016 NDAA sought to address the apparent lag in the DOD procurement system by authorizing Rapid Acquisitions programs (Oakley, 2019). Changes authorized under the NDAA were Section 804 Middle Tier—Rapid Prototyping and Rapid Fielding; Section 806—Development, Prototyping, Deployment of Weapon System Components; DODI 5000.02 Tailoring and Accelerated Acquisition Model 4; DODI 5000.02 Enclosure 13 Urgent Capability Acquisition; and changes to the FAR (Modigliani, Chang, Ward, & Murphy, 2019). This act also allowed an expanded use of OTAs, which were once considered a last resort but now are common-place for acquisitions (Pickens & Alvarado, 2018; DiNapoli, 2019). These policy workarounds have made it easier to do business with the DOD, and increased procurement while also creating an increased risk and lack of oversight (Pickens & Alvarado, 2018).

M. THERANOS

The same thought and motivation that fooled the many influential people who backed a company called Theranos is being perpetuated in the rapid acquisition mindset.

The logic of investing into status-quo-challenging, confidently represented, and expert-backed, ground-breaking capability is seductive. As a private sector example, Theranos was a company that fell from grace after their claims that they could use a small drop of blood to test for a myriad of bloodborne ailments, something unprecedented in the medical community, proved untrue (Waikar, 2018). The excitement in the VC world amounted to a $9 billion valuation of the company, which in no small part had to do with its high-profile makeup of the board of directors and investment from large companies (Fuller, 2019). The touted technology was fake, yet in the fail fast mentality of Silicon Valley, investors believed in it more from personal passion than time tested principles that produce effective results. This company believed in the Silicon Valley idea of “fake it ‘til

you make it," or in other words, "cheat 'til you win" as its guiding principle (Bech, 2019). They thought that if they could raise enough money by faking results, eventually, their research would create the technology they promised was already working (Waikar, 2018). A Wall Street Journal reporter investigated these claims, discovered the fraudulent scheme, and the company was shut down with its founders finding themselves with criminal trials set for summer 2020 (Ramsey, 2019). Theranos was able to take advantage of the positive thinking enthusiasm of Silicon Valley to defraud investors who did not need to see proof in order to believe in the idea.

N. ALL FAILURES ARE NOT CREATED EQUAL

Michael Griffin, Under Secretary of Defense for Research and Engineering (USDR&E), during the 2019 DOD Lab Day has a different perception of the fail fast ideology "We need to remember that our goal is always, ultimately, mission impact. That demands balancing speed with diligence and quality. It's not actually speed that matters; it's velocity. Velocity is a vector combining direction and speed. I don't care how fast you're going if you walk over the cliff" (Maucione, 2019a).

A look at the Navy's Littoral Combat Ship (LCS) program shows how enthusiasm without traditional checks can become a problem. The Navy LCS concept was started in the early 2000s, with two shipbuilders contending their own prototypes based on commercial designs—Lockheed Martin's Freedom variant and Austal USA's Independence variant (Mackin, 2015). The LCS was to bring the Navy new and exciting capability with state-of-the-art technology that would increase enemy space operation with limited risk and a significantly smaller crew (Mackin, 2015). The Navy was so eager to adopt this new addition to the fleet, that they rushed on the prototyping, contracting, and fielding, while deviating from the traditional procurement controls meant to effectively manage a program of that nature (Mackin, 2015). As a result, the LCS platform was deemed largley incapable of performing as promised, and Congress was urged to slow down its acquisition to better determine the realities surrounding the innovative program (Mackin, 2015).

The MRAP vehicle can be considered as a rushed project that could not maintain relevance. From a GAO report, as of July 2008, 75% of casualties in Iraq and Afghanistan were from improvised explosive devices (IED) (Sullivan, 2009). Conventional DOD Acquisition policy mandates that systems be fully tested before being fielded but the urgency of saving lives made the MRAP an exception, and thus was fielded before testing was complete (Sullivan, 2009). The MRAP's success is measured by how many lives it saved, calculated by how many times the vehicle sustained IED blasts and the number of people that survived. By 2013, the number of successful protected personnel is estimated to be 40,000 people (Friedman, 2013). This is often seen as a victory for the rapidly acquired system in the grand scheme of the wars in Iraq and Afghanistan, but that measure is flawed when juxtaposed the actual purpose of the war. If the U.S. military wanted to save even more lives than the MRAP program could possibly deliver, then all troops should have been pulled out of harm's way, therefore no troops injured at all, but saving Soldiers' lives was not the policy objective of going to war with Afghanistan. An argument can be made that, by providing a technological solution to a problem, more complicated, less physical, alternative measures to counter the source of the problem, such as population engagement and threat network targeting, get dismissed as there exists a simpler quick fix to remove the Soldier from the threat. Therefore, the MRAP saved lives from IED's but may have had negative second and third order effects on stopping the reasons IEDs were being used at all (Armstrong, 2015).

Other rapid fielding requirements still exist. Another Rand study suggested that in order to field emerging technology the DOD should "Support emerging acquisition needs with a formalized process that is separate from the traditional acquisition process. This process needs to be streamlined, agile, and able to accept an 80-percent solution (e.g., have relaxed requirements)" (Porche et al., 2012, p. 31). With modern procurement technology and practices, risk in terms of cost overruns and whether the procured entity is appropriate is now considered inherent in delivering war fighter need.

In order to operate in the current innovation environment, the 809-panel produced for congress three volumes of over 1,000 pages of altered, relaxed, removed, or recommended policy procedures on how to better acquire things faster (Section 809 Panel,

2018). The rationale to do this was because autonomous systems, with their ability to analyze large volumes of data, will be crucial for a competitive advantage against emerging peer adversaries. The most curious aspect of all of the appreciation for disruptive emerging technology that will keep the U.S. at a competitive advantage militarily, is that the same consideration was not given to how this same technology can be applied to the acquisitions problem set, thus far addressed merely with policy workarounds. This is perplexing because this technology is already available and being put into real world application.

O. 2019 OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR ACQUISITIONS AND SUSTAINMENT STRATEGY AND PRIORITIES

The policy of rapid acquisition has been adopted by DOD as official policy.

Since 2017, Ellen M. Lord has been serving as the Under Secretary of Defense for Acquisition and Sustainment (USDA&S) (Office of USDA&S, n.d.). She is "responsible to the Secretary of Defense for all matters related to acquisition; contract administration; logistics and materiel readiness; installations and environment; operational energy; chemical, biological, and nuclear weapons; the acquisition workforce; and the defense industrial base" (Office of USDA&S, n.d.). In the published strategy of the department, the mission is to "Enable the Delivery and Sustainment of Secure and Resilient Capabilities to the Warfighter and International Partners Quickly and Cost Effectively" (Office of USDA&S, n.d.). The first goal in this strategy is "Enable Innovative Acquisition Approaches that Deliver Warfighting Capability at the Speed of Relevance" (Office of USDA&S, 2019.). The theme for these priorities is the speed of relevance, which follows the theme of congressional criticisms of the procurement system. With this in mind, it is likely that significant attention will be paid to the actions of the Department of Homeland Security (DHS), with their $50,000 per the nine contractors, to demonstrate use of AI in contract analysis. In this venture, the DHS wants "to determine the extent to which artificial intelligence (AI) can assist contracting officers make more efficient and effective use of Contract Performance Assessment Reporting System (CPARS) data by rapidly identifying potentially relevant records to support past performance evaluations" (DHS, 2019). The companies that are vying for the opportunity to demonstrate their product have a baseline in addressing similar issues in the private sector.

THIS PAGE INTENTIONALLY LEFT BLANK

III. CONTRACTING IN THE ACQUISITION SYSTEM

In response to the need for rapid acquisition for technological superiority of the United States military, we first must identify what in the system causes delay.

We have identified that speed is necessary in the acquisition system, and that due diligence is essential. To understand how contracts work within the broader procurement system, this chapter will look at the current procurement program, and analyze when a procurement official would have significant decision points. The rules that are recommended for easing tie directly into this pattern of procurement. Currently, the way to accelerate certain programs is based on working around the rules and schedules while essentially following the same pattern. The language used and the patterns found in the system are mandated in the regulations that have been cultivated over multiple administrations are the results of best practices.

Research from the University of Colorado Law School has compared legal contracts to physical architecture in terms of interconnected pieces that make up a resilient structure. Just as a building architect has to consider the multitude of interlocking patterns, safety measures, and legal regulations to create something with structural integrity and appropriate aesthetic, so a lawyer has to draft a contract using similar, albeit contract-specific, thought processes (Gerding, 2013). With rules and considerations, patterns develop from contracts that perform a certain way due to particular language used for bargaining, meeting client objectives, and history of court interpretation of similar contracts (Gerding, 2013).

That said, the author of “Contracts as Pattern Language” warns that although the suitability of computational translation and analysis is appropriate for contracts, it is crucial not to remove humans from the process. Contracts, after all, are a social construct and are dependent on human interpretation of their contents, rather than a machine’s callous interpretation of data (Gerding, 2013). The humans that are involved can find the pattern-like process monotonous, and lose motivation to apply the same amount of diligence to more creative and qualitative aspects.

The decision of which tailored baseline model to follow is based on characteristics of the acquisition and urgency of its fielding (DOD, 2017). All procurement programs go through a structure that moves along decision points which trigger phase activities. The milestone decision points, denoted by triangles as seen in Figure 5, go as follows:

A. NEED IDENTIFICATION

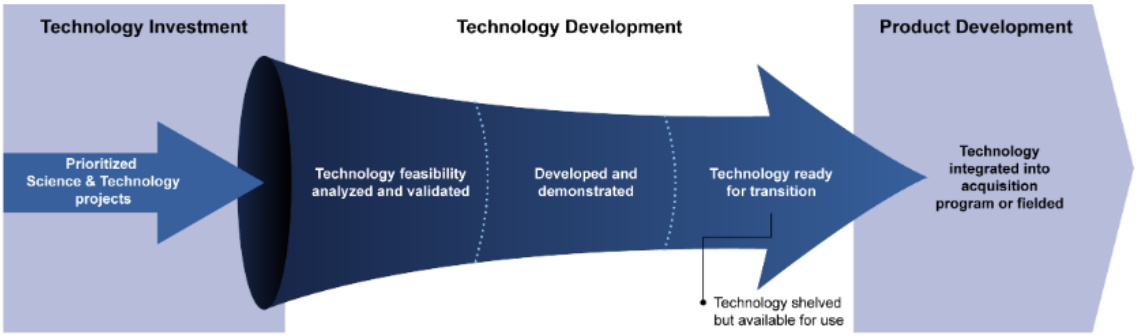
The first milestone is that a need has been identified in some way by a DOD component, which will then trigger a search for alternative solutions to the need. For example, if the Army needs an air refueling platform, acquisition professionals would first determine whether those specific needs can be met with already existing platforms and technology, and if none are discovered, the decision that a new product is needed triggers the next phase;

B. MILESTONE A: RISK REDUCTION DECISION POINT

When no alternatives can fulfill the specific need, the investment decision is made to commit resources to mature the technology that is necessary to resolve the issue. For example, if a private business has technological capability that resembles the identified need to produce new science or technology, then the DOD will sponsor the accelerated development of this capability. This is where the frustration originates with the rhetoric of Rapid Acquisitions. Other Transactional Authority (OTA) Agreements exist to rush through the steps traditionally prescribed by the acquisition system in order to determine the viability of the prototype while its technology still has relevance, and by doing so increases risk, which is purportedly justified by the urgency of staying ahead of potential adversaries inevitable discovery of this strategically relevant system.

This appears to be the philosophical foundation of current DOD innovative and rapid acquisitions community and is in line with Agile Development practices, seemingly necessary to overcome the “Valley of Death” as seen in Figure 4 where the technological development ends in ready-to-transition technology that either gets adopted or shelved indefinitely. The Valley of Death is when the scientific community is ready to provide a technological capability, but it is not accepted by acquisition community due to their higher standards for what is considered a mature technology, lack of perceived need, or

unavailability of budget to invest in the idea (Sullivan, 2015). In this phase, Science and Technology projects may be stalled for 18 to 24 months while awaiting funding (Under Secretary of Defense, 2003).



A DOD-focused science and technology community develops capabilities for production. The steps go through their own mechanisms of testing and development, then they are provided for the DOD procurement process to integrate the asset. When the asset is deemed not ready, it is shelved until some process allows it to continue to Milestone B.

Figure 4. The DOD Technology Management Process. Source: Sullivan (2015).

C. MILESTONE B: REQUIREMENTS DECISION POINT

Once a prototype has been shown to be viable, the DOD issues a request for proposal (RFP) to the broader industry. DoDI 5000.02 explicitly calls to "avoid, to the maximum extent possible, lock-in to sole and single source suppliers at any tier" (DOD, 2017, p. 79). This means that the company that created the working protype is not guaranteed the production of it for DOD. This is done in the spirit of transparency, and often, practicality, as a research and development company that developed the prototype may not have the immense production capacity often required by DOD. For DOD, "the Development RFP Release Decision Point [DP] is the point at which plans for the program must be most carefully reviewed to ensure all risks are understood and under control, the program plan is sound, and that the program will be affordable and executable" (DOD, 2017, pp. 7–8).

Contracting professionals in this step must be careful in phrasing of the RFP, because missed clauses, unclear definitions, and even misunderstanding of what is actually

wanted from the system could cause excessive time in clarification to contractors and expensive fixes after the program has been initiated, which results in cost overruns and delayed schedules. Contracts are also issued at this point, which need their own viability to be evaluated based on what the contractor stated versus actual capabilities they are able to deliver based on the complex language as prescribed by the FAR and its interpretation. PALT is referenced by the contractor to see if it is worth it to bid based on time of award alone. The engineering and development of the acquisition happens at this step with a constant interaction between DOD officials and the contractor developing the product. This step can take a longer than intended due to frequent changes to the item in production as developmental testing necessitates adjustments and end user requirements are better defined.

