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Acquisitions Above the Stratus: Procuring Consumption-Based Solutions for a Modern DoD

June 2021

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Graduate School of Defense Management

Naval Postgraduate School

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ABSTRACT

When procuring information technology requirements for systems such as cloud-based services, acquisition professionals often choose from outdated and misaligned categories of supplies or services established by Department of Defense (DoD) Acquisition regulations. Current contract structures constrain scalability, and it is imperative that the DoD revise its contract types to permit new solutions that enable commercial goods to be procured on a consumption basis. This Capstone Applied Project evaluates the impact of procuring modern DoD capabilities as consumption-based solutions by applying relevant policy analysis, cost effectiveness analysis, and case study analysis. The findings indicate that a consumption-based approach to acquiring cloud-based solutions is the most beneficial method for obtaining fair and reasonable prices while minimizing costs associated with contract administration. The authors recommend that cloud computing be placed into a new category within the DoD Taxonomy for the Acquisition of Services and Supplies & Equipment to enable greater flexibility in implementing a newly proposed contract type, consumption-based variable pricing, which must be supported by the revision of language contained in FITARA and 31 U.S.C. §1341 and an extension of FAR Clause 52.241-8.

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Katherine Bukowski is a Contract Administrator with the Department of the Air Force. She married her husband, Wesley, in 2008 and they currently have two daughters, Ellanore and Annabelle. Katherine earned her Bachelor of Applied Science, with a concentration in Business Administration, at Wayland Baptist University in 2017. After graduation, she was selected for the prestigious COPPER CAP internship program, which she completed in 2020. In her free time, Katherine enjoys volunteering with World Bird Rescue, Inc. as a trainer for birds of prey where she instructs children on wildlife conservation efforts. After graduation, Katherine is looking forward to continuing her Professional Military Education and spending more time with her family.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADA	Anti-Deficiency Act
AFI	Air Force Instruction
AOL	America Online
CBVP	Consumption-Based Variable Price
CCA	Clinger–Cohen Act
CD	Compact Disk
CIO	Chief Information Officer
CLIN	Contract Line Item Number
CO	Contracting Officer
COFC	Court of Federal Claims
COTS	Commercial Off the Shelf
DAR	Defense Acquisition Regulation
DARS	Defense Acquisition Regulations System
DEOS	Defense Enterprise Office Solution
DFARS	Defense Federal Acquisition Regulation Supplement
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPC	Defense Pricing and Contracting Office of the Under Secretary of Defense
EDA	Electronic Data Access
FAR	Federal Acquisition Regulation
FITARA	Federal Information Technology Acquisition Reform Act
FFP	Firm-Fixed-Price
FP	Fixed-Price
FPDS-NG	Federal Procurement Data System – Next Generation
FP-EPA	Fixed-Price Economic Price Adjustment
FSC	Federal Supply Codes
FY	Fiscal Year
GAO	Government Accountability Office
GPC	Government Purchase Card

GSA	General Services Administration
IaaS	Infrastructure as a Service
IDIQ	Indefinite-Delivery Indefinite-Quantity
IEEE	Institute of Electrical and Electronics Engineers
IG	Inspector General
IT	Information Technology
JEDI	Joint Enterprise Defense Infrastructure
MDO	Multi-Domain Operations
MIPR	Military Interdepartmental Purchase Request
NAICS	North American Industry Classification System
NDAA	National Defense Authorization Act
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
PaaS	Platform as a Service
PALT	Procurement Acquisition Lead Time
PCO	Procuring Contracting Officer
PoP	Period of Performance
PPI	Producer Price Index
PSC	Product Service Codes
RFP	Request for Proposal
SaaS	Software as a Service
T&M	Time-and-Materials
TO	Task Order
USD A&S	Under Secretary of Defense, Acquisition and Sustainment
USG	United States Government

I. INTRODUCTION

In the 21st century, warfare conducted by the U.S. Armed Forces has shifted from fighting under an irregular doctrine in Iraq and Afghanistan to that of multi-domain operations (MDO) (Nettis, 2020). In 2019, former Air Force Chief of Staff, General David L. Goldfein, addressed the need for these systems to be connected to bring about effective results (Pope, 2019). In terms of existing technologies, cloud-based computing solutions are the ideal platform to utilize because they offer on-demand access to shared resources through rapidly configured application or infrastructure models to satisfy continually evolving requirements (Dudash, 2016). One of the major advantages of cloud-based solutions is in the ease of scalability and flexibility with respect to delivery size, as opposed to legacy information technology (IT) systems currently used by the U.S. Armed Forces (Bhardwaj et al., 2010). In terms of Department of Defense (DoD) acquisition, these cloud-based solutions should not fall under either of the existing product or service taxonomies because they inherently possess attributes from both categories in equal measure and should therefore be organized under a new acquisition category.

