Are incentives and motivations for scientists and engineers aligned to meet the Army's modernization goals?

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April 08, 2020

PUBLISHED BY
DAU

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Acknowledgements

I would like to thank my wife, Angel for her selfless commitment and support during the course of this research and throughout my professional endeavors. I would also like to acknowledge my Research Advisor, Dr. Joseph L. Ilk of the Defense Acquisition University (DAU) for guiding me through the research process. My sincere gratitude is expressed to Ms. Lisa C. Karakashian, G1 at the Joint Program Executive Office for Armaments & Ammunition (JPEO A&A), Ms. Joanna L. Chase, Human Capital Analyst at JPEO A&A, Ms. Pota Kripotos, Chief of the Human Capital Management Office (HCMO) at the Combat Capabilities Development Command (CCDC) Armaments Center (AC), and Mr. Leon J. Moreau, Management Analyst at the CCDC AC HCMO for their help in providing valuable data and reports essential to this research.

I would also like to acknowledge the Senior Service College Fellowship (SSCF) Professionals at Picatinny, the Program Director, Mr. Chris J. Grassano, and the SSCF coordinator, Ms. Elizabeth M. Phillips for their support and help during the course of this program and this research. Last but not the least, I would like to thank my parents Joy J. and Cecily J. Palathinkal for their sacrifices and life-lessons that encouraged my education, learning, and career.

Abstract

The creation of the Army Futures Command (AFC) and the Cross Functional Teams (CFTs) in order to spur innovation and game-changing technologies for the warfighter has created ripple effects throughout the Army. These effects range from how the Army looks at generating requirements for new material solutions all the way through fielding those solutions within schedule and cost objectives that are stretch goals based on existing standards. While the majority of professionals entrusted with executing these goals for AFC came from existing Army organizations such as the Research Development Engineering Center (RDECOM), other organizations such as the office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASAALT) and their professionals were also required to collaborate with AFC to realize these goals.

This research topic looked at whether the incentives and motivations that AFC and ASAALT provided their workforce, were aligned to meet Army modernization goals, particularly considering the aggressive schedule requirement. The research yielded interesting insights into this topic particularly around what was available to AFC and ASAALT. It also looked at what other organizations, particularly high technology firms in the private sector utilized to drive their workforce for generating innovative solutions under stressing constraints. The findings and conclusions showed that a combination of both intrinsic and extrinsic incentives and motivations were required, and that those incentives and motivations were not insurmountable. However, they do require some creative thought and tailoring from leadership in order to influence the work-force of scientists and engineers to meet the Army's aggressive modernization goals.

Chapter 1 – Introduction

Theories on motivating employees and utilizing performance based incentive systems have been in existence for some time. The private sector has been utilizing iterations of the same very effectively in order to retain and encourage employee productivity. Performance based incentives are associated with pay for performance, but more often than not they are not limited to pay in terms of monetary compensation. Incentives are increasingly being tailored to motivations of employees. For example it is well known that many start-up companies as well as established companies in the private sector supplement competitive employee pay with "perks" or other incentives for increasing employee productivity and performance. The private sector, particularly within Silicon Valley, have also driven the recent spate of disruptive technologies (e.g., smart phones, social media etc…) that are changing peoples' lives. If the public sector is to follow suit for their contributions to technology development, it would be in their collective best interest to adopt best practices from the private sector for their needs. While monetary compensation is among the very first thoughts that come to mind, research suggests that one may need to look beyond monetary benefits to understand what drives people to deliver results under differing sets of constraints. Pink (2009) discusses intrinsic and extrinsic motivators as drivers of employee performance and organizations may benefit from aligning incentives with those particular motivators in order to influence employees to positively impact the organizations' bottom-line. According to Lavigna (2014), the public sector could benefit from information regarding motivational needs to develop compensation packages and intrinsic motivators to drive employee productivity. The United States (US) Army as a public sector entity may benefit from such an approach to further its modernization priorities. This research paper seeks to establish a case for evaluating the incentives and motivations for the Army's scientists and engineers entrusted with modernization responsibilities. Chapter 1 provides the background and discussion on the problem facing the United States Army (USA) with regards to the alignment of its incentives and its modernization priorities based on the Army Strategy.

Background

On November 07, 2017, the acting Secretary of the Army, the Honorable (Hon.) Ryan D. McCarthy signed US Army Directive 2017-33, thereby enabling the Army Modernization Task Force as a pre-cursor to the formation of the Army Futures Command (AFC). The issue at hand was that the Army was taking too long to develop requirements and subsequently design, build, test and field weapon systems based on those requirements (US Army, 2017, November 07). The mission of Directive 2017-33 was to enable the modernization task force by providing its leadership with the requisite authorities and latitude to identify the problems with the current modernization process stemming from the Army's existing structure and processes. The goal of the Directive was that enabling the modernization task force would lead to recommendations to redefine existing Army structures and processes while bringing unity of effort under one roof for rapidly progressing the Army's Strategic modernization priorities (US Army, 2017, November 07). The Army Strategy (US Army, 2018) further formalized the urgency for delivery of modernization priorities by stating the need to field modernization capabilities by 2028 with a priority shift to modernization from readiness as the number one Army Strategy's priority beginning in 2022.

In order to support the 2028 modernization mission objectives, Directive 2017-33 also provided the modernization task force and its leaders, "Direct Hire Authority" or the ability to hire personnel (US Army, 2017, November 07). While the Directive justified the need for a new Army Command (ACOM) and allowed for new hires, it did not provide guidance or authorities regarding incentives or motivations for the workforce realigned under the new ACOM (US Army, 2017, November 07). It is assumed that incentives and motivations would fall under the same existing construct, i.e., as indicated by the Office of Personnel Management (OPM) and as espoused by the new ACOM's senior leaders. While first time Government hires or newly hired personnel may be motivated or find it exciting to work for a new organization such as AFC, most of the workforce at AFC is comprised of realigned individuals from other Army organizations such as the Army Material Command (AMC) or the Training and Doctrine Command (TRADOC). Studying how the existing workforce operates and whether incentives need to be evaluated to better suit AFC's mission may be warranted to understand how well AFC as a whole could pivot towards meeting its modernization objectives while prioritizing schedule above all else.

Problem

The problem statement for this study is: Given the Army's push towards rapid modernization, the incentives and motivations for the Army's scientific and engineering workforce may not be aligned to support the Army's aggressive modernization schedule requirements.

AFC was created in order to meet the Army Strategy goal of modernization more effectively than how it was done in the past. However, with the current organizational structure there are two different organizations that are still responsible for delivering modernization to the end user - the Army soldier. While AFC is the organization that is tasked with the design and development piece of the modernization, the Assistant Secretary of the Army for Acquisition Logistics and Technology (ASAALT) is responsible for building and delivering the modernized products to the soldier (Kimmons, 2019). Therefore the primary task for rapidly delivering modernization capabilities rests on AFC and ASAALT's scientists and engineers. Kimmons (2019) reports that according to AFC, its creation does not change the way ASAALT operates.

While creation of the AFC entailed new hires, the majority of the AFC workforce were intended to be reassigned from other ACOMs. If current employees are accustomed to the prior methodology of doing business, reorganizing them under a new command may not be sufficient to motivate them to meet the new ACOM's objectives. Specifically these employees were pulled from other ACOMs and were brought together under AFC because the previous work flows were causing delays to requirements generation and subsequent product deliveries for the Army's soldiers. Even though these employees are now under a single management structure for one portion of the modernization puzzle, they are still part of another large organization that is comprised of 24,000 employees (Kimmons, 2019). These employees will have to work alongside another existing organization (ASAALT) to ultimately deliver the modernized products rapidly to the soldier. The Army's position is that the new organizational structure is better suited to meet rapid modernization, however, the Army, ASAALT, or AFC has not communicated how they intend to incentivize or motivate the workforce for this objective.

Purpose of this Study

This qualitative case study will explore whether incentives and motivations for ASAALT and AFC scientists and engineers are aligned properly to meet the Army's modernization schedule goals. The study will also provide insights on what incentives and motivations are currently available to these scientists and engineers and whether any recommendations on modifications to the same need to be considered in order to meet schedule goals.

Significance of the Research

The significance of this research is that workforce incentives and motivations may need to be better aligned to impact workforce output and thereby meet the Army's schedule goals. Due to the Army's major organizational restructuring and aggressive schedule to meet its modernization priorities, this research topic seeks to understand how the restructured workforce's incentives and motivations should be aligned in terms of delivering the modernization priority objectives. How incentives and motivations affect scientists and engineers under ASAALT and AFC may also benefit future research that aims to study how incentives or motivators may be of use in other Government organizations. The hypothesis for this research is that current incentives and motivations for the Army's selected workforce of scientists and engineers entrusted with modernization responsibilities may not be aligned to meet Army modernization schedule goals. This hypothesis is based on comparisons with the private sector, specifically high-technology fields including Silicon Valley companies, automotive, and technology start-up firms. It is well known that these firms are currently responsible for driving technology development rapidly and that they utilize various incentive plans and motivations to attract, retain, and engage talent.

Overview of the Research Methodology

This research seeks to understand whether current incentives for scientists and engineers within the Army's ASAALT and AFC organizations are aligned to meet the schedule requirements of the Army's modernization priorities. Since this research topic involves decisions pertaining to people and their organizations (Wood, Leenders, Mauffette-Leenders, & Erskine, 2012) the case based methodology was selected to figuratively look at the problem set from the perspective of the organizations involved. The sponsor for this research topic, the Defense Acquisition University (DAU) limited the research to be conducted based on historical data or research analyses and reviews. Therefore a qualitiative thematic analyses of prior data and research including quantitive information was best deemed suited for the basis of this research.

Limitations

Since the author's research is limited to the duration of the Senior Service College Fellowship (SSCF) program and the resources available to the SSCF program, time and resources are the primary limitations for the scope of the research. Due to this reason, the scope is also limited to the scientists and engineers from the Joint Program Executive Office for Armaments and Ammunition (JPEO A&A), and the Combat Capabilities Development Command (CCDC) Armaments Center (AC), as representative organizations of ASAALT and AFC respectively.

Expanding the research to cover the entire ASAALT and AFC scientific and engineering workforces is not feasible given the time and resource limitations.

Chapter 2 – Literature Review

The literature reviewed in chapter 2 was obtained through internet searches as well as utilizing the database services ProQuest and EbscoHost. The ProQuest and EbscoHost databases were accessed through the DAU library. Army Directives were obtained from the Department of Army (DA) publications database available on the web. The search terms included incentives, compensation, motivations, public sector, private sector, modernization, scientists, engineers, Army, Department of Defense (DoD), military, and Government. The search initially focused on research paper titles as that was assumed to be a crucial step in focusing the research on incentives as it pertains to employees. The search strings that coupled incentives with public sector or Government within the titles of their publication yielded a single peer reviewed paper by Rainey (1977). Therefore, expanding the search beyond titles of the papers and search terms to include private sector, motivations, and compensation as well as other combinations of the above mentioned search terms were needed. This provided additional research work that tied incentives or motivations with job performance. The Army Directive 2017-33 along with early research on incentives as pertinent to public or private sector employees served as the foundation for this research paper.

Historical Background

The Army Strategy states that modernization will be the Army's number one priority starting in 2022 and that capabilities to be delivered by the Army's modernization efforts through its research and development activities targets 2028 for fielding (US Army, 2018). The Army

Directive 2017-33 discussed enabling the modernization task force (US Army, 2017, November 07). While this directive provided authorities for the task force leadership to establish the unity of command, it did not discuss authorities to provide incentives to the workforce tasked with executing modernization. The Army Directive 2017-24 (US Army, 2017, October 06), preceded Directive 2017-33 and established the Cross Functional Team (CFT) pilots in order to improve the quality and speed of material development activities. The Hon. Dr. Mark T. Esper was the Secretary of the Army and General (GEN) Mark A. Milley was the Chief of Staff of the Army when they envisioned and released the Army Strategy in 2018. The Hon. Ryan D. McCarthy was the acting Secretary of the Army when he issued Directive 2017-33.

Kimmons (2019) covers the organizational growth of AFC and discusses its shared responsibilities with ASAALT in his article on the Army Futures Command. This work for the Army News Service covered topics such as the AFC's Cross Functional Teams entrusted with leading the Army towards meeting its modernization priorities and highlights of interview responses from key Army leaders including the ASAALT, the HON Dr. Bruce D. Jette, and GEN John M. Murray, the Commanding General for AFC. (Kimmons, 2019).

Rainey (1977) discusses incentives and motivations in his comparative study of public and private sector employees. This early work by Rainey provides provisional definitions of incentives and motivations as pertinent to organizations which are relevant to this research paper. Rainey (1977) describes incentives as an object or event of value to a person due to which he or she seeks to attain the same within the organization. Motivation is defined as the willingness or tendency to try to perform work well or to work hard in an organization according to the study. Rainey's work is limited to five Government organizations and managers in addition to four business or private sector organizations. The Department of Defense or the Army is not one of those organizations. Rainey's work is the earliest peer reviewed body of research observed from the author's search results that was relevant to this research topic. Rainey's definition of incentives and motivations appear to be adopted in general terms within the current professional environment and provide an inclusive foundational framework of what constitutes incentives or motivations without restricting the definitions to specific monetary or non-monetary links. Rainey's work tied incentives with public sector employee performance and due to its relevance, the definitions in this research effort were used for the purpose of this research topic. Rainey's qualitative and quantitative research relied on literature reviews, sampling of the nine (9) different organizations, followed by categorization of the data samples, and subsequent statistical analyses of the data. (Rainey, 1977).