D. MILESTONE C: INITIAL PRODUCTION OR FIELDING

The decision to go into Low-Rate Initial Production (LRIP) happens at this milestone. This allows an assessment of the product in further testing in both a lab environment and at the end user level. This is necessary so that the government is not obligated into purchasing a large scale of the item if it is not fully viable to support the need for which it was requested, or if it has some user- or maintainer- specific requests that warrant change. An example would be rearranging interface layout of a control panel, or making certain mechanical components easier to access to better facilitate human interaction with the system. This change is acceptable even at the sacrifice of the best manufacturing process to create it. After the adjustments have been made, and viability of the product determined successful, the acquisition enters full production.

Figure 5 shows how DoDI 5000.02 envisions the above steps with guidance on how to adjust for specific acquisitions. The instruction, since 2015, has had a vehicle for accelerated acquisitions, which merely blends milestone A and B into one decision. Other blends exist, to include an iterative approach, much like Agile design, but for the purposes of this paper only the below tailored models are shown.

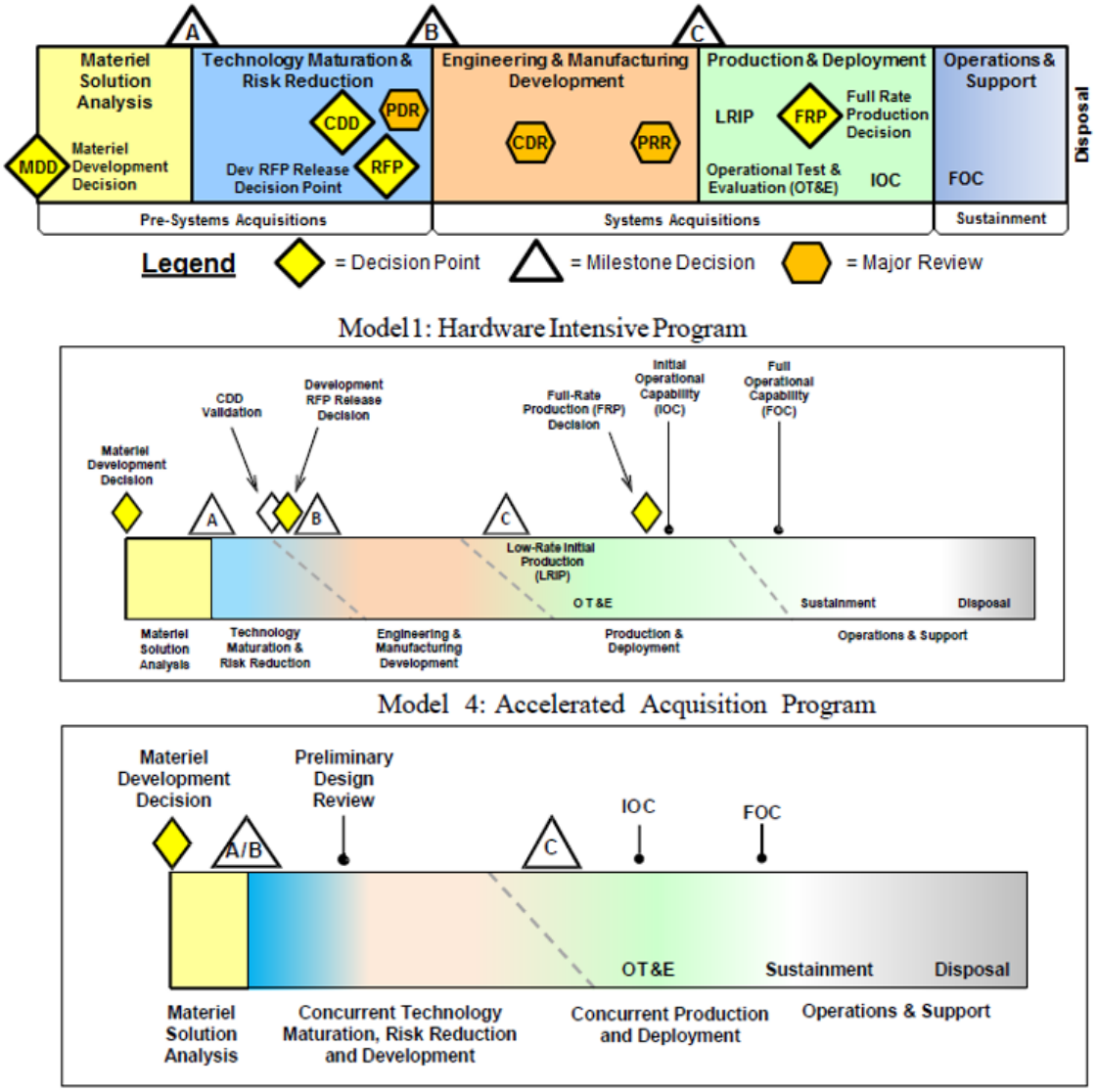
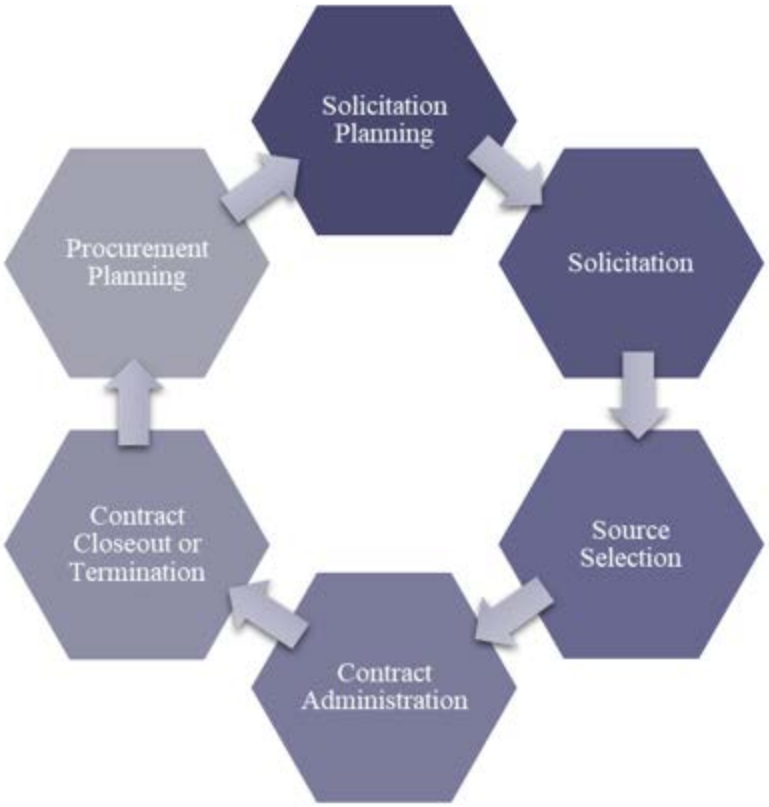


Figure 5. Standard Acquisition Model Followed by Tailored Baseline Approach Models for Hardware Intensive Programs and Accelerate Acquisition Programs. Source: Department of Defense (2017).

Starting at the material development decision, and then during each milestone decision point, the procurement staff involved in the process go through procurement cycles to enable the decision to be carried out as seen in Figure 6.



A continuous process of planning, solicitation, selection, administration, and closeout, which is then followed by subsequent planning, is the process of micro-systems working within a larger acquisition life cycle.

Figure 6. The DOD Procurement Process. Adapted from R. Jones (PowerPoint slides, 2019).

Each step has its own unique considerations and challenges. The following is brief description with some interpreted examples as described by Dr. Raymond Jones of the Naval Postgraduate School:

1. Procurement Planning

The decision whether to procure products or services from outside of the government is made during this step. It considers if the need is real, where it can be procured, what exactly it is that is being procured, how much, and when it is needed. A procurement official would need to know how to assess a wide range of available goods found in the government supply system and what is available all over the span of

possibilities for procurement, to include the private sector. They would also have to be able to find out if their efforts will be in contradiction to opportunities that already exist, referred to as Fragmentation; are pursuing something that targets similar government beneficiaries, called Overlap; or if they are pursuing a duplication of efforts. According to a 2019 recommendation from the GAO, "The Department of Defense should take actions to better manage fragmentation in its document services functions to potentially save millions of dollars annually" (GAO, 2019). Even in 2019, these problems of miscommunication continue to trouble the procurement community.

2. Solicitation Planning

Once the need is identified, how it will be requested is important in order to achieve performance rather than dictate the design. Contracting officials need to be careful of dictating the design, because this may add needless features that can make the procurement inadequate or too expensive for the problem they are solving. Keeping the process within parameters of technical performance, past performance, cost, supportability, producibility, and management approach is vital, but can prove difficult without the ten years of experience Section 809 Panel believes it takes to make an adequately experienced contracting officer (Section 809 Panel, 2018).

3. Solicitation

Contracting officers, after knowing what they want, will invite the involvement of contractors for procurement.

This is another area that creates an RFP. As mentioned earlier, this document, based on its wording, can create problems for the procurement as the process continues. Proper phrasing based on the FAR, proper provisions, and learned best practices from the past play a vital role in ensuring this process is done legally and for the desired ends. This process also defines the Statement of Work, which establishes in clear, understandable terms what the contractor must do and provide. Exclusion of seemingly minor statements can result in costly contract renegotiation after the government has already committed to the contractor relationship. An example of this would be a facility maintenance contract that did not specify trash removal from the premises, which the contractor would not

include in their proposal and leave collected trash on the premises. Contractors can learn to look for minor details from embarrassing mistakes of the past, especially what to include and what contractors are dependable.

4. Source Selection

Now the dreaded PALT kicks in. The following actions can take from days to over a year to perform; after passing of the deadline for contract bidders have turned in their proposals, the selection of contracts commences. The contracting official needs to make sure that they have the best interest of all stakeholders involved in choosing the contract, but especially the taxpayer whose money is being used to meet government needs. Considerations can become difficult when the proposals have to meet the myriad of FAR and other legal requirements. Every detail has to be in accordance to regulations, and furthermore, actually achievable. It can be difficult for a contracting officer to catch every detail, and be able to reference past performance of past contracts that share many similarities. One such consideration is if a contractor is unknowingly stating that they will be providing a good from a recently banned source or if the bidder is a banned contractor but under a deceptive different business name. Protests emerge from this process going awry and extend the time it takes to execute the program.

5. Contract Administration

Tracking the multiple points of interest in the administration of a contract can be tedious and time consuming, with opportunities for things to go wrong due to contractor shortcomings or fraud. A contracting official needs to be proficient in communication with the contractor and in how to spot negative anomalies. This is difficult to do without experience and proper training.

6. Contract Closeout or Termination

The contractor has met all obligations outlined in the contract, disputes settled, and payments are made. Monitoring all of this is the final step to the process. It is necessary to get this step right to maintain a positive relationship with the contractor.

IV. ARTIFICIAL INTELLIGENCE

A possible solution to the complexities and hazards outlined in Chapter III and to acquiring DOD technology at the speed of relevance and deliberate diligence is AI systems.

The examination AI capabilities later is to introduce the concept as it could possibly be applied to assist someone integrating with the DOD personnel.

The private sector is experiencing problems in contract management that the Summary of the 2018 DOD AI Strategy would refer to as "highly manual, repetitive, and frequent tasks which contribute to number and costs of mistakes, hinder throughout and agility, and robs higher value activities of resources" (Department of Defense, 2019). The streamlining of business processes with AI has become a new area embraced by private industry (Rich, 2018).

A report from the Naval Postgraduate School found that technology could greatly improve the effectiveness of contracting personnel by alleviating the challenges associated with training related to Contracting Officer Representative duties, and their access to related knowledge during the execution of their duties (Thomas, Christina, & Painter, 2019). These findings indicate that a problem exists with how the procurement process operates, and without mentioning AI as an assistant, the conclusion of this report was that technological assistance was necessary for better results for DOD.

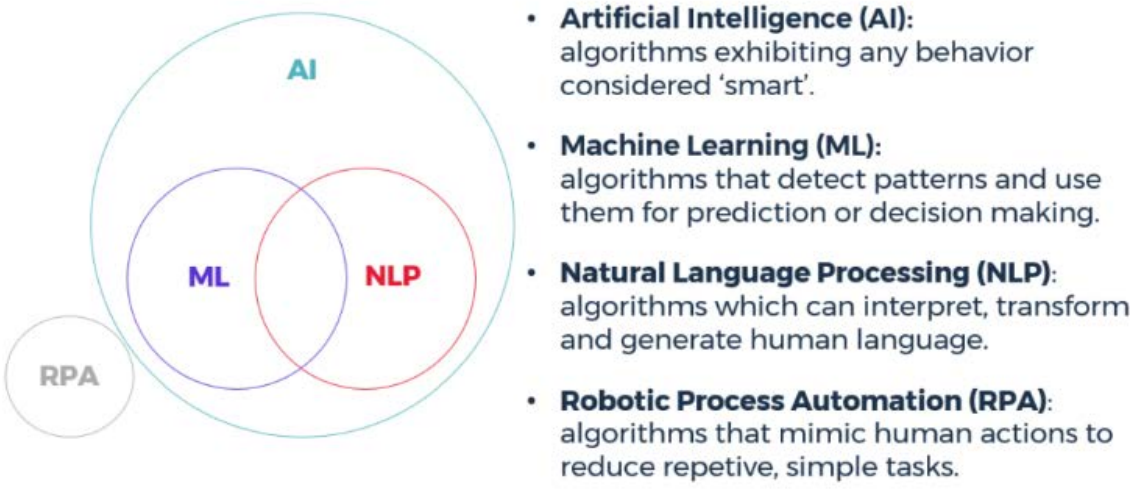
To better understand what AI is, we will examine some basic definitions.