The Section 809 Panel was established by Congress in Fiscal Year (FY) 2016 as part of the National Defense Authorization Act (NDAA) to identify key issues facing government acquisition and compiled the Report of the Advisory Panel on Streamlining and Codifying Acquisition Regulations (2019), which included 98 recommendations. Recommendation 43 called for a revision to acquisition regulations to enable more flexibility and effective means of procurement for consumption-based solutions. Information technology changes on a daily basis; it is imperative for the government to have the means of procuring these solutions as rapidly as the United States' near-peer adversaries, especially in the sector of cloud computing.

A. OBJECTIVES

This research examines the current supplies and services model, seeking methods to modernize and incorporate a consumption-based approach. This includes the following:

- Examining the structure of recent large contracts for cloud services (e.g., Defense Enterprise Solutions, Joint Enterprise Defense) and comparing them to commercial best practice methods.
- Determining types of defense acquisitions that are currently miscategorized as either supply or service when they are in fact combinations of the two, and evidence demonstrating the cost of this mismatch.
- Identifying laws or regulations that would need to change to allow for the acquisition of consumption-based solutions.
- Recognizing oversight and accountability processes that could be affected by consumption-based acquisition.
- Investigating the potential benefits of instituting a consumption-based approach to acquisition to enhance the DoD's ability to procure modern capabilities at market prices.

This research uses data from current acquisitions to evaluate the impact of procuring capabilities as consumption-based solutions and identifies costs and benefits of this approach, including non-monetary costs/benefits such as industry relations, as well as acquisitions best suited to a consumption-based model.

B. ACTIVITIES

Problem Identification: Technology is rapidly evolving and requires a fluid acquisition approach to harness its full capabilities and modernize the force in accordance with the National Defense Strategy. Current procurement efforts suggest the DoD is applying an outdated approach to acquiring modern capabilities when compared to its private industry counterparts, inhibiting scalability and driving unnecessary cost increases.

Appropriate Data: Research data for this project was collected and synthesized from the following sources: DoD policies/directives covering acquisition of consumable requirements; Producer Price Index (PPI) data from U.S. Bureau of Labor and Statistics (BLS); Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) Definitions, prescriptions and clauses; Section 809 Panel recommendations; NDAA for FY 2020; Applicable Department of Defense Instruction (DoDI) issuances on the use of product/service classification codes; North American Industry Classification System (NAICS), Product Service Code (PSC), and Federal Supply Codes (FSC) guidance from the U.S. Census Bureau; Federal Procurement Data System – Next Generation (FPDS-NG) contract data; ordering guides from selected DoD contract

vehicles; government contractor publications, product catalogs, and pricing sheets; DoD IG reports relating to acquisitions of modern capabilities; and supplemental information periodicals/aids.

Appropriate Analysis: An analysis of current acquisition efforts to obtain modern capabilities was performed to highlight constraints in the current procurement model. Further, this analysis provides tangible examples of how pivoting to a consumption-based solutions approach can benefit the DoD acquisition process. Finally, recommendations are provided on laws and regulations that would need to change to enable a consumption-based solutions acquisition model across the force.

Analytical techniques include the following: cost effectiveness analysis, contemporary contract analysis, and policy analysis. These tools are utilized to assess the current state of DoD procurement efforts regarding modern capabilities and the impact of pivoting to a consumption-based solutions approach. Chapter I introduced the need for implementation of a consumption-based acquisition program as applied to cloud computing solutions. Chapter II provides a background on the topic, problem identification, and a review of currently available Enterprise Cloud offerings. Chapter III is a literature review of the relevant topics of consumption-based acquisitions, cloud computing, commercial software acquisition strategies, DoD Inspector General (IG) and Government Accountability Office (GAO) reports, as well as currently utilized contract types. Chapter IV provides analysis of miscategorized acquisitions through the use of cost effectiveness and case study techniques, provides recommendations regarding the changes necessary to contract types, identifies the contract financing processes requiring revision, and highlights the benefits gained through implementing a consumption-based acquisition model. Finally, Chapter V provides a conclusory discussion on the presented material and summary of the project's acquisition research objectives.