Mihaly Csikszentmihalyi's (1990) book "Flow" examines the concept of "Flow" that described as the process of individuals achieving happiness by controlling their inner life. This book is based on several years of historical research conducted by Mihaly Csikszentmihalyi himself as well as other historical experts and covers how individuals experience flow of the body, thought, and work leading to inner happiness and accomplishment. The book's examination of the "conditions for flow" and "work as flow" were considered significant to the theme of this research paper. While the book's findings do not target a specific population or professional such as a scientist or an engineer, they can be considered as ubiquitously applicable. Csikszentmihalyi's work and thoughts have influenced more recent authors and thought leaders on inner happiness or intrinsic motivators such as Dan Pink, due to which the contents of this book mentioned earlier are referenced to set the stage for this paper. (Csikszentmihalyi, 1990).

This background contributes to the problem framework discussed earlier in chapter 1. The context above also helped shape the author's literature searches with respect to incentives, motivations, and the public sector as well as any relevant interdependencies. Government scientists and engineers were generally categorized under public sector employees and considered white collar employees for the purposes of this research paper.

Literature relevant to the Body of Knowledge

Questions pertinent to the research problem were used in order to narrow down the relevant literature work for this topic. These include the following questions:

1. What are incentives and motivations as pertinent to employees?
2. What are current incentives and motivations for U.S. Army or public sector employees including scientists and engineers?
3. Are current standards of incentives and motivations working for U.S. Army or public sector employees or what should be done to incentivize or motivate them?
4. What are incentives and motivations that work in the private sector particularly in sectors where technology is developed rapidly (e.g., technology sector)?
5. How should the Government motivate or incentivize its employees including scientists and engineers?

The following paragraphs summarizes the existing literature found by the author as pertinent to the framing questions above.

In addition to Rainey's definition of incentives and motivations, Yen (1992) defines incentives as short term or long term pay that is tied to the performance of an individual, team, or entire organization. Yen (1992) classifies incentives as a subset of compensation and focuses on public and private sector compensation as a whole without elaborating on incentives specifically. This research (Yen, 1992) work focuses only on leisure and recreational professionals within the public and private sectors. Yen's (1992) comparative study of samples from the private and public sector relied on questionnaires for data collection and statistical analysis using an International Business Machines (IBM) Statistical Analysis System (SAS).

In his talk organized by Technology, Entertainment, Design (TED) Conferences LLC, Dan Pink (2009) discusses extrinsic or intrinsic motivators. Pink (2009) goes on to describe that extrinsic motivators work well when there are narrow bounds or constraints for employees to operate within, and often require specific guidelines with predictable outputs tied to the effort. In such situations extrinsic motivators such as cash awards can increase productivity. However, if guidelines are more fluid and less stove-piped, with employees requiring to consider multiple interdependencies and utilize critical thinking, then intrinsic motivators such as autonomy are more desirable for generating productivity. His discussion is not limited to the public or private sector but indicates that this theme is applicable across any workforce. (Pink, 2009).

The website for the U.S. Office for Personnel Management (OPM) provides the monetary compensation charts for all Federal employees including scientists and engineers employed under its General Schedule (GS) pay scale (Office of Personnel Management (OPM), 2019). The website also provides information on the recruitment and retention incentives and other benefits offered by the federal Government to its employees. The website does not provide a comparison of benefits with comparable jobs in the private sector.

The website for the DoD Civilian Acquisition Workforce Personnel Demonstration Project provided information on the monetary compensation for federal employees under the Acquisition Demonstration (AcqDemo, 2020) broadband. The website does not provide a comparison of benefits with comparable jobs in the private sector nor does it provide any information on motivation factors for employees.

The JPEO A&A Personnel Office (G1) and the CCDC AC Human Capital Management Office (HCMO) provided information on recruitment, retention, incentives, and motivations for their respective scientific and engineering workforces. Both offices provided available data that was collected as a part of required work-force demographic understanding or self-reported information (e.g. exit interviews). JPEO A&A G1 also leveraged the Director for Acquisition Career Management (DACM) Office (USA DACM, 2019) to supplement its demographic data. Both offices did not provide any comparison data with similar jobs in the private sector.

The 5th Institute of Electrical and Electronics Engineers (IEEE) Science Technology Engineering and Mathematics (STEM) Conference proceedings included a paper on how Science and Engineering professionals can impact STEM education and the company's bottom line due to increased job satisfaction and motivation among the scientist and engineering workforce (Tillinghast, Petersen, Rizzuto, Dabiri, & Gonzalez, 2015). This paper was submitted by the CCDC AC professionals prior to the formation of AFC and CCDC AC when CCDC AC was known as the Armament Research Development Engineering Center (ARDEC). While it does not compare with the private sector, it surveyed science and engineering professionals from ARDEC to understand impacts and benefits of STEM outreach towards organizations.

A November 2012 report (Grundmann, et al., 2012) by the U.S. Merit Systems Protection Board (MSPB) presented to the U.S. President and Congress looked at federal employee engagement and the motivating potential of job characteristics and rewards towards the same. The MSPB report utilized Federal employee survey data and insights from personnel psychology to synthesize its findings. The report finds that people with job characteristics such as autonomy and high impact of the project outcome tend to have higher motivation. The report also found that employees are motivated when there is a perception of connection between the work that they do and the rewards received, as well as, when there are sound performance management practices for rewards. This effort was conducted through surveys that were agnostic of job type and representative of the federal workforce as a whole and did not contain specific attributes for the DoD, scientists, and/or engineers. The research did not try to obtain specific ties to what the motivation was linked to such as a schedule, budget or product deliverable goals but was rather tied to general job related motivation and satisfaction. (Grundmann, et al., 2012).

Bandiera, Khan, and Tobias (2017) discuss performance rewards for public sector employees and finds that there are unique challenges for Government employees when it comes to performance based incentives. Bandiera, Khan, and Tobias (2017) also highlight the benefit of non-financial rewards and the research suggests that these can be powerful strategies for motivating Government employees in a cost-effective manner. The findings are based on the synthesis of the most recent research and social experiments conducted on strategies to improve public sector workers' performance. Bandiera, Khan, and Tobias (2017) based their research on data collected from public sector employees within developing countries of Asia and Africa and did not cover comparative data from public sector employees from western or developed countries.

The Research And Development (RAND) Corporation published a report that covered retention, incentives, and DoD experience (Asch, Hosek, Kavanagh, & Mattock, 2016). This report researched the impacts of 30 year versus 40 year pay table differences on employee retention. The RAND report did not cover DoD civilian personnel nor look at pay for performance but only focused on pay as relative to years of active duty DoD experience. RAND was tasked by the Senate Armed Services Committee (SASC) as part of the Fiscal Year (FY) 2015 National Defense Authorization Act (NDAA) to conduct the study that resulted in this report. The qualitative and quantitative study utilized literature reviews, data on active-duty personnel, semi-structured interviews of civilian and military personnel as well as RAND's indigenous Dynamic Retention Model (DRM) simulating effects. This research was not utilized for this research topic due to its limitations in addressing performance. (Asch, Hosek, Kavanagh, & Mattock, 2016).

The commercial websites for LinkedIn and ZipRecruiter provided general information on the monetary compensation for scientists and engineers in the private sector and screenshots from these websites were utilized to show compensation levels and structures for those scientists and engineers. These websites are popular internet based recruitment tools and the information utilized for this research paper are based on the data collected by these websites.

The Institute for Defense Analyses (IDA) conducted a study that examined financial and non-financial incentives for Program Managers (PMs) of Major Defense Acquisition Programs (MDAPs). The purpose of this congressionally requested study (Hunter, et al., 2018) was to examine and assess incentives including financial rewards for senior civilians and military officials to remain in Program Manager (PM) roles as an incentive for executing programs on schedule and budget. The study (Hunter, et al., 2018) found weak evidence that incentives would result in PMs staying in their roles longer. The study also provided a comprehensive look at financial and non-financial incentives for both civilian and military personnel alongside industry wide-best practices. This study focused on the senior civilian and military personnel in PM specific roles and did not discuss other professionals including engineers or scientists even though they may contribute to and enable PM functions. The study (Hunter, et al., 2018) utilized a multi-faceted approach that included interviews, literature reviews, and analyses of data collected for the assessment. (Hunter, et al., 2018).

Burgess and Ratto (2003) cover the issues of incentives for the public sector in the United Kingdom (U.K.) in their paper to the Leverhulme Centre for Market and Public Organisation based at the University of Bristol. Burgess and Ratto (2003) conclude that while theory suggests that since manual labor employees in the public and private sectors have performance outputs of the same measurability and complexity, their use of merit pay incentives would be similar. But this is not suggested by evidence and that the public sector is less likely to use pay for performance incentives and this is even more pronounced for non-manual labor employees (Burgess & Ratto, 2003). Burgess and Ratto's paper did not look at public sector employees in the United States.

A 2010 RAND report looked at Performance Based Accountability Systems (PBASs) for five (5) different public sector organizations in order to understand their effectiveness. This case study based approach looked at prior literature and empirical analyses of internal RAND discussions on the five sectors that RAND picked. The DoD was not among the public organizations that RAND reviewed. (Stecher, et al., 2010).

A 2017 RAND report assessed the Civilian Acquisition Workforce Personnel Demonstration Project or AcqDemo, the primary pay for performance policies and procedures for ASAALT personnel. This data informed assessment (Lewis, et al., 2017) looked at quantitative data obtained from surveys as well as program documents from the AcqDemo website to assess AcqDemo's impacts. The impacts studied included but were not limited to compensation, retention, promotion, effectiveness as a performance-based personnel system, and influence on organizations' acquisition mission. It did not consider any comparisons to the private sector or other Government agency used performance-based systems. (Lewis, et al., 2017).

Robert Lavigna's (2014) Harvard Business Review (HBR) article discusses what makes motivating Government employees difficult. These include negative attitudes, leadership changes, aging workforce, employee protections, financial incentive constraints, union influence, public visibility, and different employee motivations. Among the eight factors covered, one factor – different employee motivations, is discussed as a potential advantage that managers could use for motivation. (Lavigna, 2014).

Alarcon (1992) in The American Behavioral Scientist discussed his findings on the recruitment processes used in Silicon Valley. This article focused on immigrant engineers and scientists and utilized a comparative case study approach using both qualitative and quantitative data. The Alarcon (1999) study finds that Silicon Valley companies or other companies in the private technology sector have the luxury and power to recruit scientific and engineering candidates from a global pool. The Army or the DoD does not generally benefit from this feature due to their security requirements that necessitate hiring of U.S. citizens for the most part. The data and findings from this research article was not utilized for the purpose of this research topic since the findings were specific to recruitment processes and did not cover specifics on motivations or incentives for employees to meet performance goals. (Alarcon, 1992).

Rynes, Gerhart and Minette (2004) discuss the impact of pay as a motivational aspect in their article. This evidence and survey based research conclude that while pay itself is not a primary motivator, it is still an important motivator. It further concludes that there is evidence to support that people do not accurately reflect how pay levels are, or how pay is determined, have on people's employment decisions. This research article does not specifically discuss public or private-sector employees but generalizes its conclusions without any distinction across organizations. (Rynes, Gerhart, & Minette, 2004).