A. OVERVIEW OF AI

The term "Artificial Intelligence" does not refer to a specific thing but is rather broad term for a collection of computer sciences that relate to the non-organic simulation of intelligence. Typically, when people think of AI, they are actually thinking of Machine Learning, a subset of AI where a computer can be programmed to recognize and categorize certain real-world stimuli. According to DOD AI strategy, AI is defined as "the ability of machines to perform tasks that normally require human intelligence—for example, recognizing patters, learning from experience, drawing conclusions, making predictions,

or taking action—whether digitally or as the smart software behind autonomous physical systems" (Department of Defense, 2019). This capability of enhanced automation is of great interest to DOD as China and Russia, potential future near-peer adversaries, are investing heavily in this field for military purposes (Department of Defense, 2019).

As the field of AI is wide, this paper will focus on the AI processes most appropriate for procurement, which are Machine Learning (ML), Natural Language Processing (NLP), and Robotic Process Automation (RPA), as shown in Figure 7.



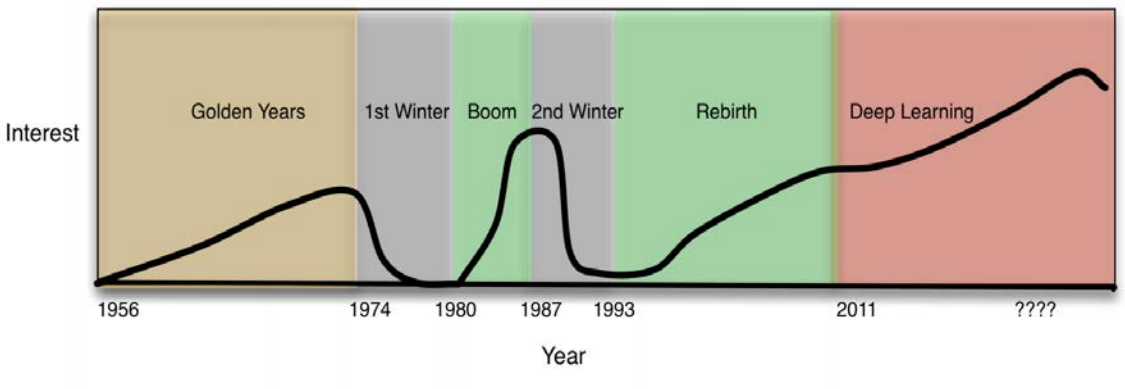
The figure shows that AI itself is a combination of AI sciences, such as ML and NLP. While RPA benefits from AI application, it itself is not simulation of human intelligence, rather just mimicking of capabilities.

Figure 7. AI Terms and Relationships. Source: Sievo (n.d.).

B. A BRIEF HISTORY OF AI

Formally founded in 1956, the science of AI was created to determine if machines could perform intelligent functions (Denning, 2019). It went through several hype cycles, due primarily to sensationalizing of what it could do, with frequent disappointments as we see in Fig 8. The enthusiasm for AI began to reemerged at the same time that Big Data computing power became more accessible to researchers and companies, which in turn could apply the science to multiple tangible applications (Haenlein & Kaplan, 2019). Currently, just a few examples of commercially viable applications of AI are in

manufacturing robots, smart assistants, proactive healthcare management, disease mapping, automated financial investing, virtual travel booking agent, social media monitoring, conversational marketing bot, NLP tools, and contract management (Daley, 2019).



AI was formally concepted in 1956 and had history of hype and disappointment until 2011, when computing power and digital data storage allowed it to flourish.

Figure 8. The Timeline of Interest in AI during Different Phases of its Development. Source: Denning (2019).

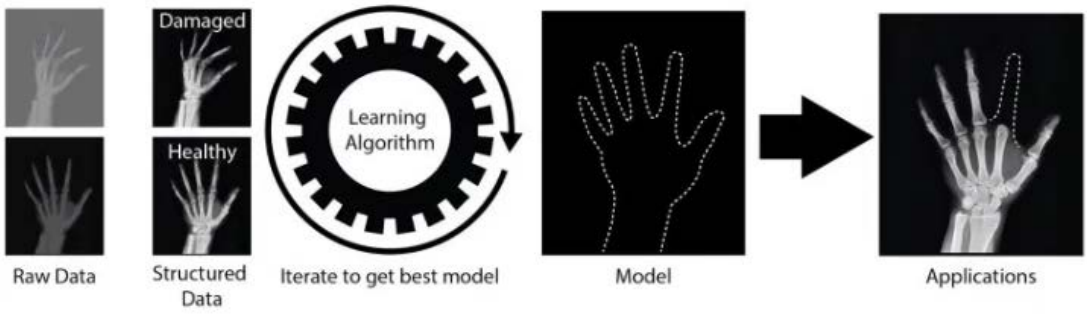
C. LEARNING

Intelligence is the capacity to process a certain kind of information, which allows that processor to solve problems that or of consequence in relation to it (Gardner, 1993). Multiple types of intelligences have been proposed by psychologists beyond the classic understanding of someone's intelligence quotient (IQ), which is a measure of how well someone takes an IQ test. Howard Gardner proposed a theory of multiple intelligences, which suggests that the traditional psychometric views of intelligence are too narrow, and should include more categories where certain processors, people in this instance, are stronger than others at making sense of certain stimulus. The categories are visual-spatial intelligence, linguistic-verbal, interpersonal, intrapersonal, logical-mathematical, musical, body-kinesthetic, and naturalistic (Gardner, 1993). An argument against this proposition would be that this is merely a representation of learned and disciplined behaviors that someone developed in their life as a result of favorable outcomes emerging out of

personality and circumstances. Either way, these concepts both inform what steps are taken to make a machine have these traits in an artificial way.

1. Machine Learning

A computer is capable of performing calculations based on data provided to it, and providing a result. It can be programed to follow certain steps repetitively and even to alter its findings based on its own previously calculated results. A combination of these two steps is the basic concept of machine learning. A computer system is first fed data, which is structured in a way that the algorithm is programed to recognize, then it derives patterns from the data, and can make assumptions about unstructured data given to it later (Greenfield, 2019). Figure 9 shows how this works in an x-ray learning algorithm.



The image shows the steps an AI algorithm goes through in order to make a recommendation to a physician on where a missing body part should be. It takes in structured data and develops its understanding of what right looks like. When given unstructured data, it compares the image against previously trained models and identifies the abnormality with a recommendation on where to apply a fix, such as a prosthetic.

Figure 9. AI Training Algorithm. Source: Greenfield (2019).

2. Types of Machine Learning in Procurement

The medical example was to simply illustrate the fundamental concept of machine learning, but the following more focused look at the different types of learning will be with procurement in mind. The following are interpretations from an AI procurement software company called Sievo, of different types of learning in the procurement algorithms.

1. Supervised Learning
   An algorithm is taught the patterns using past data, and then detects them automatically in new data. Supervision comes in the form of correct answers that humans provide to train the algorithm to seek out patterns in data. Commonly used within procurement in areas such as spend classification

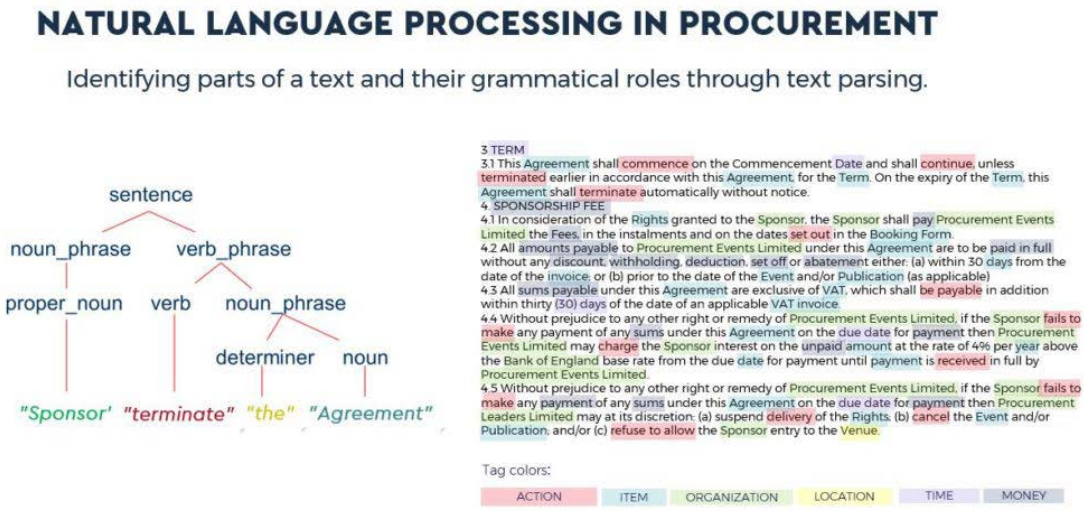
2. Unsupervised Learning
   The algorithm is programmed to detect new and interesting patterns in completely new data. Without supervision, the algorithm is not expected to surface specific correct answers instead it looks for logical patterns within raw data. Rarely used within critical procurement functions

3. Reinforcement Learning
   The algorithm decides how to act in certain situations, and the behavior is rewarded or punished depending on the consequences. Largely theoretical in the procurement context

4. Deep Learning
   An advanced class of machine learning inspired by the human brain where artificial neural networks progressively improve their ability to perform a task. Emerging opportunity in procurement functions. (Sievo, n.d.)

3. Natural Language Processing (NLP)

Anyone familiar with gadgets that are seemingly able to understand written or spoken words and act on them, such as translation apps or personal assistants like Amazon's Alexa, are already interacting with NLP enabled AI. NLP is algorithms which can act on written or audible language input, make sense of it, and present the information in human language in a way that is clearly understood by people (Sammalkorpi & Teppala, 2019). Speaking to an AI-enabled device transforms the soundwaves into computer code that has meaning to the algorithm; the code then converts that meaning back into a human-understandable, accurate response that can be applied to normal human cognition. This is done through semantic parsing, a process which maps the language of a passage to categorize each word, and through machine learning, make associations to understand more than the definition of the word, but also its meaning in its context (Raghaven & Mooney, 2013). Figure 10 demonstrates what this looks like in a contract.



The figure shows how an AI algorithm can use its learned words to distinguish the meaning of words in a document, using them to categorize and analyze their meaning in the context of each other, and derive meaning as a result.

Figure 10. Semantic Parsing in Procurement. Source: Sievo (n.d.).

One of the best aspects of NLP for DOD contracting could be to leave the complex but necessary phrasing in the FAR intact, but use an AI partner to help make sense of it.

Robotic Process Automation

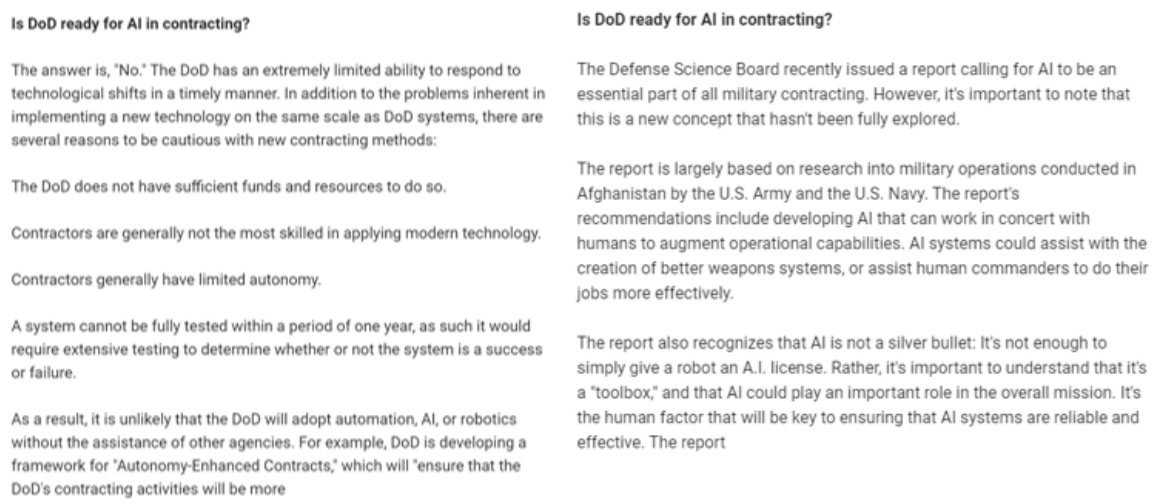
RPA is not AI but, rather a process enhanced by it. By definition, RPA is "is the application of technology that allows employees in a company to configure computer software or a robot to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems" (IRPA & AI, n.d.). This means that the things that are repetitive in nature that humans would rather not do, and can be taken over by a trained AI to automate the monotonous process. Robotic automation has many advantages when it can be appropriately applied because it is not limited by human constraints in terms of fatigue, morale, discipline, and organism survival needs. Unlike their human makers, robots also lack aspirations, so working harder will not result in promotions or more income, and even being permanently shut off bears no significance on it because it only mimics practical aspects of human intelligence, not the deeper nature of humanity itself (Zarkadakis, 2019). ML does rely on an incentive mechanism for the machine to make decisions in terms of

positive or negative responses. A possibility for future AI-enabled RPA is for a machine to learn how to manipulate the source of positive reinforcement completely out of following the rules needed to meet its goal. Things that survive, and evolve to continue survival, do so out of positive reinforcement from their environment, and the fact that they continue to act in a way deemed survivable. This should be considered in any future AI projects, and why a human must always be involved in final decisions and AI systems are to not be totally relied on despite a potentially flawless track record otherwise.