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II.   BACKGROUND

Technology is the resource of the future. The development of new and innovative information technology occurs every day in the commercial sector, while the government languishes in archaic procurement methods that prohibit rapid acquisition. This failure to meet the curve of development places the government behind its enemies and eminently represents crucial mission failure. One aspect of information technology that suffers from obsolete procurement methods is cloud computing services. Acquisition methods must be expanded to allow for flexible, consumption-based methods to acquire these services. The National Institute of Standards and Technology defines *cloud computing* as

> A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models. (U.S. Congressional Research Service, 2020, under "Summary")

When procuring cloud computing services, acquisition professionals are faced with choosing between outdated and misaligned categories of supplies or services established by current DoD acquisition regulations. These offerings are becoming increasingly obsolete in a fluid industry that thrives on speed and innovation. In response, the FY2020 National Defense Authorization Act proposed to explore the practicality of including consumption-based solutions in defense acquisition policy.

The Advisory Panel on Streamlining and Codifying Acquisition Regulations identified the need to "revise acquisition regulations to enable more flexible and effective procurement of consumption-based solutions" (Section 809 Panel, 2019). This was Recommendation 43 of 98 propositions provided to Congress in an effort to identify strategies and implementations to realign defense acquisition strategies, unencumber the contract process, invoke commercial strategies, and place the mission first.

Current contract structures constrain scalability. It is imperative that the DoD revise its contract types to permit a new type—one fashioned for commercial goods to be procured on a consumption basis, allowing for fair and accurate pricing, based upon actual

usage. Application of this concept to cloud computing permits a scaled approach, which can be applied to the DoD's annual $10 billion in acquisition of services that could be purchased on a consumption basis.

A. PROBLEM IDENTIFICATION

1. Definitions

The FAR defines a *service contract* as "a contract that directly engages the time and effort of a contractor whose primary purpose is to perform an identifiable task rather than to furnish an end item of supply" (Federal Acquisition Regulation, Section 37.101, 2021). From this, it can be inferred that a service is performance-oriented and may involve an intangible result. To further this concept, the DFARS goes on to define *cloud computing services* as

> A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This includes other commercial terms, such as on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. It also includes commercial offerings for software-as-a-service, infrastructure-as-a-service, and platform-as-a-service. (Defense Federal Acquisition Regulation Supplement, Section 239.7601, 2021)

All three commercial offerings include the word "service" in their title, but vary in the amount of service being rendered, and the level of responsibility that remains with the end user. The three commercial offerings identified above are described by the U.S. Congressional Research Service as follows:

- Software as a Service (SaaS): In the SaaS model, customers use applications that the provider supplies and makes available remotely on demand, rather than using applications installed on a local workstation or server. SaaS is the most readily visible and simplest service model to the end user. In many cases, SaaS applications are accessible through hardware or software "thin clients." Examples include webbased services such as Google Apps and online storage such as DropBox.

- Platform as a Service (PaaS): With PaaS, customers create applications on the provider's infrastructure using tools, such as programming languages, supplied by the provider. Facebook is one example of such an application. Such a platform could include hosting capability and development tools to facilitate building, testing, and launching a web application. The user controls the applications created via the platform,

and the provider controls and maintains the underlying infrastructure, including networks, servers, and platform upgrades.

- Infrastructure as a Service (IaaS): IaaS providers supply fundamental computing resources that customers can use however they wish. Customers can install, use, and control whatever operating systems and applications they desire, as they might otherwise do on desktop computers or local servers. The provider maintains the underlying cloud infrastructure. Examples of IaaS are Amazon Web Services and Microsoft Azure. (U.S. Congressional Research Service, 2020)