David Kaiser (2006) analyzed scientists working during the space race and the events around the Sputnik launch in 1957. Kaiser looked at student enrollments and research contributions in scientific and engineering fields, and noted that while political lobbying and political pushes for technological development does not always lead to “bad science” but rather well timed marketing and publicity could result in advantageous results. Kaiser’s comparative study based on historical research did not discuss individual motivations or incentives offered for performance and did not utilize any quantitative analyses for its conclusions. This research was focused on explaining the benefits of the “political cause” which included increased enrollments and research contributions in the science and engineering field. It did not go into further detail with regards to the “why”, “how”, or “what” of the impacts due to which Kaiser’s work was not utilized for this research topic. (Kaiser, 2006)

Zenger & Lazzarini (2004) conducted an empirical study based on surveys of engineers in Silicon Valley to understand the differences in how large and small private firms incentivize and motivate technical talent in the high-technology sector. This study which did not look at the public sector concluded that there are noticeable differences between how large and small firms incentivize and motivate their employees and that the nature of the size of the firms results in certain practices that yield different outcomes. According to this study, smaller firms are likely to spur greater innovation due to their more aggressive incentive approaches and while larger firms have the greater ability to screen for talent they recognize their disadvantage in designing incentives to spur innovation. (Zenger and Lazzarini, 2004)

Johnson (2002) in the Financial Times; London (UK) discussed how France's 1999 law incentivized its state scientists and engineers. This article written for a well-established newspaper concluded that there are indications that the incentives for researchers to think more like entrepreneurs are having a positive effect in terms of developing high-technology. The article is limited in scope to a few examples based on historical research conducted by the author. (Johnson, 2002)

Austan Goolsbee (1998) conducted a quantitative and qualitative assessment of on Government Research and Development (R&D) spending policy. This effort provided interesting conclusions on the utilization of R&D funds. Goolsbee (1998) suggests that when R&D spending by the Federal Government is increased, it spurs a social rate of return much more so than an economic or inventive rate of return. According to this assessment, Government R&D policy does not incentivize the utilization of the funds for increasing the quantity of inventions but rather incentivizes increasing the Government R&D workforce thereby leaving less funds for R&D specific investments that are not labor related. The evidence shows that the major component of federal funds expended on R&D goes towards wages for R&D workers than equipment or actual inventions themselves. While further research needs to be conducted on this topic and Goolsbee's paper suggesting the need to understand the impact of the share of R&D funds dedicated to workforce spending, some of the examples cited shed new perspective. For example if the percent of funds that went to employee raises were not accounted for when federal R&D

funding increased during the Reagan build up, then the actual funds that went towards increasing R&D “quantities” would have been 30 percent lower. While it lends interesting perspectives on R&D spending impacts, the paper’s findings were not utilized for this research topic due to the need for data that would have tied the findings to organizational or individual employee performance outcomes or motivations. (Goolsbee, 1998).

Jindal-Snape and Snape (2006) conducted a qualitative assessment of scientist motivations within a Government research institute in the U.K. and concluded that those scientists were more motivated by ability to perform high quality research and less motivated by extrinsic motivators such as salaries, incentive schemes, and promotions. The study emphasized that removal of negative factors were more important to the scientists than the introduction of new incentives to motivate them. Negative factors included lack of feedback from management, inability to collaborate, and old equipment among others according to the study. The study was limited by the small sample size of eighteen (18) scientists from a single Government institution due to which extrapolating the results to a larger size and other organizations is cautioned, but still offers interesting insights from a motivational perspective. (Jindal-Snape & Snape, 2006).

Farris and Cordero (2002) reviewed historical literature to analyze the four categories of prior studies and identified six new areas for leading scientists and engineers. They concluded that due to the changes in the competitive R&D business environment, strategic shifts have led to more development and less research. As a result new approaches in managing scientists and engineers are warranted to incentivize and motivate for performance. This review was focused on the management of the technical workforce than the incentives and motivations of the workforce itself and lends insights into what rewards work better for scientists and engineers in order to motivate for performance. It determined that although intrinsic rewards are more effective motivators for scientists and engineers to be passionate about their work, reward systems should consider extrinsic rewards to motivate performance due to the financial benefits of the contributions by the scientists and engineers. The authors looked at private R&D companies and did not attribute findings specifically towards public sector employees. (Farris & Cordero, 2002).

Gibbs (2006) research into compensation, recruitment, and retention of DoD scientists and engineers indicated that quality and performance of DoD scientists and engineers remained stable despite largely flat pay contrasted with the private sector from a period of 1982-1996. This quantitative and qualitative analysis looked at data prior to 2000 and a single organization but utilizes data pertinent to DoD scientists and engineers compares three (3) different pay plans. The findings indicated that the performance of Government scientists and engineers remained stable potentially due to the intrinsic motivational factors associated with the nature of Government scientific and engineering jobs among other factors. (Gibbs, 2006).

Press articles on SpaceX and General Motors (GM) provided insights on insights on workplace motivations and innovations for those companies. Josh Boehm (2017) a former employee at SpaceX answered a question in Forbes regarding work life at SpaceX and Catherine Clifford (2019) in Inc., provided a preview of SpaceX's co-founder and Chief Technology Officer (CTO), Tom Mueller's career. Boehm (2017) and Mueller (Clifford, 2019) indicated that working at SpaceX meant long work hours or high stress levels but both seem to have or had rewarding careers at SpaceX nonetheless. Tess Townsend (2016) provides insights on why millennials prefer to work at SpaceX or Tesla despite higher stress levels and lower pay compared to other firms. While not considered a high technology firm relative to the Silicon Valley companies, GM is a well-recognized large private organization that is renowned for its engineering. Therefore Jamie LaReau's article (2020) in the Detroit Free Press regarding a young engineer's exposure to innovation at GM is highlighted for the purposes of this research topic as well.

Chapter 3 – Research Methodology

This research paper utilized a qualitative comparative case study approach in order to conduct a thematic analysis of the relevant historical literature of the research topic. The various sections of this research paper were structured in accordance with this approach and was centered on a primary research question.

Research Question

The hypothesis assumes that the Army's incentives or motivators for its workforce are not aligned to meet its modernization goals. The null hypothesis is that the Army's incentives or motivators for its workforce are aligned to meet its modernization goals. The problem statement for this paper was identified as follows:

Given the Army's push towards rapid modernization, the incentives and motivations for the Army's scientists and engineers may not be aligned to support the Army's push towards modernizing faster.

Scientists and engineers were chosen specifically compared to other career fields such as business or logistics because they are the primary drivers for technology development. ASAALT and AFC were picked within the Army since they are the lead organizations responsible for the Army's modernization priorities.

The following research questions arose based on the hypothesis and the problem statement.

1. What are incentives and motivations as pertinent to employees?

   This question sought to understand the definitions of incentives and motivations as pertinent to the work force including Army scientists and engineers as well as those within the private sector.

2. What are current incentives and motivations for U.S. Army or public sector employees including scientists and engineers?

   This question seeks to understand current practices that are in place in order to drive performance within the public sector work force including the targeted work force (scientists and engineers) for this research paper. This question also looked at why scientists and engineers working within the Government (including US Army) are driven to perform and produce results both historically and currently. This question was not intended to look at whether or not the practices are effective.

3. Are current standards of incentives and motivations working for U.S. Army or public sector employees or what should be done to incentivize or motivate them?

   Answering this question should provide information on whether current practices discussed in question 2 above are effective and what current literature suggests about practices that work or do not work in the public sector.

4. What are incentives and motivations that work in the private sector particularly in sectors where technology is developed rapidly (e.g., technology sector)?

This question was looked at to identify effective practices for incentivizing and motivating the work force for performance in the private sector. The Silicon Valley type or technology start-up type firms were primarily looked at for answering this question as it is currently well known that these types of firms (e.g., Google, Uber etc…) are responsible for generating new technologies at the current pace that is observable outside the public sector and available to the end-user the consumer.

5. How should the Government motivate or incentivize its employees including scientists and engineers?

   This question is a variation of question 3 but tailored to Government scientists and engineers and builds on the information revealed in question 5.

These were deemed necessary in order to focus the literature search and review for the purposes of the thematic analysis of this study.

Research Design

This research paper is designed utilizing a qualitative case study model. The entire premise of the research is structured around the hypothesis, the problem statement and the four (4) research questions. The scope was limited to Army scientists and engineers within ASAALT and AFC due to the time and resource limitations associated with conducting this research.

The literature search was conducted in a manner that utilized key words to address the research questions. The literature search was conducted using internet based search tools. These included common internet search engines as well as professional literature review databases such as the ProQuest and EbscoHost databases available through the DAU library. The search terms included incentives, compensation, motivations, public sector, private sector, modernization, scientists, engineers, Army, Department of Defense (DoD), military, and Government. The search focused on the titles, abstract, and body of the research paper in order to focus the research on incentives as it pertains to employees. Literature sources that contained all key words within the search queries were selected. If one or more key words within the search query was not present in the search engine result, then the result was not selected. The Department of Army (DA) publications database served as the source of all official Army released information such as Directives for the Army scientists and Engineers. Likewise the Office of Personnel Management (OPM) website for the Department of Defense (DoD) served as the source of all personnel pertinent benefits information including compensation and other incentives for Army scientists and Engineers. Recorded data were provided by Subject Matter Experts (SMEs) from the G1 or HCMO offices at JPEO A&A or CCDC AC respectively. Additional information sources pertinent to JPEO A&A or CCDC AC scientists and engineers were obtained from the JPEO A&A and CCDC AC websites. The author's experience includes working with JPEO A&A and CCDC AC scientists and engineers. The author also worked in CCDC AC as an engineer and at JPEO A&A as a CCDC AC matrixed engineer.

Once the information and data pertinent to the research were collected as mentioned in the previous paragraph, they were stored electronically. All the stored information and data were sorted based on where they were obtained from, i.e., JPEO A&A G1 based, CCDC AC HCMO based and online literature search based. The collected information and data were then reviewed and summarized in chapter 2 of this paper. Literature sources deemed not relevant to the research topic were noted accordingly in chapter 2. The relevant literature was then sorted by the author in terms of pertinence to the four (4) research questions and identified in chapter 4 (Data) with more detail. The detailed review and refined sorting implied that some of the data and information applied to multiple research questions. Once the literature was documented with more detail in chapter 4 (data), the author used case study method based comparative assessments to identify and note trends, themes, and relevant similarities & contrasts under chapter 4 (Analysis of data). These were noted as pertinent to the research questions again in chapter 4 (Analysis of data). The answers to the research questions in chapter 4 were then utilized to test the hypothesis in chapter 5 of this research paper alongside the author's own observations, interpretations, and recommendations during the course of this research.

Bias and Error

Since this research paper is based on the research and subsequent interpretations of the author, the findings and conclusions regardless of the author's objectivity is subject to subjective bias based on the author's own experiences and background. The research topic is limited to the Army scientist and engineer workforce and looks at two organizations, namely, CCDC AC under AFC and JPEO A&A within ASAALT. The literature search did not yield JPEO A&A or CCDC AC specific peer reviewed research and provided only limited AFC or ASAALT specific information or data due to which a one to one match of the trends observed to the organizations studied and extrapolations to other organizations may be subject to a certain degree of subjective error. Likewise the limited use of quantitative data and lack of statistically significant quantitative results make this paper subject to biases and errors as applicable to the nature of qualitative research topics. The limitations discussed earlier in chapter 1 also provide a source of error due to constraints imposed by the limitations on the breadth and width of the research scope.

Chapter 4 – Findings

This chapter will provide a descriptive discussion of the findings from historical research as well as JPEO A&A G1 and CCDC AC HCMO provided information. The findings of this research paper are categorized as data and analysis of the data.

Data

The data is based on the findings from historical research on this topic pertinent to the research questions. The descriptive discussion of the findings are as follows:

1. What are incentives and motivations as pertinent to employees?

   Rainey (1977), Yen (1992), and Pink (2009) discuss incentives and motivations in their work. These three sources link compensation or its various forms (base pay, bonuses, cash awards etc…) with incentives or as a form of incentive to perform work. Csikszentmihalyi's (1990) book *Flow* looks at an intrinsic process referred to as "flow". This discussion of flow describes an internal state that motivates people to view work enjoyably thus leading to growth and productivity.

   Rainey (1977) reviewed multiple sources regarding the definition of incentives. Rainey (1977) defines incentives as an object or event external to an individual that is valuable to the individual due to which that particular individual's behaviors are likely to be influenced in a manner that will result in the attainment of that object or event. Rainey (1977) view incentives as an external factor even though internal perceptions and intentions are involved in this valuation and is also to be considered separate from internal phenomena such as motives. Rainey (1977) covers different theories of motivation and defines motivation broadly as an individual's tendency to work hard or well within an organization. Rainey (1977) thought that based on data, Government managers perceive greater constraints on the administration of incentives and the association of incentives with performance than private sector managers and that the effects of rewards are not clear or conclusive for Government.

Csikszentmihalyi (1990) indicates that people with flow enter a state where they do things for the sheer sake of doing it due to how enjoyable those things are for them. Csikszentmihalyi (1990) shows that this intrinsic process is consistent across hundreds of experts that include musicians, artists, athletes, and surgeons as well as simpler people such as shepherds or farmers (though experts in their own right). This is also seen among people of varying ages, of different geographical origins, and levels of affluence and those people who achieve the state of flow will seek out those activities that they enjoy and perform them in a manner that nothing else will seem to matter according to Csikszentmihalyi (1990). Those people who experience flow will likely go on to accomplish more challenging tasks within those activities that they enjoy and experience flow resulting in more complex skills and personal growth (Csikszentmihalyi, 1990). The key attribute of the optimal experience or flow process is that the activity consuming the individual becomes intrinsically rewarding due to which it is considered as a self-contained activity that is done because the process of doing that activity is the reward and not the end outcome of doing the activity itself. This is referred to as the autotelic experience. According to Csikszentmihalyi (1990, p. 67), “The term “autotelic” derives from two Greek words, *auto* meaning self, and *telos* meaning goal”.