4. Turing Test

The Turing Test is a test to see if a computer program can fool people into thinking it is a human (Stanford, 2016). In 2018, the engineers at Google created a spoken word NLP program called Duplex to integrate with its AI assistant. The purpose of it is to make phone calls on the human's behalf, to talk to other humans, and answer questions in a natural way, and to sound like a human, all at the same time (Leviathan, 2018). The program is able to search for the information needed as if a human was searching for it, such as using their own native search program, Google. The assistant then calls, for example, a restaurant to negotiate a time when the assistant's human will have a booked appointment. The program stutters, pauses, elongates certain vowels as if it had to think about it, and responds with alternative suggestions within its parameters after being given spoken information from a human hearing the commands. Although not put through the traditional Turing Test itself, an AI that can speak and respond to humans who do not react to it as if it were a machine, is close to what Alan Turing may have imagined.

For the purposes of this paper, the author asked an AI NLP program about one of the research questions, about which the program had an interesting "opinion." In Figure 11 are two responses by an AI program called 1558M. This program was created to "play" with OpenAI's new machine learning model (Talk to Transformer, n.d.). What is striking about these answers, is that they are unique, meaning a search of these phrases finds no duplicates, but the phrasing and tone makes it sound like it is from an informed source, with just enough minor evidence on the topic to sound believable. It does not finish its last sentence, however, making this program imperfect, but notable.

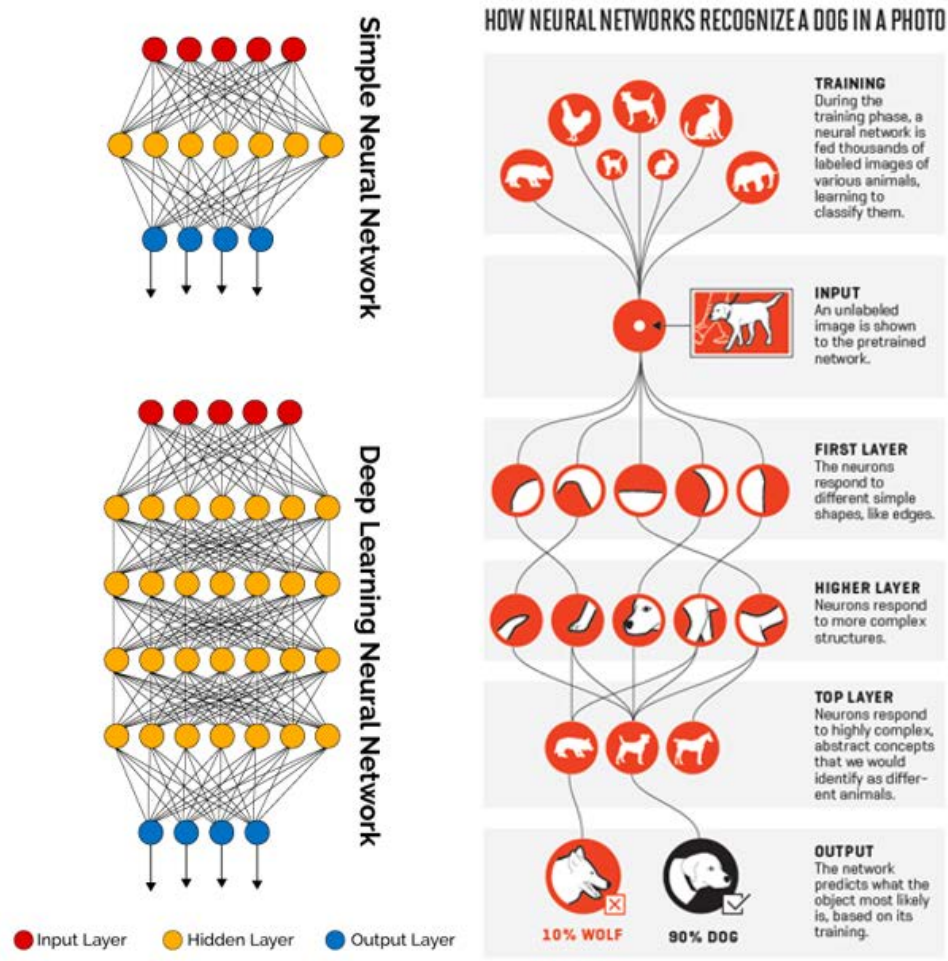


When asked if DOD was ready for AI in contracting, the program had some negative and cautionary opinions on the topic.

Figure 11. Two Separate Results from an AI Called 1558M Model. Source: Talk to Transformer (n.d.).

D. EXPLAINABLE REASONING

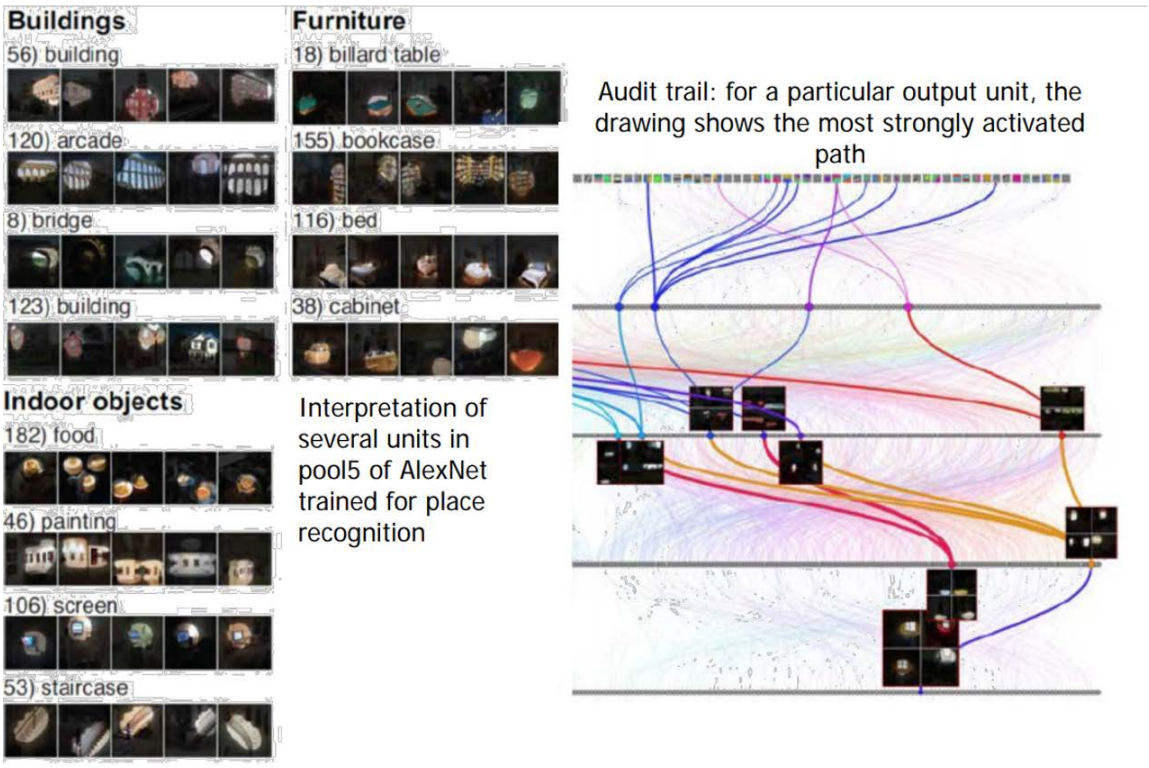
One of the factors limiting AI adoption is being able to explain how the algorithm came up with its conclusion, which is critical for auditing (Knight, 2017). It would be negligent to use AI for military or financial purposes without the ability to trace how the decisions were made. Figure 12 shows how AI currently classifies information. For the multitude of training information that is used to create the program, the AI programs that turn out the desired result come up with their own way of navigating their layer complexities to create an output.



The Simple Neural Network has a set of input data that only goes through one hidden layer to classify the output layer. The Deep Learning Neural Network sends the input data through multiple layers to better classify the output data. To classify input data to determine if the given picture is a dog, the Deep Learning Neural Network goes through simple to more detailed layers of trained data that correspond with dog features to make a 90% confidence classification that the picture is a dog and 10% possibility that it is a wolf.

Figure 12. Simple Neural Network Compared to Deep Learning Network Visualization of Deep Learning Network with Dog Classification. Adapted from Golstein (2018), Parloff (2016).

Fortunately for DOD, the Defense Advanced Research Projects Agency (DARPA), is already an organic element of the defense ecosystem, and leading the research into explainable AI (Gunning, 2017). Figure 13 visualizes in more detail how a Deep Neural Network navigates its trained data to classify different pictures.



This figure shows the images used to train an AI program on the left, and where in the neural network the associations of these trained data were used to classify an input to eventually come to a conclusion.

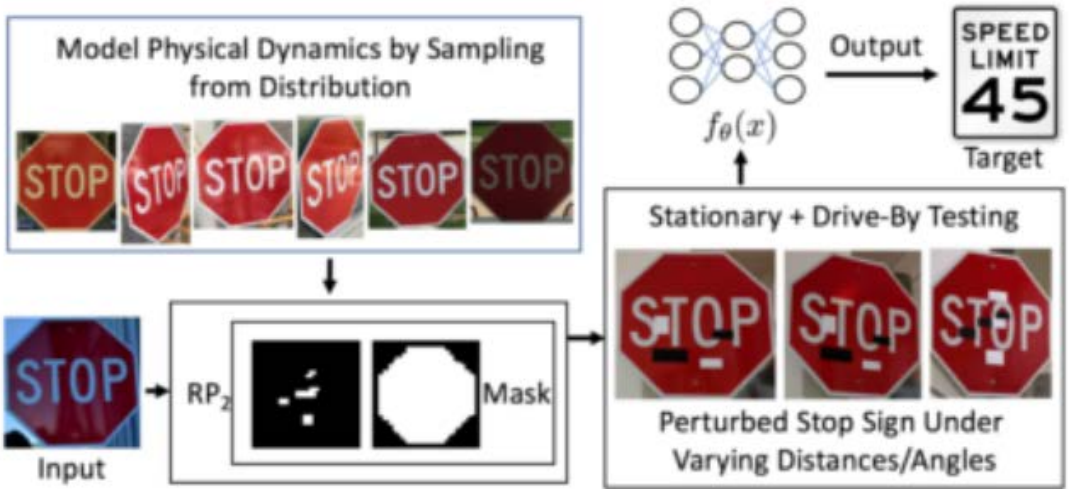
Figure 13. DARPA's Visualization of Explainable AI. Source: DARPA (n.d.)

DOD's own DARPA "has taken the lead in pioneering research to develop the next generation of AI algorithms, which will transform computers from tools into problem-solving partners. DARPA research aims to enable AI systems to explain their actions, and to acquire and reason with common sense knowledge. DARPA R&D produced the first AI successes, such as expert systems and search, and more recently has advanced machine learning tools and hardware. DARPA is now creating the next wave of AI technologies that will enable the United States to maintain its technological edge in this critical area" (DARPA, n.d.). This means that if DOD wanted to pursue human-machine partnerships in areas like contracting, their organic system is providing the capability to do so.

E. HUMAN–MACHINE PARTNERSHIP

DARPA believes AI integration is critical as a human-machine symbiosis “because sensor, information, and communication systems generate data at rates beyond what humans can assimilate, understand, and act on” (DARPA, n.d.). This is because machines, as in the industrial revolution, are better at certain things that free humans to become creative and productive in other areas.

Humans and machines excel in separate areas of processing. Computers calculate, while humans decide; compare vs make judgements; apply logic vs empathize; do not mind tedious monotony vs having preferences; computers deal with large data, and humans focus on what most important based on intuition (Darken, 2019). While AI performs well in some tasks, it works better with a human partner. Without proper controls, AI is a gullible learning system, it can be vulnerable to being deceived by bad actors. Some studies show that AI can be fooled in a way that humans would not be due to human intuition. Other research has been able to fool a self-driving car into thinking a benignly tampered-with stop sign was a speed limit sign, which would undoubtedly lead to collisions if the car was left unsupervised (see Figure 14; Eykholt et al, 2018).



An AI program in a self-driving car has trained data about a stop sign in its algorithm. When a target sign is seen in its environment, it references the trained data. Researchers attached benign interruption markers on the sign, which confused the AI program to think the stop sign was a speed limit sign.

Figure 14. AI System Interpreting a Stop Sign. Source: Eykholt et al. (2018).

Many people are familiar with current intelligent machine partnerships that they may experience on a daily basis. Google is the most popular search engine on the internet because it provides a better satisfaction to users than competitors (Shaw, 2019). Google is so common as the preferred search engine that when someone talks about searching for something online, they refer to it as "Googling." Interacting naturally with an AI system that uses Bidirectional Encoder Representations (BERT) (Nayak, 2019). This is when a machine learns to not answer the users' question based on their words but rather their meaning in the context of their question. When asking what time is it right before lunch, the user is not asking for the time, but for when they can eat. This is gleaning meaning from a question, rather than answering it outright, as in giving the actual time where the asker will then decide if it is the time to eat, which was meaning of their question. The user of an AI system should only do what they have to do, and the computer should do the rest. Trust in current AI can also be seen in the autopilot feature of a Tesla vehicle. For the most part, the user sits in a supervisory role while the car takes one of the most dangerous events in that person's life and autonomously conducts all road tasks to drive (Darken, 2019).

If contractors relied on an AI system to make all of the decisions for them, they will be susceptible to bad actors introducing adversarial information for either gain or disruption. Anti-computer tactics by fraudsters can only be spotted by the human partner. Fraudsters can predict how to exploit computer algorithms; humans can judge the action.

> AI software, however, can easily extract data and clarify the content of contracts. (It could quickly pull and organize the renewal dates and renegotiation terms from any number of contracts). It can let companies review contracts more rapidly, organize and locate large amounts of contract data more easily, decrease the potential for contract disputes (and antagonistic contract negotiations), and increase the volume of contracts it is able to negotiate and execute. (Rich, 2018)

F. CLOUD-BASED AI

To understand how AI can be propagated throughout a system and update regulations and learn from multiple human teachers instantly, we look at the concept of cloud computing.