2. Iaas, SaaS, and PaaS

To better understand the difference between IaaS, SaaS, and PaaS, Albert Barron (2014), an enterprise architect for Google offered the comparison of these services as explained by pizza., as seen in Figure 1. The traditional on-premises model relies on full development by the user, requiring creation and updates to the software as well as management and housing of the servers. All work is performed in-house, and nothing is contracted out.
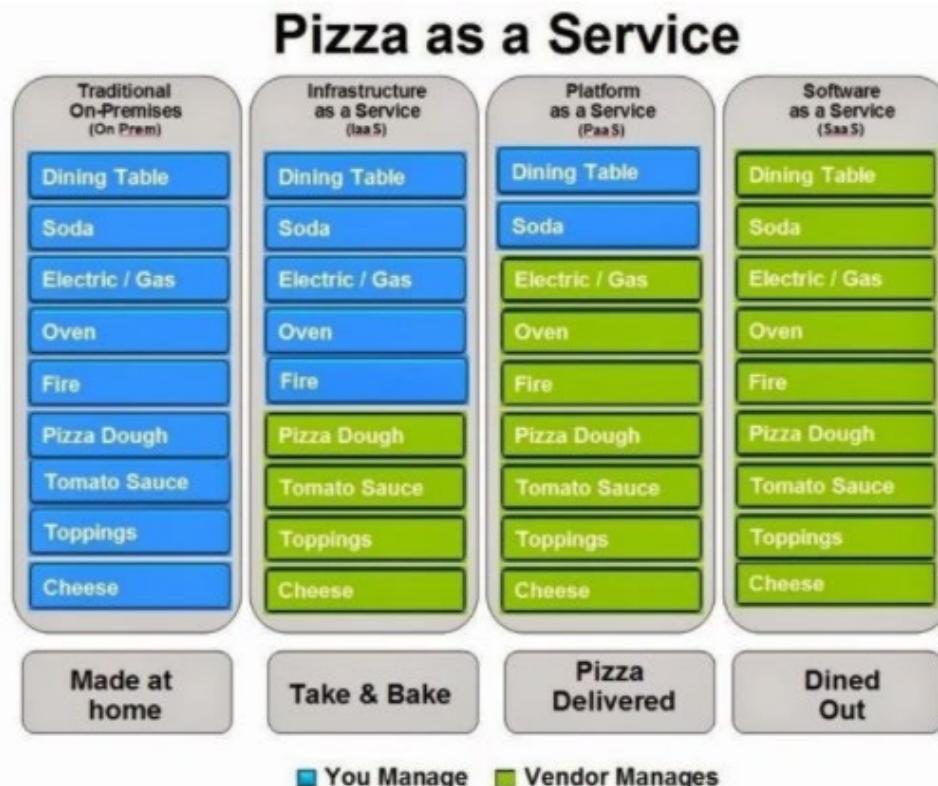

Figure 1.   IaaS, SaaS, and PaaS in Terms of Pizza. Source: Barron (2014).

When the FAR's definition of a service contract is taken into consideration, it becomes evident that the commercial offerings of cloud computing are not accurately characterized. If the requirement is for PaaS, the requirement owner is only gaining access to the hardware framework hosted by the contractor. Services are being rendered for maintenance and housing of the implements, but no work product is being provided to the user's data. It is little more than an intellectual parking garage. IaaS expands closer to the concept of a service and offers the "fundamental resources" (U.S. Congressional Research Service, 2020) to end user, but still depends on the customer to control the operation of the information. Only SaaS truly fits the definition of a service as the end user expends no effort in its creation or management.

Choosing to pursue a services route for acquiring cloud-based solutions introduces risk in terms of complexity throughout the buying process as it relates to the assessment of monetary results, vague objective intervals, and required cognitive input, due to the intangible nature and performance-based focus of a service requirement (Smeltzer & Ogden, 2002). However, the SaaS model, one of the most utilized cloud-based offerings, includes in its definition the issuance of a user license by the providers for their customers to use a given software application (Bhardwaj et al., 2010). This may be offered via digital download, as well as physical media such as a compact disk (CD), which could form the basis for classifying cloud-based solutions as a tangible end item instead.

Conversely, the FAR defines products as being synonymous with supplies, which includes a broad definition of "all property except land or interest in land. It includes (but is not limited to) public works, buildings, and facilities; ships, floating equipment, and vessels of every character, type, and description, together with parts and accessories; aircraft and aircraft parts, accessories, and equipment; machine tools; and the alteration or installation of any of the foregoing" (Federal Acquisition Regulation, Section 2.101, 2021). The language used to describe these products possesses inherently tangible characteristics. Yet, cloud computing deals exclusively with web-based hosting where data is both stored and accessed utilizing the provider's remote servers at an off-site location (Bhardwaj et al., 2010).

B. CURRENT CONTRACT STRUCTURES

1. Contract Types—Current Strategies

One of the best methods for mitigating risk in federal acquisitions is the selection of contract type. For IT acquisitions, it is helpful to think in general terms. Build, buy, or rent—these three simple categories are a means of understanding the benefits attainable through selection of the proper contract model (Kohl, 2012). Procurement of commercially available IT as a product represents the buy model. Build and buy models are well researched (as reported in the Institute of Electrical and Electronics Engineers (IEEE) 0162, Recommended Practice for Software Acquisition), but constrain the end user to a particular model or version of a software (Kohl, 2012). Updateability is key to long-term acquisition of IT, which supports consideration of a rental model. The government does not need to possess the server farms, programmers, or software, but it does need access to the best of these commercially available solutions at the speed of a commercial acquisition.