Yen (1992) suggests that incentives are a part of compensation. The discussion of compensation and motivation indicates that compensation as a motivator helps to meet lower level needs of individuals such as psychological and safety needs as covered in Maslow’s hierarchy of needs and that the level of compensation serves as an indicator of social status or success. Yen (1992) suggests that as per the need theory of motivation, compensation does not serve as a motivator for higher level needs. Also discussed was Herzberg, Mausner, and Snydermans’ two-factor theory of motivation that covers intrinsic and extrinsic motivators. This indicates that intrinsic motivators such as job autonomy and responsibility do not create dissatisfaction when absent but do increase satisfaction or motivation when present. This contrasts with extrinsic motivators such as compensation. According to Yen (1992), extrinsic motivators, do not increase satisfaction or motivation when increased beyond basic sufficient amounts but will create dissatisfaction if not present at a sufficient level. The implication is that while extrinsic motivators particularly compensation are used to attract, retain, and motivate employees, it can be detrimental when linked to performance particularly if high performing employees perceive that there is no equity or parity of pay as it relates to performance levels, a factor particularly prevalent in the public sector. Yen (1992) indicates achievement oriented individuals are attracted to organizations that base pay on performance but if performance pay is not administered properly these individuals may leave and lower performing individuals will gain seniority and ask for more pay within those organizations. Yen (1992) indicates that this has been a challenge for public pay administrators due to the bureaucratic nature of public sector jobs. Yen also indicated that public sector employees indicated higher preference for benefits as an incentive compared to pay unlike private sector employees where they emphasized pay as a greater incentive. Yen (1992) also indicated that comparable private sector employees are younger and often paid less but are greater risk takers than public sector employees, due to which increased pay might be an effective motivator for them.

Pink (2009) gives an overview of motivators and incentives in his TED talk and covers incentives as part of external motivators such as cash, bonuses, or other extrinsic sources of rewards. Pink (2009) references early work done by psychologist Karl Duncker and Princeton university scientist Sam Glucksberg on incentives that was repeated over time and across geographical boundaries. Pink (2009) discusses extrinsic motivators including compensatory incentives was that they may restrict possibilities and narrow down focus when they are used for motivating performance associated with tasks requiring high cognitive function but the same candle and stick method is beneficial for increasing performance on tasks associated with mechanical ability and with set bounds or constraints. Intrinsic motivators such as autonomy, mastery, and purpose while may seem to be a new way of doing things tend to be more effective for tasks that require creativity, critical thinking, and purpose (Pink, 2009).

2. What are current incentives and motivations for U.S. Army or public sector employees including scientists and engineers?

   Information put forth by federal agencies such as the U.S. Office of Personnel Management (OPM), JPEO A&A, and CCDC AC as well as literature reviewed provided data pertinent to this question. The U.S. OPM serves as the human resources management and administrator of policies including those applicable to incentives such as compensation and benefits administered for all federal employees (OPM, 2020). The Army and its sub-organizations including JPEO A&A and CCDC AC utilize the General Schedule (GS) pay guidelines established by OPM for administering pay policies and programs for its employees. Figure 1 below shows the base pay rate guideline set by OPM for federal employees including Army scientists and engineers.

SALARY TABLE 2020-GS
INCORPORATING THE 2.6% GENERAL SCHEDULE INCREASE
EFFECTIVE JANUARY 2020

Annual Rates by Grade and Step

Grade	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10	WITHIN GRADE AMOUNTS
1	$ 19,543	$ 20,198	$ 20,848	$ 21,494	$ 22,144	$ 22,524	$ 23,166	$ 23,814	$ 23,840	$ 24,448	VARIES
2	21,974	22,497	23,225	23,840	24,108	24,817	25,526	26,235	26,944	27,653	VARIES
3	23,976	24,775	25,574	26,373	27,172	27,971	28,770	29,569	30,368	31,167	799
4	26,915	27,812	28,709	29,606	30,503	31,400	32,297	33,194	34,091	34,988	897
5	30,113	31,117	32,121	33,125	34,129	35,133	36,137	37,141	38,145	39,149	1,004
6	33,567	34,686	35,805	36,924	38,043	39,162	40,281	41,400	42,519	43,638	1,119
7	37,301	38,544	39,787	41,030	42,273	43,516	44,759	46,002	47,245	48,488	1,243
8	41,310	42,687	44,064	45,441	46,818	48,195	49,572	50,949	52,326	53,703	1,377
9	45,627	47,148	48,669	50,190	51,711	53,232	54,753	56,274	57,795	59,316	1,521
10	50,246	51,921	53,596	55,271	56,946	58,621	60,296	61,971	63,646	65,321	1,675
11	55,204	57,044	58,884	60,724	62,564	64,404	66,244	68,084	69,924	71,764	1,840
12	66,167	68,373	70,579	72,785	74,991	77,197	79,403	81,609	83,815	86,021	2,206
13	78,681	81,304	83,927	86,550	89,173	91,796	94,419	97,042	99,665	102,288	2,623
14	92,977	96,076	99,175	102,274	105,373	108,472	111,571	114,670	117,769	120,868	3,099
15	109,366	113,012	116,658	120,304	123,950	127,596	131,242	134,888	138,534	142,180	3,646

Figure 1. 2020 GS pay scale for Army scientists and Engineers (OPM, 2020)

The salaries shown in Figure 1 do not include locality pay. Locality pay is a geography based percentage rate of pay that is added to the base pay in order to reflect pay levels of non-federal workers (OPM, 2020) for a particular region. There are 47 such pay areas identified to pay federal workers region dependent locality pay in addition to the base pay rate (OPM, 2020). Figure 2 below shows the GS pay rate including the locality rate for NJ based federal employees where more than ninety (90) percent of the JPEO A&A and CCDC AC scientists and engineers are located.

SALARY TABLE 2020-NY
INCORPORATING THE 2.6% GENERAL SCHEDULE INCREASE AND A LOCALITY PAYMENT OF 33.98%
FOR THE LOCALITY PAY AREA OF NEW YORK-NEWARK, NY-NJ-CT-PA
TOTAL INCREASE: 3.31%
EFFECTIVE JANUARY 2020

Annual Rates by Grade and Step

Grade	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10
1	$ 26,184	$ 27,061	$ 27,932	$ 28,798	$ 29,669	$ 30,178	$ 31,038	$ 31,906	$ 31,941	$ 32,755
2	29,441	30,141	31,117	31,941	32,300	33,250	34,200	35,150	36,100	37,049
3	32,123	33,194	34,264	35,335	36,405	37,476	38,546	39,617	40,687	41,758
4	36,061	37,263	38,464	39,666	40,868	42,070	43,272	44,473	45,675	46,877
5	40,345	41,691	43,036	44,381	45,726	47,071	48,416	49,762	51,107	52,452
6	44,973	46,472	47,972	49,471	50,970	52,469	53,968	55,468	56,967	58,466
7	49,976	51,641	53,307	54,972	56,637	58,303	59,968	61,633	63,299	64,964
8	55,347	57,192	59,037	60,882	62,727	64,572	66,417	68,261	70,106	71,951
9	61,131	63,169	65,207	67,245	69,282	71,320	73,358	75,396	77,434	79,472
10	67,320	69,564	71,808	74,052	76,296	78,540	80,785	83,029	85,273	87,517
11	73,962	76,428	78,893	81,358	83,823	86,288	88,754	91,219	93,684	96,149
12	88,651	91,606	94,562	97,517	100,473	103,429	106,384	109,340	112,295	115,251
13	105,417	108,931	112,445	115,960	119,474	122,988	126,503	130,017	133,531	137,045
14	124,571	128,723	132,875	137,027	141,179	145,331	149,483	153,635	157,787	161,939
15	146,529	151,413	156,298	161,183	166,068	170,800 *	170,800 *	170,800 *	170,800 *	170,800 *

* Rate limited to the rate for level IV of the Executive Schedule (5 U.S.C. 5304 (g)(1)).

Applicable locations are shown on the 2020 Locality Pay Area Definitions page: http://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/2020/locality-pay-area-definitions/

Figure 2. 2020 GS pay scale for Army scientists and Engineers in NJ (OPM, 2020)

Army scientists and engineers who are not Senior Executive Service (SES) or Senior Technical-advisors (ST) are in grades GS 1 through 15 and are paid in accordance with the GS base pay plus the appropriate locality pay for the region similar to Figures 1 and 2. As shown in figures 1 and 2, within each grade GS 1 through 15, there are a series of 10 steps or pay gradations. Majority of the Army scientists and engineers are in the GS based pay-grades with SES and ST type positions held by senior most management or technical leadership similar to C-suite positions found in corporate offices.

While JPEO A&A and CCDC AC follow the GS pay scales covered in figures 1 and 2 for their GS employees, they also have a large number of their scientist and engineering workforce covered by pay for performance systems that are different from the GS-based system. Most dominant of the pay for performance systems are the Acquisition Demonstration (AcqDemo) and Laboratory Demonstration (LabDemo). Both AcqDemo and LabDemo enable Government managers to rate and incentivize their employees including scientists and engineers with respect to their individual efforts as well as their contributions to the overall organizational mission(s). JPEO A&A utilizes the AcqDemo or Contribution-based Compensation and Appraisal System (CCAS) and CCDC AC utilizes the LabDemo pay for performance practice. Both AcqDemo and LabDemo use a pay banding system where the GS grades and their respective compensation packages are set as ranges as opposed to specific grades and steps within those grades as seen in the GS approach. Figures 3, 4, 5, 6, and 7 illustrate relevant details pertinent to AcqDemo and LabDemo further. Figure 3 below shows the comparison between AcqDemo and the GS system (JPEO A&A G1, 2019).

General Schedule	ACQDEMO
Occupational Series	**Occupational Series**
Occupational Groups	**Career Path & Pay Schedules** Business Management and Technical Management Professional Technical Management Support Administrative Support
Pay Plan Code **GS**	Pay Plan Designator NH, NJ, NK
Grades 1-15/Steps 1-10	**Broadband** I, II, III, IV
Position Description (PD)	**Position Requirements Document (PRD)**

Figure 3. Terminology crosswalk of GS and AcqDemo (JPEO A&A G1, 2019)

Figure 4 below shows how the broadband or grades within AcqDemo compare to the grades in GS (AcqDemo, 2020).

The AcqDemo's career paths and broadband levels.

Broadband	NH-Business and Technical Mgmt. Professional	NJ-Technical Mgmt. Support	NK-Administrative Support
I	GS 1-4	GS 1-4	GS 1-4
II	GS 5-11	GS 5-8	GS 5-7
III	GS 12-13	GS 9-11	GS 8-10
IV	GS 14-15	GS 12-13	

Figure 4. AcqDemo versus GS comparison (AcqDemo, 2020)

Figure 5 below shows how the basic compensation (without locality pay) is spread out across the broadband levels (AcqDemo, 2020).

2020 AcqDemo Basic Pay Range Tables with 2.6% GPI

NH - Business Management and Technical Management Professional			
I	II	III	IV
$19,543 - $34,988	$30,113 - $71,764	$66,167 - $102,288	$92,977 - $142,180
GS 1 - GS 4	GS 5 - GS 11	GS 12 - GS 13	GS 14 - GS 15

NJ - Technical Management Support			
I	II	III	IV
$19,543 - $34,988	$30,113 - $53,703	$45,627 - $71,764	$66,167 - $102,288
GS 1 - GS 4	GS 5 - GS 8	GS 9 - GS 11	GS 12 - GS 13

NK- Administrative Support		
I	II	III
$19,543 - $34,988	$30,113 - $48,488	$41,310 - $65,321
GS 1 - GS 4	GS 5 - GS 7	GS 8 - GS 10

Locality Pay is not included in the Pay Range Chart

http:/acqdemo.hci.mil

Figure 5. AcqDemo basic pay scale (AcqDemo, 2020)

JPEO A&A predominantly utilizes the NH broadband indicated in figures 4 and 5 for its scientific and engineering workforce. LabDemo, the CCDC AC equivalent of AcqDemo utilizes a similar approach but differs in the number of broadbands. LabDemo has broadbands I through VI for Engineering and Science professionals under the DB (similar to NH) pay plan. Business and certain Technical positions are covered under the DE pay plan which has five (5) broadbands and General Support is covered under the DK pay plan which has three (3) broadbands. Figure 6 below shows the equivalent GS grades for these broadbands and figure 7 shows the pay scale for Lab Demo personnel.