The speed of relevance is a popular term in discussing DOD technology adoption. In the 2018 DOD Cloud Strategy, the term "Cloud" refers to an offsite physical information technology (IT) infrastructure. This external infrastructure communicates with a user's computer through the internet to access data servers that store information and run operating systems, such as Microsoft Windows, which are centrally maintained. This means that every user has the same software computing power and access to the most up-to-date software at all times, and is not limited by their own organization's IT professional talent or budget for new software. Organizations can get as much, or as little, access that they need for projects, and it is unaffected by times of surging need or times of idleness which currently add excess cost to DOD systems (Shanahan, 2018).

The objective for DOD is to have AI augmented rapid decision making, in an environment where data is secure and visible for enhanced operational efficiency.

> Data stored in an enterprise DOD cloud will be highly available, well-governed, and secure. Data will be the fuel that powers those advanced technologies, such as ML and AI. This critical decision-making data will be made available through modem cloud networking, access control, and cross domain solutions to those who require access. Common data standards will

> be a key part of the Department's methodology for tagging, storing, accessing, and processing information. Ensuring an enterprise cloud environment will increase the transparency of this data, and drive the velocity of data analysis, processing, and decision making. Leveraging advances in commercial cloud security technologies will ensure the Department's information is protected at the appropriate level. (Shanahan, 2018, pp. 5–6)

G. PRIVATE-SECTOR AI APPLICATION TO CONTRACTING

To explore solutions to the DOD acquisition problem, we examine similar circumstances in the U.S. private sector.

Lawgeex is an example of a company that is applying the AI integration process in the private industry procurement world. They demonstrated that their AI software could outperform U.S. trained lawyers on an example contract aspect, the Non-Disclosure Agreement (NDA) with an average accuracy of 94% as compared to 85% for humans (Lawgeex, 2018). The study was conducted in order to respond to a common business problem in large companies that rely on contracts to engage with partners, suppliers, and vendors of an 83% dissatisfaction with their organizations contracting processes (Lawgeex, 2018). Another example is Icertis, a company which services large and commonly familiar companies such as 3M, Johnson & Johnson, and Microsoft, to list a few (Icertis, n.d.-a). Icertis provides their customers with a cloud-based AI platform that learns from contracts provided by the client, along with control measures, to create and assist in contract setup; contract operations; governance, risk, and compliance; and reporting (Icertis, 2019).

What makes this possible now, instead of when it was first theorized decades ago, is that industry is more reliant and consistent on storing their professional documents on a digitally accessible storage platform, whether local hard drives or the cloud (Betts & Jaep, 2017). Currently, the major hurdles that prevent a fully automated contract review and analysis are non-technical, such as the "collection of contract performance data; publication of private contracts and their corresponding performance data; and changes in ethical constraints on computer usage in legal practice" (Betts & Jaep, 2017, p. 233). The authors of these constraints also offer possible policy solutions to address these obstacles. The first one being to actually start using contract management software, which will be a

forcing function to create data in an AI teachable format; expand copyright protection for vendors to protect their intellectual property; and create new rules to help mitigate AI risks to enable its ability to work (Betts & Jaep, 2017). Specific companies will be further discussed in Chapter V.

THIS PAGE INTENTIONALLY LEFT BLANK

V. DATA

The most definitive data about whether the DOD procurement process is slow, has all been from the perspective of professionals, not from studies done to specifically show why. This study draws upon information from authoritative sources, but just as findings from the Department of Homeland Security, which is also pursuing solutions for contract speed problems, "anecdotal evidence suggests that the volume of records and the inability to rapidly identify relevant reviews, make it difficult for contracting officers to easily utilize the data for past performance evaluations" (DHS, 2019, p. 3). In review of rapid acquisition of command and control systems, RAND determined that "the Defense Acquisition Guidebook discusses the importance of tailoring a program's acquisition strategy to fit the program, but in reality, it has seemed anecdotally hard for program managers to omit any step, stakeholder, or document in performing a rapid acquisition" (Williams, Drezner, McKernan, Shontz, & Solinger, 2014, p. 70). In existing research, no studies have been done to determine which steps of procurement process can be sped up through elimination or alteration.

Regardless, the executive office of the President has ordered that federal agencies identify opportunities to improve their processes with the use of AI (E.O. 13859, 2019). Furthermore, the OUSD(A&S) official policy is to deliver warfighter needs at the speed of relevance by getting these things as quickly and cost effectively as possible (Office of USDA&S, n.d.). The Office of the USDR&E states one of their modernization priorities is "The DOD will leverage AI to enable U.S. forces to operate more effectively and efficiently. As a Department, we are evaluating which of our processes and procedures can be enabled via adoption of AI technology to meet warfighter needs and Defense priorities" (Office of USDR&E, n.d.). The DOD Artificial Intelligence Strategy further emphasis these points with a strategic focus to "Streamlining business processes. AI will be used with the objective of reducing the time spent on highly manual, repetitive, and frequent tasks. By enabling humans to supervise automated tasks, AI has the potential to reduce the number and costs of mistakes, increase throughput and agility, and promote the allocation

of DOD resources to higher-value activities and emerging mission priorities" (Department of Defense, 2019).

A. WHEN THE PROCUREMENT PROCESS FAILS

The DOD acquisition problem is slow because of the humans involved.

An example of when the procurement system is ineffective can be drawn from an investigative report into an internal audit of the Defense Contract Management Agency (DCMA) by Daniel Van Shooten, from the Project on Government Oversight (Van Schooten, 2018). The investigation highlights the internal findings of massive fraud, waste, and abuse in attempting to manage a contract for software called Integrated Workload Management System, which was meant to review, implement, and track defense contracts. After contract award of $46.6 million dollars, $17 million of which was fraudulent, and the program was halfway done when halted. The agency used the wrong type of funding, while citing regulation that it did not actually read or understood.

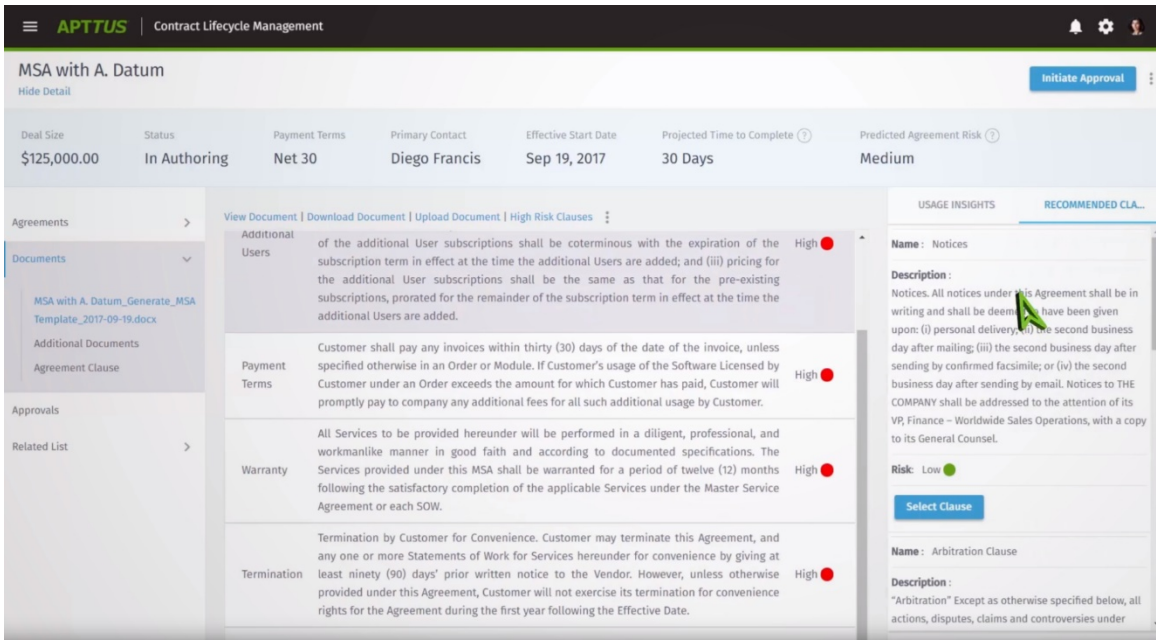
Previous investigative reports into the DCMA found that they failed to identify contractors that had provided faulty parts or services, reimbursed contractors with unallowable costs, did not withhold payments from contractors when they should have, and did not keep track of what they were being charged for. The agency was also found to not escalate problems when they should have, which were only identified when the cost, schedule and performance were negatively affected.

In an interview with one of the people involved, the employee said that "No one was trying to do anything wrong." In 2011,GAO, identified that the workforce was greatly eroded and that decentralized initiatives created inconsistent guidance across the agency (Hutton, 2011).

B. AVAILABLE APPLICATIONS

Private industry is concerned with limiting value loss and ensuring that their high skilled employees are more focused on strategic endeavors, rather than bureaucratic paper organizing, compliance checking, and long hours of research for a specific contract (Rich, 2018). The area of immediate interest and easiest adoption by procurement officials is the

semantic parsing and recommendation aspect of an AI assistant. By extracting and displaying the elements of the contract the program identified as significant, the human operator is better able to make decisions on key elements of the contract. In each phase of the procurement process that involves agreements and obligations, the human contract official will be able to see an interface as shown in Figure 15.



This figure shows a hypothetical contracting officer's computer dashboard that give details of a contract. The AI program has predicted that, with these specific clauses, the contract's overall risk is medium, and certain clauses are driving that risk. When the contracting officer selects one of the identified clauses, the AI program offers a recommendation based on all of the contracts it has been trained on to lower the risk.

Figure 15. Apttus AI Contract Management Dashboard. Source: Apttus (2017).

Furthermore, companies that provide AI contract management tools, are automating the research that goes into negotiating a contract, generating the actual contract itself, and scoring the risk level of a document based on anomalous language or language that has been shown to cause legal problems. The databases of protests would be the source for teaching the AI assistant on what specifically caused the problem, even helping the contracting officer dealing with a protest have an automatic database of precedence decisions tailored to that specific case.

C. PRIVATE-SECTOR CASE STUDIES

Several private-sector companies handle contracting by means of AI, and they have reported their own results. Obtaining more academically rigorous results is made difficult by the emerging nature of this technology and the proprietary secrecy surrounding the private companies' data. Although much research says that AI is an effective tool at creating value for companies, due to proprietary concerns, few examples of actual results are made public. Figure 16 shows the market leaders of AI assisted contract management software.

Icertis and Apttus are the top providers of private-sector AI contract management software in terms of strategy and offering.

Figure 16. Top AI Contract Management Providers. Source: Bartels (2019).

1. Icertis

As an identified industry leader, Icertis reported success with Microsoft as their client, a company comparable to DOD contracting in size and global presence. They claim that Microsoft had demonstrated a challenge with information exchange among their more than 115,000 employees, about 650,000 partners, and millions of customers. Including,

problems with fragmented contracts and lengthy contract management processes. With the application of Icertis AI contract management software, Microsoft “reduced contract administration costs by 40%, improved speed of contracting by 60%, improved customer, partner and employee satisfaction, and improved auditable contracting compliance and administration, while taking only 12 weeks to fully deploy the system across the entire company” (Icertis, n.d.-c).

Another customer of Icertis, MindTree, a multinational information technology and outsourcing company with 11,000 employees, had a problem with a large number of customer contracts due to the manual and human-dependent nature of the process. This caused frequent instances of non-compliance due to the difficulty of oversight. Icertis claims that their contract management system improved contract turnaround times by 40%, and created a 100% compliance rate (Icertis, n.d.-b).

2. Apttus

As the other industry leader in contract management, Apttus also self-reported success with some customers. Paypal, a company that works as an intermediary to process payments between buyers and sellers, needed a way to reduce employee workload by eliminating a duplication of effort between two programs, Excel and Salesforce. The Apttus AI program, called X-Author, allowed the employees that were more comfortable using Excel instead of the new program, Salesforce, to continue using their preferred program, and the X-Author AI would translate that work into SalesForce, only needing the authors’ approval, not work. This analysis helps illustrate a way for AI to allow effective employees to continue being value added without being limited by their lack of understanding of new technology (Apttus, 2015).

VI. DISCUSSION AND ANALYSIS

This chapter reviews the available information on private industry application of AI to determine applicability to DOD.

A. ANSWERS TO THE RESEARCH QUESTIONS

1. Is the DOD procurement process impeding the U.S. military from being ahead of potential adversary's technological development advantages?

The plurality of government related reports agree that the procurement cycle for emerging technology is not adapted to move at the speed of relevance, without providing proof outside of anecdotal evidence from interviews with stakeholders. No research exists that shows what strategic need was not made available, when required, which then provided a strategic advantage to a potential adversary due to the inelasticity of the procurement system. All agencies concerned with speeding up the acquisition process cite the threats posed by potential adversaries like China and Russia investing heavily into technological superiority as why the procurement process needs to be amended through policy. However, China and Russia have proven that they are innovating to defeat the United States, so their innovation is more reactionary than overtaking, despite official declarations otherwise. The greatest driving factor to blame the U.S. procurement process for being too slow, is based on Chinese ambitions that are more in declaration than reality. China is still trying to catch up to the advanced DOD procurement system already in place.

Multiple steps have to be taken by acquisitions professionals in order to ensure good stewardship of taxpayer resources and that the right resources get to the right problem set at the speed of relevance. The high standard of developmental and operation testing, which moves at the speed of reliability, ensure high quality procurements, and should not be jeopardized over perceived, but unrealized threats.

Previous and current attempts to address speed of acquisitions have all focused on which steps to assume risk or on removing processes that are no longer relevant. People like Frank Kendell, Ellen Lord, and Michael Griffin, who had the leadership roles to

address these issues, do not agree on what is actually the cause of the acquisition shortcoming. Introducing needless risk by relaxing the processes that humans do not enjoy doing is not necessary when AI is being used in private industry to offload those menial tasks with more efficient and accurate performance. The FAR was created from decades of best practice and refinement, and it should be supported by procurement officials, made even more capable because of strong administrative systems powered by AI.