Occupational Family	Equivalent GS Grades					
	I	II	III	IV	V	VI
E&S	GS-01 – 04	GS-05 – 11	GS-12 – 13	GS-14	GS-15	>GS-15
Business & Technical	GS-01 – 04	GS-05 – 11	GS-12 – 13	GS-14	GS-15	
General Support	GS-01 – 04	GS-05 – 08	GS-09			

Figure 6. LabDemo broadband GS equivalents (CCDC AC HCMO, 2020)

CY 2020 Lab Demo Pay Band Salary Scale

Occupational Family	(OCS Base Salaries)					
	I	II	III	IV	V	VI
E&S (DB)	$19,543 – $35,491	$30,270 – $75,570	$67,069 – $108,099	$94,050 – $129,289	$110,271 – $142,807	$131,886 – $170,800
	0-30	22-68	62-86	79-95	87-100	96-109
B&T (DE)	$19,543– $35,491	$30,270– $75,570	$67,069 – $108,099	$94,050 – $129,289	$110,271 – $142,807	
	0-30	22-68	62-86	79-95	87-100	
Gen Spt (DK)	$19543 – $35,491	$30,270 – $57,203	$45,963 – $63,184	All references to salaries in Lab Demo are to base salaries. Locality Pay is added.		
	0-30	22-54	43-59			

- **Salaries linked to Overall Contribution Score (OCS); not exact match with GS Scale**
- **Lab Demo Salaries overlap Bands just as GS salaries overlap Grades**
- **Updated with 2.6% GPI (1/1/20)**

Figure 7. LabDemo base pay (CCDC AC HCMO, 2020)

The average and median salaries for JPEO A&A's 90 scientists and engineers were $153,141 and $159,990 respectively (JPEO A&A G1, 2020). CCDC HCMO (2020) reported the average and median salaries for its 2446 scientists and engineers as $121,145 and $122,988 respectively. The U.S. OPM's website (OPM, 2020) has also provided guidelines on other incentives such as workplace benefits including leave (general and sick), healthcare insurance, life insurance, workplace recruitment and retention incentives, student loan repayment incentives, and retirement benefits. While left to federal agency discretion, other work-life policies issued by OPM (2020) include alternative work schedules, telework policies, subsidized transportation, child and eldercare assistance, as well as employee assistance programs. JPEO A&A and CCDC AC scientists and engineers working at Picatinny Arsenal, NJ have the option to use the Arsenal facilities, including an onsite gym, cafeterias, a local pub, a golf course, and even a waterpark albeit a small one open to both working civilians and local residents (Picatinny Arsenal, 2020). These facilities are similar to, or comparable to what other DoD military installations provide to their employees and local residents.

The MSPB Report (2012) written by Susan Tsui Grundmann, Anne M Wagner, Mark A Robbins, James J Tsugawa, J Peter Leeds, Julie Osowski, and Sharon Roth, found that 71% of the federal workforce is motivated at work with variation across agencies ranging from 62 to 77 percent. This Report indicated that motivations can be shaped by features of the work environment and that there is room for improvement. The Report found that job characteristics such as autonomy or the freedom to execute work tasks, skill varieties, and feedback, affect work motivation as well as the personal satisfaction received as a result of their engagement in public service, or having a sense of job security or interesting work were also rewarding. These intrinsic items were also placed in a higher value than monetary compensation or bonuses according to the Report. (Grundmann, et al., 2012).

The IDA Report found that Government civilians are motivated by challenging work, a sense of accomplishment, and career-enhancing opportunities. The ability to plan and have control over individual career paths were important non-financial incentives for Government civilians in program management or acquisition. (Hunter, et al., 2018).

Jindal-Snape & Snape (2006) studied the perceptions of UK based Government scientists regarding intrinsic and extrinsic motivational factors and management's role in enhancing or motivating them. Jindal-Snape & Snape (2006) found that high quality and curiosity-driven research were more driving factors intrinsically and weighed heavier than extrinsic factors such as salaries, incentive schemes, or promotions. An equally important finding was on removing negative factors. For example, lack of feedback or recognition and constant change in direction were significant negative factors and recommendations to remove these negatives were viewed more favorable than adding new incentives. The authors had a small sample size of participating scientists but observed that nearly all of them had a need for high achievement and their predominant driving force or satisfaction was derived from the ability to publish and share their research with their highly valued network of scientists. Besides proactive and constructive feedback from managers, other factors found from this group of scientists was that non-financial methods for recognizing success, attention to physical layouts of organization to facilitate communication and avoid isolation, and opportunities for setting up national and international networks of scientists all improved motivations in a practical manner. (Jindal-Snape & Snape, 2006).

3. Are current standards of incentives and motivations working for U.S. Army or public sector employees or what should be done to incentivize or motivate them?

   The enclosure to the US Army Directive 2017-33 dated November 07 defined the problem of getting modernized equipment rapidly for the Army as follows:

   "The Army's current requirements and capabilities development practices take too long. On average, the Army takes from 3 to 5 years to approve requirements and another 10 years to design, build, and test new weapon systems. The Army is losing near-peer competitive advantage in many areas: we are outranged, outgunned, and increasingly outdated. Private industry and some potential adversaries are fielding new capabilities much faster than we are. The speed of change in warfighting concepts, threats, and technology is outpacing current Army modernization constructs and processes."

   This problem statement precipitated the need for Directive 2017-33 and authorized moves intended to provide unity of command and authority to enable the re-design of modernization processes designed several years ago (US Army, 2017, November 07). The Army Directive 2017-33 in itself supports the Army Strategy that includes Modernization and Reform among the four lines of effort it promotes to achieve its vision. The Directive 2017-24 which preceded 2017-33, put in place the eight (8) pilot programs that established the CFTs, a core structural component of the AFC organization (US Army, 2017, October 06). The intent of the CFTs was to narrow existing capability gaps that fall within the Army's priorities, and, enable the horizontal and vertical integration required to improve the quality and speed of material development activities in a more cost effective manner (US Army, 2017, October 06). Directive 2017-24 also directed the then existing Army organizations to provide support in terms of personnel and actions to support the CFTs (US Army, 2017, October 06). Kimmons (2019) stated that the AFC organization was built on a blank canvas and the CFTs were created to handle the most essential modernization needs. Kimmons (2019) discusses the realignment of the former Research, Development, and Engineering Command (RDECOM) Centers to form the new CCDC centers (including the CCDC AC), the transition of the Army Capabilities Integration Center (ARCIC) to AFC, and also covers the teaming with ASAALT's science and technology experts in order to tackle the modernization priorities.

The 2017 RAND Report assessed the AcqDemo project (Lewis, et al., 2017) and included results of surveys from personnel within the AcqDemo system. AcqDemo employees performed comparatively similar to GS employees when it came to retention and pay raises and RAND's administrative data analysis found that higher levels of contribution or performance were associated with promotions, retention, higher salaries, and more rapid pay increases (Lewis, et al., 2017). Subject Matter Expert (SME) survey data in the RAND

Report also indicated that SMEs perceived AcqDemo to help with recruiting talent even though RAND could not objectively assess the same. Lewis et al. (2017), reported that the SMEs attributed this to the agility provided by the AcqDemo towards meeting mission requirements. According to Lewis et al. (2017) AcqDemo was designed to be competitive for attracting highly motivated and talented personnel and their analysis supported that this design intent was being applied. However, it was not clear whether the flexibility of AcqDemo was used appropriately. For instance, promotions were less prevalent in the AcqDemo system than the GS system (Lewis, et al., 2017). While higher levels of contribution were tied to compensation, there was a misalignment between employee perception and empirical reality. Lewis et al. (2017) attributed this misalignment to lack of perceived transparency in how ratings are assessed and translated to pay. Employees also felt that the AcqDemo system does not effectively capture their contributions and that compensation does not differ much with performance (Lewis, et al., 2017). The Report suggested that pay caps were constraints that contributed to this discrepancy among other factors such as the heavy representation of senior level employees and supervisors in AcqDemo. According to Lewis et al. (2017) as pay is capped and awards are constrained the ability to link contribution to compensation gets diminished.

Rynes, Gerhart, & Minette (2004) reviewed evidence across research conducted on the importance of pay in employment surveys. Rynes, Gerhart, & Minette (2004) found that pay is more likely a general motivator that is important but underestimated by managers. Rynes, Gerhart, & Minette (2004) do not recommend a one size fits all strategy, and note that there are circumstances where pay is likely to be more or less important to the employee. For instance, people are more likely to reject “under market” pay due to the offered amount without considering other factors such as benefits. Pay will do little to motivate performance when pay for performance systems or policies dictate similar pay increases regardless of individual or firm performance (Rynes, Gerhart, & Minette, 2004).

Gibbs (2006) studied differences in private sector and public sector pay as well as comparisons across different pay schemes found that the DOD did not experience any decline in its ability to attract and retain high-quality scientists and engineers over the 1980s and early 1990s. While this research is pre-2000s and removed from today’s work environment, it offers an insight into impacts when contrasted with private sector pay and incentives. Considering that the private sector pay was higher and that DOD pay remained relatively flat over this time-frame, the ability of the DOD to recruit and retain talent could be attributed to the other benefits associated with federal employment (Gibbs, 2006). These include intrinsic motivators such as an unparalleled DOD budget towards research areas of interest, patriotism, and that DOD labs were among some of the most advanced research facilities in the world (Gibbs, 2006).

Tillinghast, Petersen, Rizzuto, Dabiri, & Gonzalez (2015) found that benefits of ARDEC allowing scientists and engineers participate in STEM outreach showed promising results as it pertained to workforce motivation, drive, and job satisfaction. A survey of approximately 150 scientists and engineers from ARDEC revealed that: 98% of survey participants agreed that STEM outreach increased job satisfaction; 70% indicated that STEM outreach resulted in an increase in motivation or drive towards their jobs; and; 64% expressed that the outreach programs renewed their vigor or interest in their chosen career field (Tillinghast, Petersen, Rizzuto, Dabiri, & Gonzalez, 2015). The paper concluded that in addition to workforce satisfaction, such STEM outreach by organizations could benefit marketing and public relations for the firms potentially leading to better recruitment and retention of employees and ultimately benefiting the organizations' bottom-line (Tillinghast, Petersen, Rizzuto, Dabiri, & Gonzalez, 2015).

4. What are incentives and motivations that work in the private sector particularly in sectors where technology is developed rapidly (e.g., technology sector)?

   LinkedIn and ZipRecruiter, two widely accepted online professional recruitment portals provided information on private sector salaries that were made publically available. Figures 8 and 9 are screenshots that provide information on science and engineering salaries, comparisons of national and New Jersey (NJ) salary averages, as well as examples of salaries in the local NJ area for science and engineering (ZipRecruiter, 2020). Figure 9 is a screenshot that indicates that the Science and Engineering field is very active and that NJ is ranked 20 out of 50 states nationwide for Science Engineering job salaries (ZipRecruiter, 2020). Figure 10 provides information collected on salary ranges for Engineering Scientists with 1-5 years of experience including the median salary for those professionals with that level of experience as well as local engineers and scientists with comparable titles (LinkedIn, 2020).

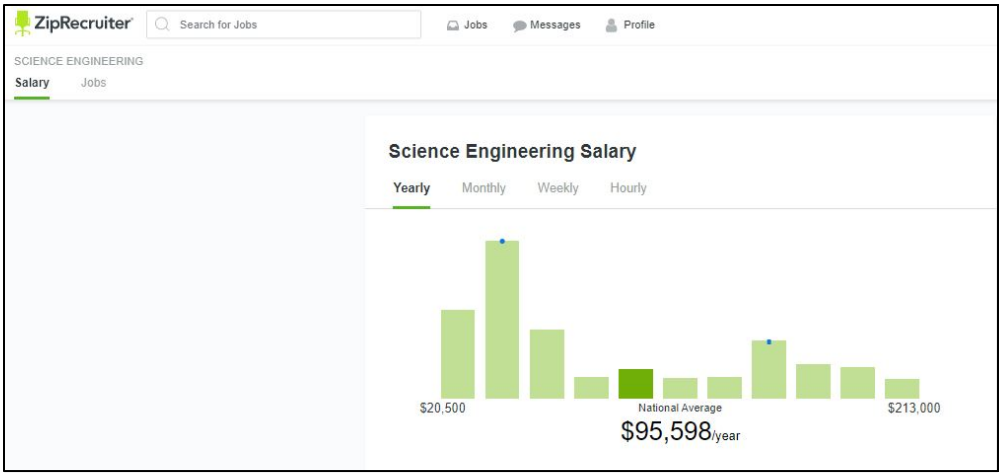

Figure 8. Screenshot of Science & Engineering job salaries (ZipRecruiter, 2020)

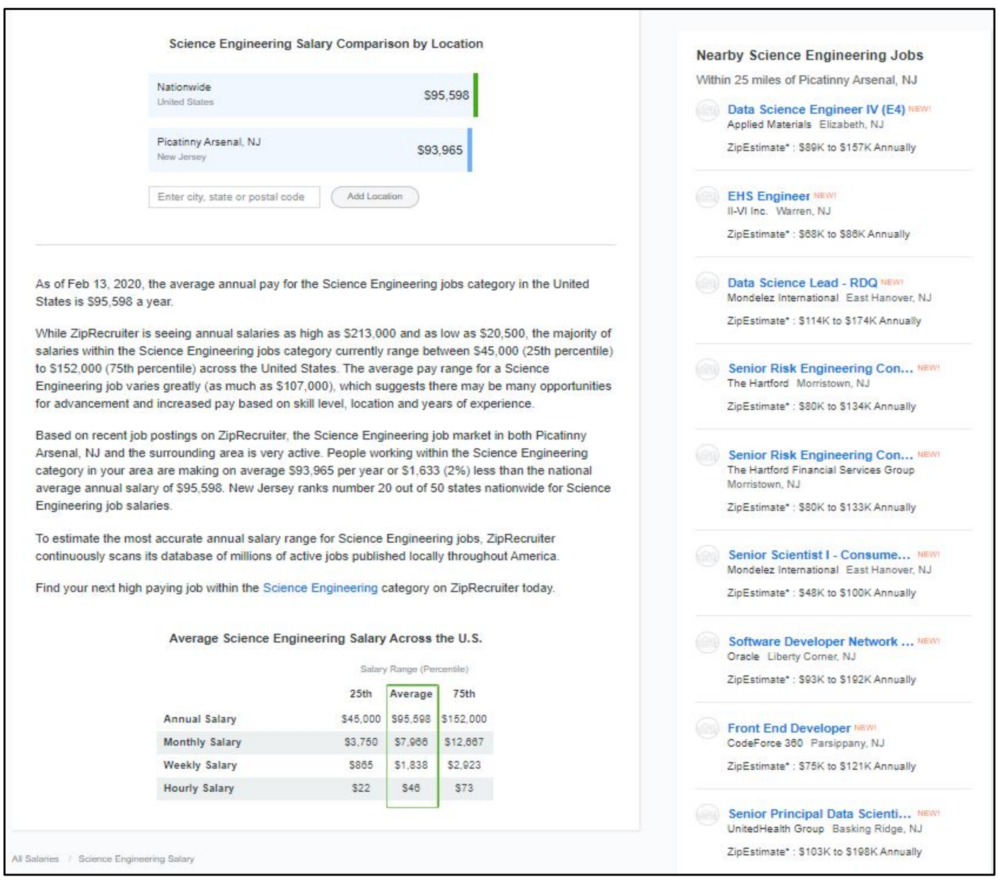

Figure 9. Screenshot with excerpt on Science & Engineering jobs (ZipRecruiter, 2020)

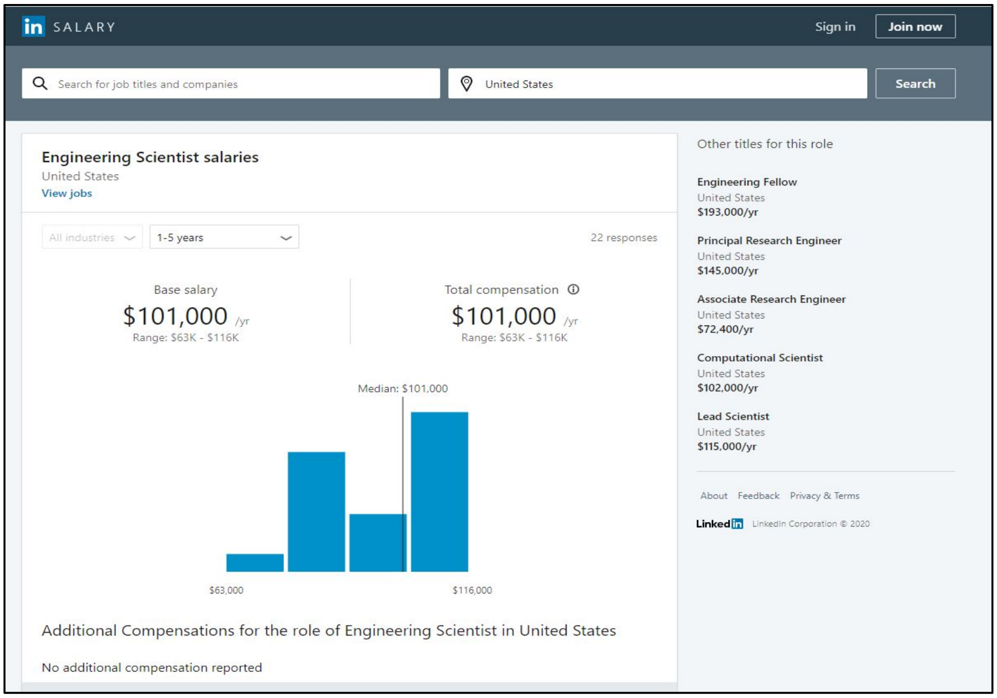

Figure 10. Screenshot of salaries for Engineering Scientists with 1-5 years' experience (LinkedIn, 2020)

The IDA Report did a comparison of public sector incentives with those in the private sector (Hunter, et al., 2018). The report stated that extrinsic motivators have greater potential to motivate managers in private sector while intrinsic motivators were better for public sector personnel due to which different rewards and incentive systems are suited to recruit and train quality Government program managers (Hunter, et al., 2018). This also stemmed from the fact that for-profit companies have the option to motivate by rewarding their management with a portion of corporate profits due to which Industry program managers can quickly manage successful programs to increase profits and shut down bad ones to save on expenses (Hunter, et al., 2018). Industry managers who fail bear the risk of losing their jobs, but program managers in Government, while less likely to lose their jobs are gauged for success based on their ability to avoid program cancellation besides cost and schedule management (Hunter, et al., 2018). This finding supports the earlier work of Burgess and Ratto (2003) study of incentives in the U.K.'s public sector. Burgess and Ratto (2003) concluded that optimal incentive schemes for the public sector are different from private sector including for comparable functions (e.g., manual labor) and alternative incentive schemes should be explored especially when considering motivations for employees.

Zenger & Lazzarini (2004) discussed the incentive mechanisms of smaller firms in Silicon Valley to lure engineering talent and motivate high performance and compared the same against larger high technology firms. Zenger & Lazzarini (2004) find that smaller firms are more efficient at innovation particularly more radical innovation and that large firms have efforts in place that attempt at imitating the small firm approach or try to form alliances with the smaller firms to spur this radical innovation. According to Zenger & Lazzarini (2004), while cannibalizing their existing technologies seem to be one hindrance that prevent larger firms from pursuing radical innovative opportunities, the degree of efficiency for spurring innovation is also tied to the speed of shutting down "likely-to-fail" projects. Larger firms often have a large number of existing technologies that are likely to be disrupted by newer technologies and a high number of "social attachments" and "influence activities" tied to ongoing development efforts (Zenger & Lazzarini, 2004). According to Zenger & Lazzarini (2004), small firms utilized talent management systems to heavily incentivize employment contracts to spur innovation. The results of the study showed that small firms offer R&D engineers employment incentives that are very distinct from those of larger firms. While firm size itself was not tied to outcomes, the results showed consistently that outcomes were linked directly to employment contracts (including rewards and incentives) which in turn were related to firm size (Zenger & Lazzarini, 2004). According to Zenger & Lazzarini (2004), firms with more aggressive reward systems were found more likely to generate high effort, recruit, and retain talent. Large firms have the ability to screen for unsuitable talent but were also highly likely to overpay low performing or low ability engineers. Small firms on the other hand recruit both high and low ability engineers but are less likely to end up overpaying low ability engineers (Zenger & Lazzarini, 2004). Zenger & Lazzarini (2004) determined that some of the large high technology firms are crafting higher-powered incentive schemes and rewarding smaller subunits for group efforts, something which is considered harder to do in large firms due to the large number of employees per divisions within the firms. While the study recommends future research into such approaches, these approaches are well underway along with other innovative adaptations. For instance, large firms are disaggregating into configurations of smaller firms or of smaller but autonomous internal units in order to incentivize and drive effort to spur innovation (Zenger & Lazzarini, 2004).

Boehm (2017) and Clifford (2020) reflected that Josh Boehm and Tom Mueller had rewarding careers at SpaceX while working for an enigmatic leader Elon Musk the founder of the Electric Vehicle (EV) companies Tesla and SpaceX. Both Tesla and SpaceX can be considered high technology firms that have disrupted their respective markets. Boehm

(2017) talks about how the job satisfaction and team camaraderie is great at SpaceX and that employees tend to be their own “slave drivers” when it comes to work hours. While there are fancy perks such as free FroYo or a masseuse, people find themselves working long hours to keep up with the workload and also because they enjoy the work that they don’t want to leave according to Boehm (2017). Boehm (2017) notes that even though Tesla has grown and different departments may have different cultures, communication is open and people are often decked out in SpaceX garb because they love to show off that they work for SpaceX. “Getting a mission patch after a launch was always a very satisfying feeling” says Boehm (2017) and that everyone cheers on at mission control during launches. Clifford (2019) explains that Tom Mueller meeting a visionary (Elon Musk) along with his ability in excelling at what he loves helped his career. Mueller worked as an engineer at TRW, a technology company before being asked by Elon Musk to sign on as a co-founder of SpaceX due to his tendency to build and test rockets out of his garage in order to keep himself inspired. He went from working with a tiny propulsion budget at TRW and not working on rockets, to fulfilling his childhood rocketry dreams as vice president of propulsion at SpaceX before eventually becoming its CTO (Clifford, 2019). Mueller indicated that working at SpaceX came with high levels of both stress and excitement but nonetheless attributed his career success due to his decision to focus on his passion (Clifford, 2019).

According to Townsend (2016), data compiled from PayScale (a compensation tracking company), Tesla and SpaceX ranked highest in terms of employees who rated their jobs as meaningful. Both the companies also rated high for rating their jobs as stressful and had median ages of 29 (SpaceX) and 30 (Tesla), thus rating very closely along with Facebook (median age of 29) for youngest median employee age. The two companies also ranked among the lowest for median wages ($78,000 and $82,000) for employees with less than five (5) years of experience despite tech being a highly paid field to be in according to PayScale (Townsend, 2016). This contrasted with Facebook where the median pay was $116,800 and generated interesting comparisons with IBM where employees reported the highest median tenure (7 years) with early salaries at $72,700. According to Townsend (2016) companies where employees stayed longer had lower salaries and millennials tend to job hop in order to gain a faster rate of pay increase. Townsend (2016) notes that millennials value purpose and making a difference and care more about that than the job being lucrative relative to other jobs.

LaReau (2020) highlighted the achievements of a young female engineer, Ms. Alex Archer at General Motors (GM). LaReau (2020) noted that Ms. Archer was tasked by her superiors to be the lead design engineer for an invention that was to go on GM's line of big SUVs despite the fact that she was only two (2) years out of college. Ms. Archer was also tagged by her bosses to get the invention into full swing within three (3) years (LaReau, 2020). LaReau (2020) indicates that Ms. Archer's bosses recognized that she was still learning but that was the impetus that they wanted to come up with something that was never done before or benchmarked before. LaReau (2020) mentions that the invention was a success with it greenlighted for production. LaReau (2020) stated that

Ms. Archer was a problem solver who was inspired by a design course during her undergraduate years at Stanford to pursue a career field in engineering. She was also influenced by her childhood experiences of working with her grandfather on cars and was drawn by the fact that Ms. Mary Barra the female CEO of GM started out as an engineer in a primarily male dominated field.

5. How should the Government motivate or incentivize its employees including scientists and engineers?

Csikszentmihalyi (1990) discusses the conditions for flow as summarized by figure 11.

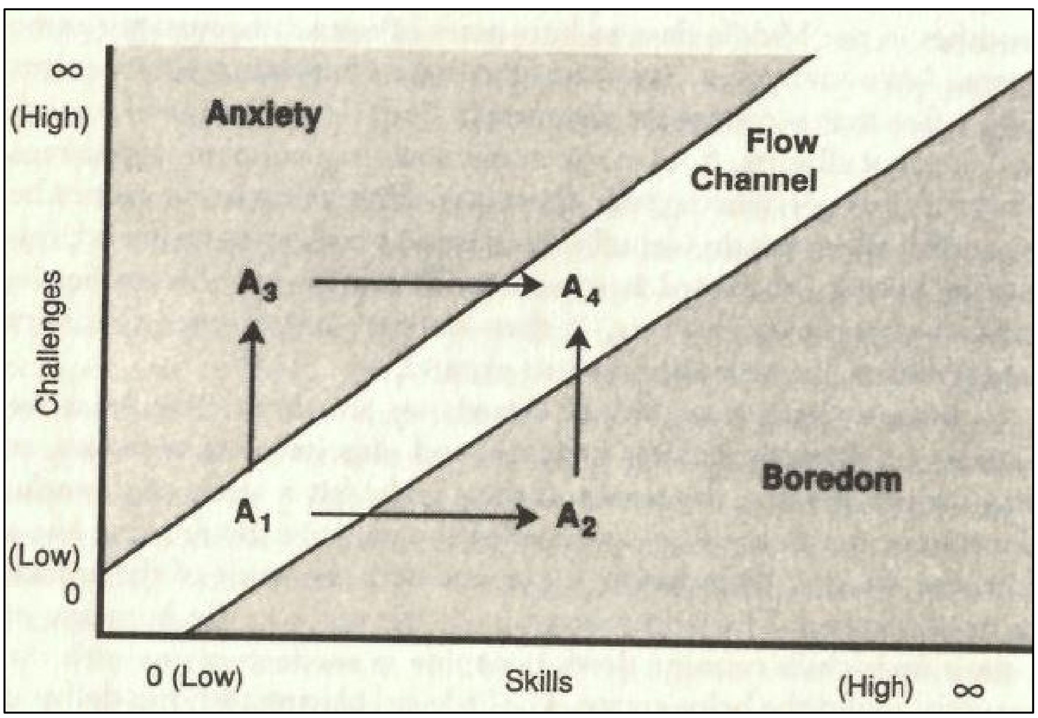

Figure 11. The conditions for flow (Csikszentmihalyi, 1990, p. 74)

In figure 11, the x-axis represents the skills of the individual, while the y-axis represents the complexity of the challenges faced by the individual (Csikszentmihalyi, 1990). Both of them are on a hypothetical scale of zero (0) to infinity (∞). The diagonal channel referred to as the “flow channel” is the optimal state that the individual performing work must be along in order to achieve “flow” (Csikszentmihalyi, 1990). If the individual has a low skill level and faces a highly complex task, then that will result in anxiety for the individual due to which he or she may not find the activity enjoyable. Csikszentmihalyi (1990) notes that if the individual has a high skill level but a lower level of challenge, they will be bored. The individual in a flow state will seek to gain new skills to increase his or her ability to tackle greater challenges or will seek greater challenges when bored as indicated by the arrows between A1, A2, A3, and A4 in figure 11. This results in growth and discovery by reinvigorating the desire to push ourselves and stretch our skills (Csikszentmihalyi, 1990). Csikszentmihalyi (1990) notes that autotelic workers who may be at the lowest rung in a factory but may also be the most important person due to their ability to learn every aspect about how the factory runs. Csikszentmihalyi (1990) discusses about surgeons who may or may not enjoy their jobs. Csikszentmihalyi (1990) determined that the surgeons who enjoy their jobs tend to usually practice at hospitals that allow them the autonomy to experiment with latest techniques. These surgeons are also more likely to state that while extrinsic incentives such as money, and prestige are important, their greatest source of inspiration comes from the intrinsic aspects of the job (Csikszentmihalyi, 1990).