2. Is artificial intelligence in its current form appropriate to be applied to supplement contracting officers and DOD contractors to make more informed procurement decisions while increasing speed and mitigating risk?

As seen by the application of AI systems to contracting processes in the private sector, the overwhelming call from DOD leadership and policy makers to apply AI and counter GPC, and the first move made by DHS to begin receiving proof of concepts to their own contracting process, DOD is ready to being this process as well.

Private sector companies such as Microsoft can experience similar contracting constraints to DOD due to their employee numbers and global reach. Early success in a company of that size investing in AI for contract management is promising for an enterprise as large as DOD.

Addressing the issues discovered in the POGO, GAO, and the internal audit of the DCMA, AI can be applied to mitigate each of these alarming findings. Where previous investigative reports found that DCMA staff failed to identify contractors that had provided faulty parts or services, an AI partner would flag that contractor while providing historical findings to the contracting official. Within the very programmed nature of contract management AI programs is to escalate problems identified early before they can, or continue, to negatively affect cost, schedule and performance.

What is possible in the near future, is that a contracting officer will submit an RFP and run the AI to produce a list of risk based on FAR and DFAR regulations, automatically create a presentation with these issues highlighted, and provide recommendations on changes or where risk may be tolerable.

As Section 809 findings point out, it takes roughly 10 years to produce a fully capable contracting official able to do their job. As technological advancement increases, there is a chance to lose this individuals skill set if they are not able to adapt to new technology. However, as the Paypal example showed, AI can assist personnel by translating their work on a preferred platform to the one that meets their organizations compliance standard. This will keep effective federal employees value added into the future independent of their technological adaptability.

The FAR dictates specifically how a contract will be constructed, which provides an ideal format for machine learning to analyze. Special Form (SF) 26 Award/Contract, SF 30 Amendment of Solicitation/Modification of Contract, and SF Solicitation, Offer & Award are standardized forms that have a specific pattern that a contracting officer must be familiar with and that an AI program can learn from (Defense Procurement and Acquisition Policy, 2012). Many forms exist in the DOD procurement process, but we will look specifically on SF 26 to see where both a contracting official and an AI program would look in order to interpret the contract. Figure 17 is a blank SF 26 with the boxes being categories, while the blue area is where unique, but specific information is placed. This pattern style is repeated in all FAR-mandated forms.

AWARD/CONTRACT

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700) ▶ | RATING | PAGE OF PAGES

2. CONTRACT *(Proc. Inst. Indent.)* NO. | 3. EFFECTIVE DATE | 4. REQUISITION/PURCHASE REQUEST/PROJECT NO.

5. ISSUED BY CODE | 6. ADMINISTERED BY *(If other than Item 5)* CODE

7. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*

CODE FACILITY CODE

8. DELIVERY
☐ FOB ORIGIN ☐ OTHER *(See below)*

9. DISCOUNT FOR PROMPT PAYMENT

10. SUBMIT INVOICES *(4 copies unless otherwise specified)* TO THE ADDRESS SHOWN IN ▶ | ITEM

11. SHIP TO/MARK FOR CODE | 12. PAYMENT WILL BE MADE BY CODE

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:
☐ 10 U.S.C. 2304(c)( ) ☐ 41 U.S.C. 253(c)( )

14. ACCOUNTING AND APPROPRIATION DATA

15A. ITEM NO.	15B. SUPPLIES/SERVICES	15C. QUANTITY	15D.UNIT	15E. UNIT PRICE	15F. AMOUNT

15G. TOTAL AMOUNT OF CONTRACT ▶ $

16. TABLE OF CONTENTS

(X)	SEC.	DESCRIPTION	PAGE(S)
		PART I - THE SCHEDULE	
☐	A	SOLICITATION/CONTRACT FORM	
☐	B	SUPPLIES OR SERVICES AND PRICES/COSTS	
☐	C	DESCRIPTION/SPECS./WORK STATEMENT	
☐	D	PACKAGING AND MARKING	
☐	E	INSPECTION AND ACCEPTANCE	
☐	F	DELIVERIES OR PERFORMANCE	
☐	G	CONTRACT ADMINISTRATION DATA	
☐	H	SPECIAL CONTRACT REQUIREMENTS	
		PART II - CONTRACT CLAUSES	
☐	I	CONTRACT CLAUSES	
		PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACH.	
☐	J	LIST OF ATTACHMENTS	
		PART IV - REPRESENTATIONS AND INSTRUCTIONS	
☐	K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
☐	L	INSTRS., CONDS., AND NOTICES TO OFFERORS	
☐	M	EVALUATION FACTORS FOR AWARD	

CONTRACTING OFFICER WILL COMPLETE ITEM 17 (SEALED-BID OR NEGOTIATED PROCUREMENT) OR 18 (SEALED-BID PROCUREMENT) AS APPLICABLE

17. ☐ CONTRACTOR'S NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return _____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. *(Attachments are listed herein.)*

18. ☐ SEALED-BID AWARD *(Contractor is not required to sign this document.)*
Your bid on Solicitation Number _____, including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the terms listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your bid, and (b) this award/contract. No further contractual document is necessary. (Block 18 should be checked only when awarding a sealed-bid contract.)

19A. NAME AND TITLE OF SIGNER *(Type or Print)*

20A. NAME OF CONTRACTING OFFICER

19B. NAME OF CONTRACTOR | 19C. DATE SIGNED

BY _____
(Signature of person authorized to sign)

20B. UNITED STATES OF AMERICA | 20C. DATE SIGNED

BY _____
(Signature of Contracting Officer)

AUTHORIZED FOR LOCAL REPRODUCTION
Previous edition is NOT usable

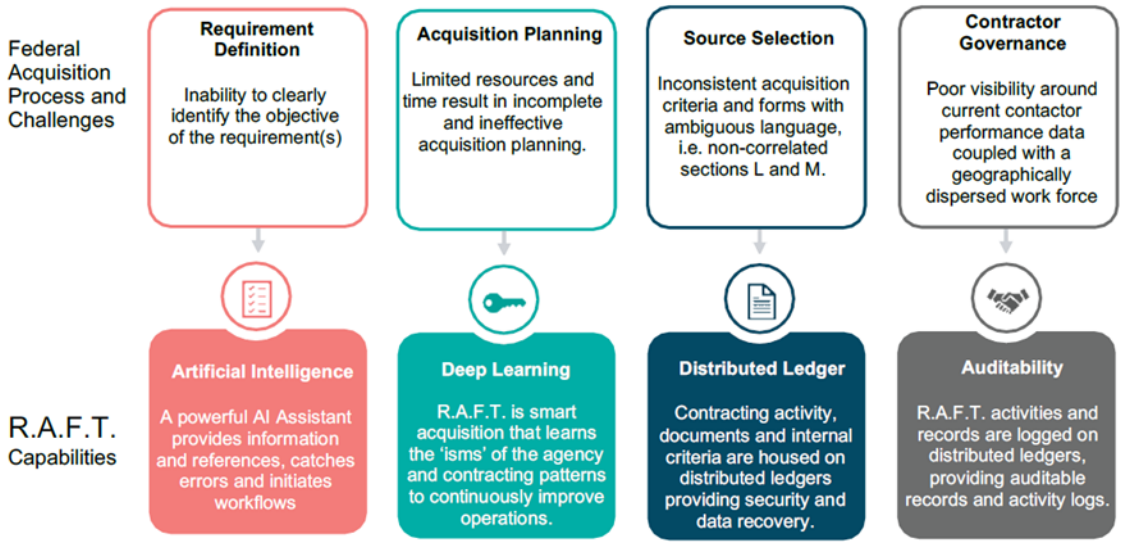
STANDARD FORM 26 (REV. 5/2011)
Prescribed by GSA - FAR (48 CFR) 53.214(a)

The SF 26 contains easy-to-identify categories that need to be filled out with specific information that can be read to determine the parameters of the award/contract.

Figure 17. Standard Form 26. Source: Defense Procurement and Acquisition Policy (2012).

Contract language is thus uniquely suited for machine learning over other applications due to its literal nature—how it defines terms as to reduce misinterpretation, which is manifested in its structured and pattern-like nature. The most essential element needed for categorizing and sorting to successfully occur, is a set of pattern data that have a set of rules delineating right and wrong. Contracts themselves have an architecture that follows certain rules for what right and wrong looks like, but the architecture fits a specific style for the type of need being acquired. This means that, while contracts can differ in what they procure, all have a rulebook, the FAR, to dictate what elements will be included in the acquisition.

A model to study closely is the late 2019 contract award by DHS to nine companies that would demonstrate the application of AI in the acquisition system. Of the nine companies that the DHS is soliciting, Federal Government Experts, has a tailored approach to what it would look like to service government contracts through something they refer to as the Rapid Acquisition Facilitation Tool (R.A.F.T.) (Stewart, 2019). This company hopes to provide AI based contract management to the DHS and shows interest in supporting the DOD as well. Their proposed capabilities, as seen in Figure 18, shows that their perceived acquisition challenges and solutions that are in agreement with the findings of this study. The only questionable promise is the level of auditability that is currently possible with deep neural network AI, and what this company proposes they can do to resolve this shortcoming.



The identified challenges of the federal acquisitions are shown with the R.A.F.T. solution.

Figure 18. Acquisition Challenges and R.A.F.T. Solutions. Source: Stewart (2019).

This software uses the same principles that private industry is using, except it is designed to search through federal databases and within the barriers of the FAR, which makes it an ideal candidate to review as it moves through the DHS acquisitions process.

A major concern regarding DHS's bidders is that they will not be using the still-in-development concept of DARPA's explainable AI. This is an important feature for the auditability that is fundamentally necessary in transparent and accountable government organizations. This means that the proposed system is reliant only on human training and not deep learning, which limits its capabilities.

As for the concerns of Lord regarding too many people involved in the acquisitions process, the new AI system would be on a cloud where stakeholders have the appropriate level of interaction and visibility, which would eliminate needless meetings and briefings on program status and would identify who is delaying the process. Kendall said that too many new requirements come out of the NDAA process, and the DCMA had issues with uniformity of guidance and standards. The same cloud-based AI would be able to be globally updated immediately upon rule enactment, and start providing the most junior and experienced officials alike with the most up to date regulations on a federally universally accepted formatted

document. It is unlikely that procurement personnel have any ill intent when things go wrong, and that their human nature itself was the cause of the DCMA issues. By eliminating those barriers, the system becomes faster for the right reasons.

B. CONCLUSION

The fears associated with the U.S. falling behind GPC countries due to the procurement process that fields innovative technology not being responsive enough has come from anecdotal supposition, albeit from the highest authorities in the federal government, from which the procurement process is dictated. The biggest problem is the limitation of humans in doing work that is best suited for an AI algorithm to allow the human partner to focus on more nuanced tasks.

These nuanced tasks are things that a robotic calculation could not and should not make decisions about and where giving humans the freedom to do so creates better results. Instead of figuring out how a person can work tirelessly to quickly field something, the person should think about *why* they are fielding the said product in the first place. As the MRAP was fielded to save lives, but might have aggravated the problem that necessitated saving those lives.

The author of this study was deployed to Afghanistan in 2010, and facilitated the transition from up-armored High Mobility Multi-Wheeled Vehicles (HMMWV) to the MRAP for his Provincial Reconstruction Team (PRT) Farah. The mission of the PRT was "providing security through development and reconstruction and extending the reach and influence of both the Coalition Forces and the Afghan Government" (Institute for the Study of War, n.d.).

The PRT, during that deployment, encountered very few IEDs, with the most notable being one that disabled one of the MRAPs; all occupants survived with no physical injuries. From our mechanic's analysis, the IED was too small to be intended to cause damage to the occupants of an MRAP, as the damage was more characteristic of one intended for the local police force, in their lightly armored trucks, who extorted and harassed the local opium economy. This would be considered a negligent discharge by U.S. Army terms, as the weapon was fired at an unintended time and target. Furthermore, the

outgoing PRT, whose assigned security forces were Guam National Guard Infantry Soldiers, who were enthusiastically proud of their home island, were ordered by the Forward Operating Base Farah security leadership, a separate command, to remove Guam Flags from their vehicle's prominently raised external antennas, because it provided an unfair security posture. In other words, if an MRAP with a Guam flag drove into the kill zone of an IED, the triggerman would not detonate the IED because he believed the occupants were members of the PRT.

The adjacent units to the PRT continued to sustain ongoing IED blasts. One tactic by the local adversary forces, due to the MRAP's superior armor and high center of gravity, was to bury an IED on the rising part of a slope, such as a river bank, and detonate it as the vehicle was going up, thus flipping the vehicle over and causing the inhabitants to suffer rollover injuries due to unsecured people and equipment inside, and sometimes crushing the gunner in the roof turret. The base security command wanted to increase the security posture of their own MRAP riders by making PRT MRAPs look like all others, which forced the IED triggerman to consider that their target may be a PRT MRAP and therefore hesitate. In short, the safety of these Soldiers may have not been a result of better armor, but possibly better community engagement, the mission of the PRT.

The question that should be considered from this example is whether the rapidly fielded technology was appropriate to fix the supposed problem at hand, or maybe less exciting, longer timeline, measures were more appropriate. Perhaps if contracting personnel were given time and freedom to question the intent of the end user before expending national treasure on something that could possibly have had a harmful effect to the true purpose of the U.S. forces in Afghanistan, which was stability, then the MRAP may have looked much different, if were created at all.

The solution to technological advances should not be to get them faster, but rather get the right things for the right reasons at the speed of relevance.

Private industry has begun adopting AI in contract management with increased efficiency, and the DHS has already awarded contracts for private AI contract management companies to create similar solutions for them based on government requirements.

The DOD is ready to explore AI as a solution to multiple issues that an increasingly connected and technologically evolving reality develops. The same tools that can help the U.S. be technologically ahead of future competition can be applied inwardly to ensure that introducing risk into the procurement system through relaxation of policy is not the only way to stay technologically superior. AI is at the dawn of being able to assist human contracting officers to deliver warfighter needs at an unprecedented speed and scale. While an AI assistant can calculate, compare, and apply rule-based logic while approaching the large amounts of tedious and monotonous tasks and data with neutrality, humans can dedicate their focus to deciding, making judgements, empathizing, and preferring one option over another based on nuance, so that better decisions can be made at the speed of relevance.

THIS PAGE INTENTIONALLY LEFT BLANK

VII. RECOMMENDATION

A. RECOMMENDATION

DOD needs to experiment with AI application to the procurement process. This should be sponsored by the Joint Artificial Intelligence Center and the Army's AI initiative with Army Futures Command.

AI is the solution to mitigate compliance errors due to the need to meticulously analyze every aspect of a contract whether the language present is appropriate or if the appropriate language is present. With AI the value loss generated by contracting inefficiencies would be reduced; therefore, it is the right disruptive technology to apply to current systems.

Before any computer program is written, the appropriate roles of humans and machines needs to be determined, with humans having ultimate decision and intervention ability. User interfaces are about communication and expectation management. The user must be interrupted intelligently: the AI should know when and how to get the attention of the human supervisor. The supervisor must be able to easily correct the AI without introducing false information into the machine's understanding. For example, if the contracting officer is correcting the AI on a personally misunderstood provision, the AI must be able to challenge the change with data, but then be over ruled once the information has been considered by the authorized official, unlike the scene from *A Space Odyssey* where Hal AI refused to comply human orders. A large community of contracting officers, as in crowdsourcing, would need to overwhelmingly agree on what the machine understands, or a small number of super users with no user-based machine learning interdiction.

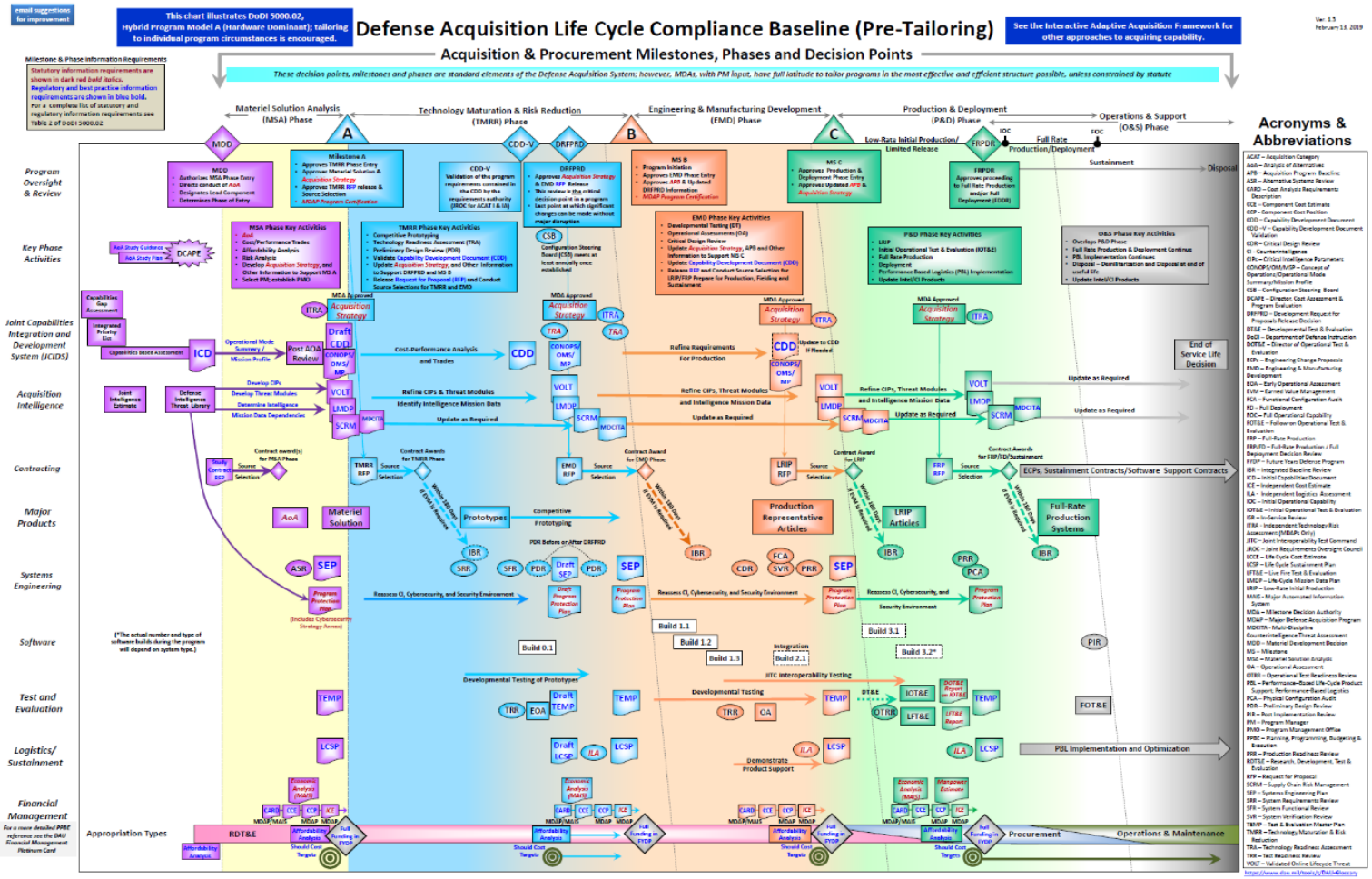
B. FURTHER RESEARCH

A comprehensive study of where the procurement system is committed to needless or outdated practices would better support anecdotal arguments and place blame where it belongs.

As DHS is experiencing the growing pains of applying AI to their contracting system, research should be done to analyze adoption across all federal agencies.

A contracting unit that deals with low-value, low-impact contracts, and a similar control unit, should be analyzed for an appropriate time with the use of AI systems to determine feasibility of deployment and training needs for when it is deployed.

APPENDIX. DEFENSE ACQUISITION LIFE CYCLE COMPLIANCE BASELINE



Defense Acquisition Life Cycle Compliance Baseline. Source: Defense Acquisition University (2019).

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

Alton, L. (2018, December 02). The secrets of successful Silicon Valley startups. Retrieved from https://www.thebalancesmb.com/silicon-valleys-success-in-startups-4056396

Apttus. (2015). Success with PayPal. Retrieved from https://solutions.apttus.com/rs/902-TNK-191/images/Apttus%20Case%20Study%20paypal.pdf

Apttus. (2017, September 20). Apttus contract management: Using applied AI in contract management. Retrieved from https://www.youtube.com/watch?V=vthnaq2505y

Armstrong, C. S. (2015). *The quest for Achilles' Shield: Is the American military's fetish with technology harming mission accomplishment?* Norfolk, VA: Joint Forces Staff College.

Baig, M. A. (2019, March 10). *Gerasimov doctrine and modern hybrid warfare*. Retrieved from https://dailytimes.com.pk/295075/gerasimov-doctrine-and-modern-hybrid-war/

Bartels, A. (2019). *The Forrester Wave™: Contract life cycle management for all contracts, Q1 2019*. Cambridge, MA: Forrester Research.

Bech, H. (2019, September 26). Silicon Valley's rule number one: Fake it till you make it. Retrieved from https://tbkconsult.com/silicon-valleys-rule-number-one-fake-it-to-you-make-it/

Betts, K. D., & Jaep, K. R. (2017). The dawn of fully automated contract drafting: machine learning breathes new life into a decades-old promises. *Duke Law and Technology Review*, *15*(1), 216–233.

Burton, S. (2018, February). The case for plain-language contracts. Retrieved from Harvard Business Review: https://hbr.org/2018/01/the-case-for-plain-language-contracts

Cassidy Law. (2018, September 21). The dread-inducing review of a federal government RFP or contract. Retrieved from http://cassidylawpllc.com/review-of-a-federal-government-rfp-or-contract/

Char, J., & Bitzinger, R. (2016). Reshaping the People's Liberation Army since the 18th Party Congress: Politics, policymaking, and professionalism. *Journal of Strategic Studies, 39*(5-6), 604-605. https://doi.org/10.1080/01402390.2016.1235037

Congressional Research Service. (2018). *The global research and development landscape and implications for the Department of Defense*. Washington, DC: Author.

Cook, R. I. (2000). *How complex systems fail*. Retrieved from https://web.mit.edu/2.75/resources/random/How%20Complex%20Systems%20Fail.pdf

Cooper, D. E. (2005). *Contract management: Opportunities to improve surveillance on department of defense service contracts* (GAO-05-274). Washington, DC: Government Accountability Office.

Cross, J. (2019, May 9). Department of Defense emerging technology strategy: A venture capital perspective. *Proceedings of the Sixteenth Annual Acquisition Research Symposium*. Retrieved from https://calhoun.nps.edu/bitstream/handle/10945/63024/SYM-AM-19-040.pdf?Sequence=1&isallowed=y

Cummins, T. (2019, October). The cost of a contract. Retrieved from https://blog.iaccm.com/commitment-matters-tim-cummins-blog/the-cost-of-a-contract

Daley, S. (2019, September 24). 19 examples of artificial intelligence shaking up business as usual. Retrieved from https://builtin.com/artificial-intelligence/examples-ai-in-industry

Darken, R. (2019, October 21). *Human-Machine teaming AI*. Monterey, CA: Naval Postgraduate School.

Defense Acquisition University. (2019, August 28). Defense Acquisition Life Cycle Compliance Baseline. Retrieved from https://www.dau.edu/tools/_layouts/15/WopiFrame.aspx?sourcedoc=/tools/Documents/Interactive%20Lifecycle%20Chart.pptx&action=default

Defense Advanced Research Projects Agency (DARPA). (n.d.). AI next campaign. Retrieved November 3, 2019, from https://www.darpa.mil/work-with-us/ai-next-campaign

Defense Procurement and Acquisition Policy. (2012, April). *Defense contingency contracting handbook*. Retrieved from https://www.acq.osd.mil/dpap/ccap/cc/corhb/Files/DCCOR_Handbook_2012.pdf

Denning, P. (2019, September). *Harnessing artificial intelligence*. Monterey, CA: Naval Postgraduate School.

Department of Defense (DOD). (2017, August 3). *Operation of the Defense Acquisition System* (DOD Instruction 5000.02). Washington, DC: Author.

Department of Defense (DOD). (2019, February 12). Summary of the 2018 Department of Defense artificial intelligence strategy: Harnessing AI to advance our security and prosperity. Retrieved from https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEGY.PDF

Department of Defense (DOD). (n.d.). PALT. Retrieved November 2019, from Department of Defense Procurement Toolbox: https://DoDprocurementtoolbox.com/site-pages/palt

Department of Homeland Security (DHS). (2019, August 9). Artificial intelligence (AI) for past performance—CPARS. Retrieved from https://gov.surf/opportunitydetails/Index?Id=CSOP-HQ-GS-000001&originalposteddate=08/05/2019%2005:00:01

DiNapoli, T. (2019). *DOD's use of other transactions for prototype projects has increased* (GAO-20-84). Washington, DC: Government Accountability Office. Retrieved from https://www.gao.gov/assets/710/702861.pdf

E.O. 13859. (2019, February 11). *Maintaining American leadership in artificial intelligence*. Retrieved from https://www.federalregister.gov/documents/2019/02/14/2019-02544/maintaining-american-leadership-in-artificial-intelligence

Evron, Y. (2012). China's military procurement approach in the early 21st century and its operational implications. *Journal of Strategic Studies*, *35*(1), 63–93, https://doi.org/10.1080/01402390.2011.592004

Eykholt, K., Evitimov, I., Fernandes, E., Li, B., Rahmati, A., Xia, C., & Song, D. (2018). Robust physical-world attacks on deep learning visual classification. *Proceedings of the Conference of Computer Vision and Pattern Recognition 2018*, arXiv: 1707.08945. Retrieved from https://arxiv.org/pdf/1707.08945.pdf

Fischetti, M. P. (2018, January 2). Yes, it can be done: Expediting defense acquisition. Retrieved from https://www.federaltimes.com/opinions/2018/01/02/yes-it-can-be-done-expediting-defense-acquisition/

Federal Acquisition Regulation (FAR), 48 C.F.R. 1.102 (2019).

Friedman, N. (2013). *This truck saved my life: Joint program office mine-resistant ambush-protected vehicles*. Washington, DC: Department of Defense

Fuller, J. B. (2019, September). Theranos: The unicorn that wasn't. Retrieved from Harvard Business School: https://www.hbs.edu/faculty/Pages/item.aspx?Num=55762

GAO. (2019, May 21). *2019 annual report: Additional opportunities to reduce fragmentation, overlap, and duplication and achieve billions in financial benefits* (GAO-19-285SP). Retrieved from https://www.gao.gov/reports/GAO-19-285SP/

Gardner, H. (1993). *Multiple intelligences*. New York, NY: Basic Books.