The MSPB Report found that employees who saw a strong correlation between receipt of performance ratings, valued rewards, and their efforts were more likely to perform better than those who did not (Grundmann, et al., 2012). The Report found that most federal employees unfortunately did not see a strong connection between their efforts, performance ratings, and the rewards. Based on these findings, the MSPB recommended that structuring jobs to maximize desirable characteristics, sound supervisory performance management practices, and giving rewards in the right ways could influence motivation and performance (Grundmann, et al., 2012). The Report also provided specific examples on how these could be done.

Bandiera, Khan, and Tobias (2017) found that well-designed financial rewards linked to performance can improve outcomes in the public sector provided that the incentives are simple, clearly understood, and linked to measurable outcomes or objectives. For example, gauging student test scores showed that relatively small incentives equal to three (3) percent of public school teacher salaries improved student learning outcomes in a large-scale education program in India aimed at improving student learning in math and language (Bandiera, Khan, and Tobias, 2017). The challenges associated with civil service salaries such as the rigid formulaic pay scales with minimal ability to reward performance with financial incentives but Governments are getting creative to attract more qualified personnel and motivate for performance (Bandiera, Khan, and Tobias, 2017). Bandiera, Khan, and Tobias (2017) found that financial incentives can be detrimental if performance objectives are broad or hard to measure. A key lesson learned from the research conducted in Asia and Africa was that incentive practices need to be pilot-tested and designed for specific contexts to be effective and to avoid inadvertently incentivizing employees from “gaming” the system (Bandiera, Khan, and Tobias, 2017). Another key finding from the research was that non-financial incentives such as social recognition or performance based positions can also be motivating for high achievers (Bandiera, Khan, and Tobias, 2017).

The RAND Report on PBASs concluded that accountability systems can be effective for delivering results to the public but are dependent on certain optimal circumstances to be met (Stecher, et al., 2010). Among these circumstances include unambiguous and easy to observe measures as well as adequate resources to design, implement, and operate the PBASs (Stecher, et al, 2010). While these findings may be beneficial for other organizations seeking to implement PBASs, the Report noted that often times the optimal conditions are rarely fully realized due to which it may be hard to implement PBASs that are uniformly effective (Stecher, et al., 2010).

Lavigna (2014) suggests multiple reasons for the challenges surrounding motivating Government employees. The lack of objectively measurable units for goals in public organizations and hard-to-measure achievement are among these reasons. Lavigna (2014) suggested that the Government managers could consider taking advantage of workforce demographics to solve critical problems including helping older employees ease gracefully into retirement and recruiting highly motivated new employees to replace departing baby boomers. In 2013, 56.7% of the federal workforce were between the ages of 45 and 64 (Lavigna, 2014). In 2019, 58.8% of the JPEO A&A scientists and engineers were above the age of 50 (USA DACM, 2019) and so were 32.4% of the CCDC AC scientists and engineers (CCDC HCMO, 2019). CCDC AC's average age for its scientists and engineers was 43 and the median was 39 (CCDC HCMO, 2019). Average and median age data for JPEO A&A was not available during this research. Lavigna (2014) indicates that public sector employees are motivated by making positive differences in the life of the citizens they serve. Agencies can use this to their advantage to build engagement and should aggressively recruit candidates motivated by public-service. Lavigna (2014) suggests that managers must leverage this public service motivation by involving employees in decisions, and helping them to understand and recognize their contributions.

Rynes, Gerhart, & Minette (2004) found contingency factors affecting pay importance for individuals. These include;

1. Performance pay is more important to high academic achievers than others.
2. High performing employees are more sensitive to above-average pay increases for high performance, while low performers prefer low-contingency pay systems.
3. People with higher opinions of self-efficacy and achievement prefer pay systems that closely tie performance with pay.

Johnson (2002) discusses the advantages of an entrepreneurial approach with Government scientists and engineers. Johnson (2002) provides examples of personnel from organizations under France's National Centre for Scientific Research (CNRS) capitalizing from their research and intellectual property due to changes to French law introduced to spur innovation. While the law itself has not contributed to the desired rates at which publically funded research translates to gains in the real economy, the signs point to a real effect from the researcher outcomes based on the examples cited in the article (Johnson, 2002). According to Johnson (2002), not only do researchers have the ability to spin off their efforts and form start-ups, but state employed researchers also have a guaranteed return to their old post for up to six years with stakes allowed in the companies (up to 15 percent) that are formed. Johnson (2002) stated that Tima, an organization within CNRS, now drives ninety (90) percent of its revenues from private sector contracts. Johnson (2002) also stated, Leti an organization that is a part of the French Atomic Energy Commission has filed more than 100 patents every year since 1996.

Farris & Cordero (2002) suggests that the trend of R&D that emphasizes more development than research and the importance of time-to-market may warrant newer approaches towards rewarding scientists and engineers both extrinsically and intrinsically. While time-to-market is a term more suited for the private sector this is considered applicable for this research topic considering the Army's push towards emphasizing a faster pace for its modernization efforts. Farris & Cordero (2002) agree with prior research on the greater valuation of intrinsic rewards over extrinsic rewards as motivators for scientists and engineers. Farris & Cordero (2002) found that while intrinsic rewards were excellent for retention in the private sector, attrition was tied to extrinsic rewards. For instance, high performers were likely to leave if they found that they were not treated better than lower performers with extrinsic rewards (Farris & Cordero, 2002). Farris & Cordero (2002) suggests that quality of life arrangements such as tele-commuting, flex time, on-site child care, and on-site health clubs and gyms not only help retain but also attract scientists and engineers. Farris & Cordero (2002) provided insight on how successful organizations approach evaluation of performance. For instance, while a publication may be viewed as an indicator of innovation, the number of citations reflect the quality of that publication. Similarly a patent is a quantitative indicator of market potential, but the revenues generated by the patent are a significant indicator of the measure of that patent. Farris & Cordero (2002) indicated that the environment is trending in a direction where scientists and engineers are not focused on pursuing a career within the same organization, due to which it may be beneficial to develop cross-functional capabilities or skills from a career management perspective for scientists and engineers. Farris & Cordero (2002) recommended that; scientists and engineers should be led through "catalyst" roles as opposed to "captain" type roles (with the former resulting less of the need for the latter); knowledge should be managed effectively so that the scientist and engineering workforce have appropriate access to the requisite knowledge via creation and sharing; diversity should be embraced in the workforce; the needs of a diverse workforce should be accommodated; and; electronic technologies such as centralized repositories should be leveraged for all-project related information.

Analysis of the Data

This section analyzed the information collected against the research questions to extract themes and compares Government and Private Sector information where relevant. The analysis with respect to the questions are:

1. What are incentives and motivations as pertinent to employees?

   The findings from the literature review point to different variations or definitions of incentives and motivations that tend to overlap. However, the general theme extracted from the findings on incentives and motivations as pertinent to employees is that of intrinsic and extrinsic factors. These factors are relevant to incentives and motivations and could incentivize and motivate employees and drive performance. It can be summarized that extrinsic factors can include compensation (Yen, 1992) such as salaries or internal motives (Rainey, 1977) such as autonomy (Pink, 2009). Csikszentmihalyi's (1990) discussion of flow and the autotelic experience is very telling on how intrinsic factors are very relevant towards pushing the envelope and achieving superior performance consistently and continuously.

2. What are current incentives and motivations for U.S. Army or public sector employees including scientists and engineers?

   CCDC AC hires engineers most of the time as GS 7s which indicates that the starting compensation for a GS 7 scientist or engineer fresh out of college working for CCDC AC is $49,976 in accordance with figure 2. CCDC AC like most federal employers do not have much ability to offer salaries higher than that associated with OPM's pay tables (figures 1 and 2) so it is reasonable to infer that CCDC AC is restricted to the GS 7 pay scale which cannot go higher than $64,964 (figure 2). However, by the end of year three from hiring, these same engineers are sequentially promoted to GS 12s (skipping GS 8 and GS-10s) and can expect to make at least $88,651 as GS 12s. If they remain in GS 12 positions, they can expect to make at least $94,562 by year 5 as they move in step levels in accordance with OPM's pay raise guidelines (OPM, 2020). If they receive promotions to GS 13 positions, then they can expect to go higher further along the pay scale.

The above findings are also comparable for JPEO A&A and applies comparably if employees are within the LabDemo or AcqDemo pay scales (refer figures 5 and 7). Compared to the private sector in accordance with figures 8, 9, and 10, the salaries for CCDC AC and JPEO A&A scientists and engineers are not too far off at least when considering average and median salaries overall. However, private sector salaries are significantly higher when looking at the higher range of earnings (figure 8) and for professionals with 1-5 years of experience (figure 10) and it can be assumed that private sector compensation metrics are not necessarily dictated by a set number for a starting salary other than market forces. Private sector employees also may receive stock options or stock purchase plans as part of their compensation depending on the company's policy, stock availability, and employee eligibility. Federal employees including JPEO A&A and CCDC scientists and engineers do not receive stock options or purchase plans as forms of compensation from the Government.

Federal employees including JPEO A&A and CCDC AC engineers have both pensions and 401K programs. The private sector has mostly moved towards having exclusive 401K plans or equivalents. Many technology companies offer paid or unpaid perks such as food, gyms and other perks to lure talent. This is similar to what is available to public sector employees even though the qualities of the facilities and perks may vary depending on location. However, the Government does not market these benefits as heavily as private sector employers and thus may not benefit from a recruitment advantage that the private sector has, especially when considering the higher salaries that the private sector can offer to beginner employees. Overall, when looking at extrinsic incentives and motivators, it is reasonable to infer that the Government scientists and engineers fare comparably with that provided by the private sector with the exception of employees in the private sector who are the highest earners. Table 1 below shows a comparison of the data on extrinsic motivators gathered from the previous section in this chapter.

Extrinsic Motivator	**JPEO A&A**	**CCDC AC**	**Private Sector**
Salary Range	$49,976 - $170,800[#]	$49,976 - $170,800[#]	$20,500 - $213,000[*]
Average Salary	$153,141	$121,145	$95,598[**]
Median Salary	$159,990	$122,988	-
1-5 year Salary Range	$49,976 - $94,562[##]	$49,976 - $94,562[##]	$63,000 - $116,000[+]
401K	Yes	Yes	Yes[++]
Pension	Yes	Yes	Rarely[++]
Stocks	Yes	Yes	Yes[++]
Paid or unpaid food	Paid	Paid	Paid or unpaid
Paid or unpaid gym	Paid	Paid	Paid or unpaid

Reference figure 2
* Reference figure 8
** Reference figure 9
Reference figure 2 and OPM based estimate to account for increases after year 3 of hire
+ Reference figure 10
++ 401Ks are predominantly available. Pension plans are very rare. Stocks in the form of options or purchase plans are company dependent but when available are usually provided to employees

Table 1. Comparison of data on extrinsic motivators for scientists and engineers

With regards to intrinsic factors, the findings showed that challenging work and a sense of accomplishment (Hunter, et al., 2018) were important along with motivations such as autonomy or the freedom to execute work assignments (Grundmann, et al., 2012) or the ability to pursue research and communicate with similar minded people (Jindal-Snape & Snape, 2006). Intrinsic motivators were placed higher than extrinsic motivators such as monetary compensation or bonuses (Grundmann, et al., 2012) but removing negative factors such as lack of feedback or bureaucratic behaviors like the lack of recognition are also important (Jindal-Snape & Snape, 2006). While there are a lot of engineers and scientists who are lured to the Government due to the presence of intrinsic incentives and motivations as gleaned from the findings, bureaucracy and restrictions on traveling for networking events such as conferences are highly characteristic of Government organizations including the DOD. Successful private sector engineers and scientists as well as organizations mostly start-ups, tend not to be burdened by bureaucracy as indicated by the open communication within SpaceX (Boehm, 2017) and also provide strong intrinsic incentives and motivations for its employees as indicated by Boehm (2017) and Tom Mueller (Clifford, 2019).