Gerding, E. F. (2013). Contract as a pattern language. *Washington Law Review, 88*(4), 1323–1356. Retrieved from: https://digital.lib.washington.edu/dspace-law/bitstream/handle/1773.1/1312/88WLR1323.pdf?sequence=1&isAllowed=y

Golstein, B. (2018, October 10). A brief taxonomy of AI. Retrieved from https://www.sharper.ai/taxonomy-ai/

Good, A. (2019, November 8). Intelligent failure assessment. Retrieved from Fail Forward: https://static1.squarespace.com/static/583382786b8f5b1d0c788b9e/t/58af22a6e4fcb57eb0f01028/1487872679331/Fail+Forward+Intelligent+Failure+Assessment.pdf

Gourley, S. (2012, November 28). Rapid Fielding Initiative: A decade of prividing urgently needed gear. Retrieved from https://www.defensemedianetwork.com/stories/rapid-fielding-initiative/

Greenfield, D. (2019, June 19). Artificial intelligence in medicine: Applications, implications and limitations. Retrieved from http://sitn.hms.harvard.edu/flash/2019/artificial-intelligence-in-medicine-applications-implications-and-limitations/

Gunning, D. (2017, November). Explainable artificial intelligence. Retrieved from https://www.darpa.mil/attachments/xaiprogramupdate.pdf

Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On past, present, and future of AI. *California Management Review 61*(4), 5–14. https://doi.org/10.1177/0008125619864925

Hagan, G. (2009, November). Glossary of defense acquisition acronyms and terms. Retrieved from Defense Acquisition University: http://www.acqnotes.com/Attachments/DAU%20-%2013th_Edition_Glossary.pdf

Hagel, C. (2014, November 15). The defense innovation initiative. Retrieved from https://archive.defense.gov/pubs/OSD013411-14.pdf

Hutton, J. (2011). D*efense contract management agency: Amid ongoing efforts to rebuild capacity, several factors present challenges in meeting its missions* (GAO-12-83). Washington, DC: Government Accountability Office. Retrieved from https://www.gao.gov/assets/590/586078.pdf

Icertis. (2019, October 11). Contract management software. Retrieved from https://www.icertis.com/contract-management-software/

Icertis. (n.d.-a). Customers. Retrieved October 10, 2019, from https://www.icertis.com/customers/

Icertis. (n.d.-b). Icertis customer profile: Mindtree. Retrieved October 10, 2019, from https://www.icertis.com/customer/mindtree/

Icertis. (n.d.-c). Microsoft streamlined its contract management. Retrieved Retrieved October 10, 2019, from https://www.icertis.com/customers/microsoft-information-exchange-agreements-case-study/

Inhofe, J., & Reed, J. (2019). *FY 2020 National Defense Authorization Act*. Washington, DC: Senate Armed Services Committee.

IRPA & AI. (n.d.). What is robotic process automation? Retrieved November 16, 2019, from https://irpaai.com/what-is-robotic-process-automation/

Institute for the Study of War. (n.d.). Provincial reconstruction teams. Retrieved November 2, 2019, from http://www.understandingwar.org/provincial-reconstruction-teams-prts

Kania, E. B. (2019, August 27). In military-civil fusion, China is learning lessons from the United States and starting to innovate. Retrieved from https://www.realcleardefense.com/articles/2019/08/27/in_military-civil_fusion_china_is_learning_lessons_from_the_united_states_and_starting_to_innovate_114699.html

Kendall, F. (2017). Getting defense acquisition right. Retrieved from https://dod.defense.gov/Portals/1/Documents/pubs/Getting-Acquisition-Right-Jan2017.pdf

Kendall, F. (2018, March 20). Five myths about pentagon weapons programs. Retrieved from https://www.defenseone.com/ideas/2018/03/five-myths-about-pentagon-weapons-programs/146803/

Talk to Transformer. (n.d.). Talk to transformer. Retrieved November 16, 2019, from https://talktotransformer.com/

Knight, W. (2017, April 11). The dark secret at the heart of AI. Retrieved from https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/

Lawgeex. (2018, February). Comparing the performance of artificial intelligence to human lawyers in the review of standard business contracts. Retrieved from https://images.law.com/contrib/content/uploads/documents/397/5408/lawgeex.pdf

Leviathan, Y. (2018, May 8). Google Duplex: An AI system for accomplishing real-world tasks over the phone. Retrieved from https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html

Levine, P., & Greenwalt, B. (2019, April 4). What the 809 panel didn't quite get right. Retrieved from https://breakingdefense.com/2019/04/what-the-809-panel-didnt-quite-get-right-greenwalt-levine/

Mackin, M. (2015). *Littoral Combat Ship: Knowledge of survivability and lethality capabilities needed prior to making major funding decisions* (GAO-16-201). Washington, DC: Government Accountability Office.

Maucione, S. (2019a, April 26). DOD doesn't want to end up like Theranos, so it's being cautious about 'fail fast'. Retrieved from https://federalnewsnetwork.com/defense-main/2019/04/DOD-doesnt-want-to-end-up-like-theranos-so-its-being-cautious-about-fail-fast/

Maucione, S. (2019b, October 30). Special report: Failure is an option for DOD's experimental agency, but how much? Retrieved from https://federalnewsnetwork.com/defense-main/2019/10/special-report-failure-is-an-option-for-DoDs-experimental-agency-but-how-much/

McCain, J. (2015, November 15). It's time to upgrade the defense department. Retrieved from https://warontherocks.com/2015/11/its-time-to-upgrade-the-defense-department/

McCusker, E. (2019). *Department of Defense news briefing on the President's fiscal year 2020 defense budget*. Alexandria, VA: Under Secretary of the Department of Defense Comptroller. Retrieved from https://www.defense.gov/Newsroom/Transcripts/Transcript/Article/1783618/department-of-defense-news-briefing-on-the-presidents-fiscal-year-2020-defense/

Modigliani, P., Chang, S. Ward, D. & Murphy, C. (2019). *Middle tier acquisition and other rapid acquisition pathways*. Bedford: MITRE Organization. Retrieved from https://aida.mitre.org/wp-content/uploads/2019/03/Middle-Tier-and-Rapid-Acquisition-Pathways-8-Mar-19.pdf

Nayak, P. (2019, Oct. 25). Understanding searches better than ever before. Retrieved from https://blog.google/products/search/search-language-understanding-bert

Oakley, Shelby. (2019, June). *DOD acquisition reform: Leadership attention needed to effectively implement changes to acquisition oversight* (GAO-19-439). Retrieved from https://www.gao.gov/assets/700/699582.pdf

Office of Small Business Programs. (n.d.). Rapid Innovation Fund. Retrieved November 5, 2019, from https://business.defense.gov/Programs/RIF/

Office of USDA&S. (2019, September 30). OUSD(A&S) Strategy road map. Retrieved https://www.acq.osd.mil/fo/docs/as-roadmap.pdf

Office of USDA&S. (n.d.). Ellen M. Lord. Retrieved November 1, 2019, from https://www.acq.osd.mil/bio_lord.html

Office of USDR&E. (n.d.). USD(R&E) modernization priorities. Retrieved December 2, 2019, from https://www.cto.mil/modernization-priorities/

Parloff, R. (2016, September 28). From 2016: Why deep learning is suddenly changing your life. Retrieved from https://fortune.com/longform/ai-artificial-intelligence-deep-machine-learning/

People's Republic of China Ministry of Science and Technology. (2018). National High-Tech Program (863 Program). Retrieved from Ministry of Science and Technology: http://www.most.gov.cn/eng/programmes1/

Pickens, A. H., & Alvarado, D. J. (2018). Other transaction agreements: An analysis of the oracle decision and its potential impact on the use of OTAs. *The Procurement Lawyer*, *54*(1), 1–24. Retrieved from http://libproxy.nps.edu/login?url=https://search-proquest-com.libproxy.nps.edu/docview/2157810530?accountid=12702

Porche, I. R., Mckay, S., Mckernan, M., Button, R. W., Murphy, B. Giglio, K., & Axelband, E. (2012). Rapid acquisition and fielding for information assurance and cyber security in the Navy. Washington, DC: Rand Corporation.

Raghaven, S., & Mooney, R. J. (2013). Online inference-rule learning from natural-language extractions. Austin: The University of Texas.

Ramsey, L. (2019, Jun 28). Theranos founder Elizabeth Holmes faces jail time for fraud charges. Her trial is set to begin in summer 2020. Retrieved from https://www.businessinsider.com/theranos-founder-elizabeth-holmes-president-sunny-balwani-trial-date-2019-6

Rich, B. (2018, February 12). How AI is changing contracts. Retrieved from Harvard Business Review: https://hbr.org/2018/02/how-ai-is-changing-contracts

Sargent, J. F., Gallo, M. E., & Schwartz, M. (2018, November 8). *The global research and development landscape and implications for the Department of Defense* (CRS Report No. R45403). Retrieved from Congressional Research Service: https://fas.org/sgp/crs/natsec/R45403.pdf

Schaeffer, C. (2016, July 12). Agile versus waterfall for CRM implementation success. Retrieved from https://customerthink.com/agile-versus-waterfall-for-crm-implementation-success/

Schlimmer, S., & Brennan, B. (2018, July 4). For vendors, DOD's CUI requirements more than an exercise. Retrieved from https://federalnewsnetwork.com/commentary/2018/07/for-vendors-dods-cui-requirements-are-more-than-an-exercise/

Schwartz, M., Sargent, J. F., & Mann, C. T. (2018, July 2). Defense Acquisitions: How and where DOD spends its contracting dollars. Retrieved from Homeland Security Digital Library: https://www.hsdl.org/?view&did=812910

Scott, W. A. (2007). *Request for and use of emergency supplemental funds for the Rapid Fielding Initiative*. Alexandria, VA: Inspector General United States DOD.

Section 809 Panel. (2018). *Report of the advisory panel of streamlining and codifying acquisition regulations Vol 1 of 3*. Washington, DC: Author.

Section 809 Panel. (2019). *A road map to the Section 809 Panel reports*. Washington, DC: Author.

Section 809 Panel. (2019). *Report of the advisory panel on streamlining and codifying acquisition regulations Vol. 3 of 3*. Washington, DC: Author.

Shanahan, P. (2018). *DOD cloud strategy*. Washington, DC: Department of Defense. Retrieved from: https://media.defense.gov/2019/Feb/04/2002085866/-1/-1/1/DOD-CLOUD-STRATEGY.PDF

Shaw, M. (2019, October 15). Why Google is the best search engine (and why businesses should care). Retrieved from https://www.towermarketing.net/blog/google-best-search-engine/

Sievo. (n.d.). AI in procurement. Retrieved November 16, 2019, from https://sievo.com/resources/ai-in-procurement

Simpson, J. (2018, March 12). FY18 Procurement action lead time (PALT) metric. Retrieved from https://www.peostri.army.mil/palt-memo

Stanford. (2016, February 8). The Turing test. Retrieved from https://plato.stanford.edu/entries/turing-test/

Stewart, R. (2019, July 26). AFCEA Shark Tank—Rapid Acquisition Facilitation Tool (R.A.F.T.). Retrieved from https://www.federalgovernmentexperts.com/post/afcea-shark-tank-rapid-acquisition-facilitation-tool-r-a-f-t

Sullivan, M. (2009). *Rapid acquisition of MRAP vehicles* (GAO-10-155T). Washington, DC: Government Accountability Office. Retrieved from https://www.gao.gov/new.items/d10155t.pdf

Sullivan, M. (2015). *Defense Advanced Research Project Agency: Key factors drive transition of technologies, but better training and data dissemination can increase success* (GAO-16-5). Washington, DC: Government Accountability Office. Retrieved from https://www.gao.gov/assets/680/673746.pdf

Sullivan. M. (2017). Military acquisitions: DOD is taking steps to address challenges faced by certain companies (GAO-17-644). Washington, DC: Government Accountability Office. Retrieved from https://www.gao.gov/assets/690/686012.pdf

Tatum, D. (2018, June). *Contracting Officer's Representative (COR): An analysis of part-time and full-time COR roles, competency requirements and effectiveness* (Joint Applied Project Report). Retrieved from https://calhoun.nps.edu/bitstream/handle/10945/59604/18Jun_Tatum_Denise.pdf?Sequence=1&isallowed=y

Thomas, E., Christina, C., & Painter, G. (2019). *Leveraging technology to improve contract surveillance: Opportunity identification and analysis* (Joint Applied Project Report). Retrieved from https://calhoun.nps.edu/bitstream/handle/10945/62770/19Jun_Thomas_Clark_Painter.pdf?sequence=1&isAllowed=y

Under Secretary of Defense. (2003). *Manager's guide to technology transition in an evolutionary acquisition environment.* Alexandria, VA: Author. Retrieved from: https://www.acq.osd.mil/dpap/docs/aq201s1v10complete.pdf

Van Schooten, D. (2018, August 16). The pentagon's contracting gurus mismanaged their own contracts: The Defense Contract Management Agency botched a $45-million project to help manage trillions of dollars in other contracts. Retrieved from Project on Government Oversight: https://www.pogo.org/investigation/2018/08/pentagons-contracting-gurus-mismanaged-their-own-contracts/

Waikar, S. (2018, Dec 17). What can we learn from the downfall of Theranos? Retrieved from https://www.gsb.stanford.edu/insights/what-can-we-learn-downfall-theranos

Walton, T. (2016). Securing the Third Offset Strategy: Priorities for the next secretary of defense. Retrieved from https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-82/jfq-82_6-15_Walton.pdf

Williams, S., Drezner, J. A., McKernan, M., Shontz, D., & Sollinger, J. M. (2014). Rapid acquisition of Army command and control Systems. Washington, DC: RAND Corporation. Retrieved from https://www.rand.org/content/dam/rand/pubs/research_reports/RR200/RR274/RAND_RR274.pdf

World Bank. (n.d.). Gross domestic product 2018. Retrieved December 20, 2019, from https://databank.worldbank.org/data/download/GDP.pdf

Zarkadakis, G. (2019, September 11). The rise of the conscious machines: How far should we take AI? Retrieved from https://www.sciencefocus.com/future-technology/the-rise-of-the-conscious-machines-how-far-should-we-take-ai/

Zoroya, G. (2013, December 18). How the IED changed the U.S. Military. Retrieved from https://www.usatoday.com/story/news/nation/2013/12/18/ied-10-years-blast-wounds-amputations/3803017/

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California