3. Are current standards of incentives and motivations working for U.S. Army or public sector employees or what should be done to incentivize or motivate them?

   The answer here depends on how one perceives the question. If one were to look at the question as is, then the answer is likely to be skewed positive in nature. However, if one looks at the question from the perspective of the hypothesis: "current incentives and motivations for the Army's selected workforce of scientists and engineers entrusted with modernization responsibilities may not be aligned to meet Army modernization schedule goals."; then the answer is more likely to be viewed negatively.

When one views incentives and motivations extrinsically, the relative lower salaries or compensation when compared to starting salaries or upper limits in the private sector does not necessarily deter the ability of the Government organizations to recruit or retain its scientists and engineers (Gibbs, 2006). Gibbs (2006) attributed to the presence of intrinsic incentives or motivations. Tillinghast, Petersen, Rizzuto, Dabiri, & Gonzalez (2015) tend to support this argument about intrinsic incentives as they found with STEM outreach the increased feelings of workforce satisfaction may be attributed to the ability of the engineers to participate in activities that renewed or reinvigorate their original interests in their chosen career fields. These observations attributed to intrinsic factors are also comparable to the private sector where employees at Tesla or SpaceX tend to take lower paying jobs relative to the high technology industry but find greater meaningfulness in their work (Townsend, 2016). While there may be exceptions due to increased demand for scientists and engineers in the short term, extrinsic motivators or incentives such as pay are more likely general motivators but leaders cannot underestimate them especially when considering external factors (Rynes, Gerhart, & Minette, 2004). According to Rynes, Gerhart, & Minette (2004), if the starting salaries of scientists and engineers between the private sector and the Army were compared (refer 1-5 year salary range in Table 1), then it may be harder for the DOD and the Army to recruit the best science and engineering talent due to the tendency of people to reject "under market" pay in contrast to Gibbs's findings.

Army Directive 2017-24 (US Army, 2017, October 06) and Army Directive 2017-33 (US Army, 2017, November 07) indicated the need for the new AFC and the CFT construct to modernize faster. The Directives allude to the fact that the existing processes and constructs were not meeting modernization objectives so the new organizational construct was needed and the formation of the CFTs and the AFC was warranted.

Lewis et al. (2017) discussed in the RAND Report, the benefits and challenges of the AcqDemo system. AcqDemo is used heavily by JPEO A&A and ASAALT. While there were benefits such as the flexibility that AcqDemo provided, the Report highlighted areas for improvement. These included challenges such as how AcqDemo's flexibility was not utilized effectively and the perceived lack of transparency in communicating how performance was tied to compensation. The Report also discussed how pay caps, and constraints on awards can diminish the effects of tying compensation to performance (Lewis et al., 2017). If the old construct did not support modernization as discussed in the previous paragraph, and the challenges to existing systems such as AcqDemo are not conducive to measure performance with extrinsic incentives such as pay, then the data lends more support to the hypothesis over the null hypothesis.

Both Army Directive 2017-24 (US Army, 2017, October 06) and Kimmons (2019) indicate that organizations such as ARCIC, ASAALT, and the former RDECOM (currently CCDC) would provide their existing personnel and/or team with the newly formed CFTs and AFC. Based on this information, if the same set of personnel including engineers and scientists from existing organizations (ASAALT, RDECOM etc…) were realigned or teamed under newly named organizations (e.g. CCDC, CFTs etc…) to form AFC, then it would be prudent to question whether the motivations or incentives for these personnel have changed since the new organizational construct. The limitations of this research did not allow further exploration of this subject, however, it is important to explore this further in the future and adds further probing questions to the hypothesis.

4. What are incentives and motivations that work in the private sector particularly in sectors where technology is developed rapidly (e.g., technology sector)?

   Both extrinsic and intrinsic factors exist in the private sector and the private sector has greater flexibility to utilize both of them to their advantage. According to Hunter et al. (2018), findings showed that managers of private firms have greater proclivity towards extrinsic motivators than those of public sector firms whose managers are more driven by intrinsic motivators. While the average pay seems relatively comparable albeit a little bit more higher in the private sector, the pay disparity is more relevant when it comes to entry level salaries and higher range of salaries as indicated by LinkedIn and ZipRecruiter data for 1-5 year experience salaries and senior professional salaries for scientists and engineers (refer table 1). Such issues are further exacerbated by the pay caps discussed in the RAND Report (Lewis, et al., 2017)

Zenger and Lazzarini (2004) showed that smaller high technology firms in Silicon Valley utilize innovative incentive mechanisms to lure and retain talent, an approach that is seemingly also picking traction with larger private sector firms trying to emulate the same. According to Zenger & Lazzarini (2004), both large and small high technology firms while presented with different sets of challenges in terms of hiring talent, use their firm size and corresponding resources to their advantage in order to incentivize and motivate people. According Zenger & Lazzarini (2004), smaller firms seem to be more likely to incentivize their personnel with the ability to develop and grow innovative and disruptive technologies while the larger firms seem to have more risk with the same approach due to the potential of cannibalizing existing technologies. The ability to work on innovative and disruptive technologies aligned with individual passions or intrinsic motivators seem to be a big driver for top talent as in the examples of Josh Boehm and Tom Mueller, early employees of the space sector disruptor, SpaceX (Boehm, 2017; Clifford, 2020).

While extrinsic factors such as the ability to receive exponential increases in pay tend to abound in the private sector, intrinsic factors are what seems to drive fresh talent towards private sector firms. Townsend (2016) indicated that the median age of employees at SpaceX (median age 29) and Tesla (median age 30) were among the lowest, and that scientists and engineers at these companies found their jobs very meaningful. The demographics in the Government are different. 58.8% of the JPEO A&A scientists and engineers were above the age of 50 (USA DACM, 2019) and the median age for CCDC AC scientists and engineers was 39 (CCDC HCMO, 2019). While the data for SpaceX and Tesla were from 2016, the Government does have an aging workforce concern (USA DACM, 2019). The LaReau (2020) on Ms. Alex Archer showed that one of the key drivers for Ms. Archer to pursue a career in engineering at GM, was because of her childhood experiences with her grandfather, and being influenced by the female CEO of GM, Ms. Mary Barra. This is a relevant examples of intrinsic motivation and GM leadership's trust in their younger generation to deliver a production ready invention in a short amount of time. This can be considered as an example of how organizations are adapting to take advantage of talent to provide innovative capabilities for their customers (LaReau, 2020).

5. How should the Government motivate or incentivize its employees including scientists and engineers?

   The research showed that intrinsic drivers are best suited to incentivize or motivate Government employees including scientists and engineers. However, the findings also indicate that extrinsic factors should not be ignored. Tailoring both extrinsic and intrinsic factors may yield beneficial results for Government organizations.

   If the Army seeks to achieve its modernization priorities in a manner that stretches its schedule goals, then Csikszentmihalyi's flow model (figure 11) best represents what the Army's scientists and engineers should experience in order to continuously attain the flow of growth and discovery that could lead to tackling bigger and greater challenges. In addition to redesigning the mission to provide such intrinsic factors, the findings indicate that Army leadership should look at tailoring the multiple range of extrinsic factors such as compensation, awards, and performance recognition to be more measurable (Bandiera, Khan, and Tobias, 2017). The RAND Report provided areas for improvement in pay for performance systems such as AcqDemo (Lewis, et al., 2017). The findings also suggest that the Government should account for contingency factors in order to drive high performers (Rynes, Gerhart, & Minette, 2004). If extrinsic rewards are ignored, then the Government may risk losing its high performers (Farris & Cordero, 2002).

While there are challenges associated with inherent bureaucracy, the Government should look at removing negative factors such as constant change in guidance and direction or the lack of feedback (Jindal-Snape & Snape, 2006). Army leaders should learn from the findings to look at innovative approaches to incentivize or motivate its people. According to Johnson (2002), France's CNRS pioneered a new entrepreneurial approach with its scientists and engineers to spur innovation. Issues such as the AcqDemo challenges mentioned in the 2017 RAND Report could benefit from considering different but effective methods to evaluate performance. For example, both qualitative and quantitative assessment of patents were used in measuring scientist performance (Farris & Cordero, 2002). The Government should also consider taking advantage of workforce demographics to solve critical problems (Lavigna, 2014). These examples leverage both intrinsic and extrinsic, incentives and motivations currently available to the Government.

Chapter 5 – Conclusions

The following findings are relevant based on the research questions and the hypothesis:

Extrinsic and intrinsic incentives and motivations are available to the Government and are in use to varying levels of efficacy. The findings on pay and perks such as the gym, child care etc… are available to Government employees and at par with the private sector with the exception of lower and higher end ranges (e.g. pay). The Government should consider utilizing this parity to recruit the brightest talent to work on its modernization priorities. Intrinsic factors such as the ability to work on interesting research and security (job tenure) are also available within the Government. The Government may also have a relative advantage when it comes to funding and pursuing interesting research as the private sector research is mostly tied to the organization's return on investment on that research within a certain timeframe.

Intrinsic factors may hold the key to achieving the stretch schedule goals put forth by AFC for achieving modernization priorities. The research increasingly shows that regardless of sector, public or private, cutting edge discovery and innovations are mostly spurred by internal interests such as the examples from SpaceX and GM. In accordance with Csikszentmihalyi, (1990), in order to increase the number of autotelic scientists and engineers, re-designing mission related tasks or realigning personnel within teams to bridge their interests to mission goals will be important.

According to the USA DACM (2019), ASAALT's JPEO A&A is concerned with the reality of baby boomers leaving the workforce. Baby boomers also represent a large segment (32.4%) of the CCDC AC population (CCDC HCMO, 2019). In accordance with Lavigna (2014), the Government can minimize the downsides of this demographic change by taking advantage of the experienced work force to solve critical problems. According to Lavigna (2014), public sector employees are motivated by making a difference in the lives of the citizens they serve. The author recommends to take advantage of Lavigna's findings along with successful practices from the private sector to make impactful change.

The author recommends testing a pilot program based on the concept similar to Ms. Archer at GM. The pilot program would involve young and new engineers to be tasked with the responsibilities of significant modernization projects. In accordance with Farris & Cordero (2002), more experienced scientists and engineers would then take the role of "catalysts" to create a stimulating work environment while empowering the young professionals. In this way the Government would be positioned to leverage its demographics and potentially tailor its intrinsic incentives and motivations for those demographics. There will undoubtedly be challenges to this pilot program. For example young and new engineers may not necessarily be experienced enough to apply "system of systems thinking" effectively for the complex modernization programs. Likewise Government leaders may not be able to exhibit "trust-based behaviors" when entrusting new scientists or engineers with expensive multi-system programs funded through tax-payer dollars. Additional research into these topics including trust research done by Brescia (2020) and system of systems thinking research done by Conner (2020) could yield insights into how these challenges may be addressed. Further research on effective teaming arrangements need to be understood to support the proposed pilot program's team structures. While challenges exist, there may be potential benefits. Zenger & Lazzarini's (2004) discussion on how small and large-firms shut-down projects is relevant here. Zenger & Lazzarini (2004) found that large firms are less likely to shut down projects due to strong attachments and influence activities. Smaller firms on the other hand are more fiscally constrained compared to larger firms due to which they are likely to shut down poorly performing projects to preserve cash (Zenger & Lazzarini, 2004). The Government is a large organization and has recognized the presence of projects that bleed cash without any meaningful impact to modernization. If the strong attachments and influence stems from the experience that Government personnel have with these projects, then wouldn't someone without the experience have less attachments thereby being more likely to shut down the project? Additional research is needed to ascertain this question and the author's suggestion that experience may be tied to the inability to shut down projects quickly in the Government. An explanation offered by the author is referred to as the "burden of experience". The author suggests that experienced personnel may be "burdened" with what they know, as correct or incorrect, with regards to a project while inexperienced personnel do not have experience to begin with so are free of that "burden". Therefore, the author suggests that inexperienced personnel are more likely to shut down unviable projects and pursue riskier approaches to obtain solutions than experienced personnel. The author recommends further research to verify this suggestion.

Extrinsic factors should not be discounted and de-motivators should be removed or addressed effectively. While the Government has constraints in terms of the amount of compensation, it can review innovative private sector pay for performance plans to improve the Government's pay for performance plans. The examples of utilizing qualitative and quantitative measures for performance, proactive and constructive feedback from managers, and social recognition are relevant and synchronous with those used by successful high technology firms such as SpaceX where milestones are celebrated and open communication is the status quo.

In conclusion, the findings of this research topic point to the need for a review of the intrinsic and extrinsic incentives and motivations of ASAALT and AFC's scientists and engineers for better alignment with modernization schedule goals. While additional research on probing areas are needed, the Army may benefit from customizing its existing incentives and motivators and taking calculated risks to meet its modernization needs.

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