In terms of impacting the warfighter, the DoD's inability to modernize the acquisition process for dynamic technological solutions has left it at a disadvantage in terms of achieving parity with its public sector counterparts (Section 809 Panel, 2019). As early as 2016, organizations in the public sector embraced the SaaS model of cloud-based applications over legacy IT systems and associated services (Raghavan & Nargundkar, 2020). The DoD responded with its controversial Joint Enterprise Defense Infrastructure (JEDI) cloud contract award in 2019 to Microsoft for cloud computing services, having been under protest for a year and reaffirmed in late 2020 (U.S. Department of Defense, 2020).

As innovative as JEDI's strategy was to institute a cloud-based solution that each of the DoD components could leverage based on their individual needs, the process to acquire it was the exact opposite. Instead of using a novel approach to selecting the contract type, such as a time-and-materials contract, which was suggested by a federal acquisition and advisory panel (Section 809 Panel, 2019), JEDI's RFP reflected the textbook services acquisition strategy of utilizing a firm-fixed price (FFP), indefinite-delivery, indefinite-quantity contract (Washington Headquarters Services, 2018).

JEDI's decision to follow a services acquisition strategy approach ultimately positioned the government at a disadvantage. As commercial cloud providers bill on a consumption-based model, FFP contracts require a set price and cannot therefore capitalize on potential cost savings based on usage and fluctuating market conditions. In addition, FFP contracts require obligated funds to prevent Anti-Deficiency Act violations, which is not appropriate for a consumption-based billing model and may result in paying for services not received or overpaying on the most up-to-date market rates (Section 809 Panel, 2019).

The JEDI contract utilized an indefinite-delivery indefinite-quantity (IDIQ) contract type with FFP task orders (TO). Use of fixed-price contracts for commercial items is mandated by FAR 16.201(a) and FAR 12.207(a), except when provisions of 12.207(b) apply. Selection of an FFP performance-based contract or TO is further supported by FAR 37.102(a)(2)(i) when acquiring services. In fact, the DoD Guidebook for the Acquisition of Services notes that the CO's rationale must be documented if any contract type other than FFP is selected (U.S. Department of Defense, 2012). It is certainly plausible that the government prefers to use FFP contracts for service requirements because cost risk is mitigated through locked-in pricing. However, IT does not neatly fit into the classification of just a service or just a product as it is truly a combination of both, especially within the sphere of cloud computing. As seen in the JEDI contract, the FFP contract type offers no incentive to the contractor to pass on cost savings to the government (Schneider, 2018). Locked-in prices can be detrimental in IT procurements as it can prohibit the government from realizing cost savings as the price of the IT acquired ages and invariably declines. The price of a new laptop, server, or software today will be significantly lower five 5 years from now. In the same way families used to buy access to the internet through America Online (AOL) disks and pay by the minute, it is time for the DoD to foster a new means of procuring IT via commercial, scalable methods.

2. Current DoD Enterprise Cloud Offerings

The U.S. Department of Defense's Enterprise Cloud webpage, cloud.mil, states that the Enterprise Cloud is a "Multi-cloud and multi-vendor ecosystem composed of a general-purpose and multiple fit-for-purpose clouds that are available globally and at the tactical

edge" (U.S. Department of Defense, 2021). The DoD Enterprise Clouds include Defense Enterprise Office Solution (DEOS), JEDI Cloud, and milCloud 2.0. The website offered the following brief explanations for each of the Enterprise Clouds, key information for which is summarized in Table 1.

Table 1. DoD Enterprise Cloud Contracts

DEOS	"DEOS (Defense Enterprise Office Solution) is an enterprise commercial cloud environment supporting the DoD strategy to acquire and implement enterprise applications and services for joint use across the Department, standardize cloud adoption, and enable cross-department collaboration. DEOS will provide commercial cloud services that unify many existing capabilities and is intended to aid the Department in replacing disparate legacy enterprise information technology services for office productivity, messaging, content management, and collaboration. DEOS will be deployed on NIPRNet, SIPRNet, and in denied, disconnected, intermittent, and limited bandwidth environments worldwide." (U.S. Department of Defense, 2021)	• "Tiered user consumption (i.e., browser vs client based) and flexible pricing structures" (U.S. Department of Defense, 2021) • Blanket Purchase Agreement (BPA) • $4.4B ceiling • 10-year period (General Services Administration, 2020)
JEDI	"The DoD's General Purpose Enterprise Cloud, also known as the Joint Enterprise Defense Infrastructure (JEDI) Cloud, is the initiative that will deploy foundational cloud technology, while leveraging commercial parity, to the entire Department, with a focus on where our military operates--from the homefront to the tactical edge. JEDI Cloud will provide fast, responsive, flexible, and adaptive cloud services to users at all classification levels. This initiative will create a foundation for efficient data sharing via its evolutionary cross domain solution, advanced data analytics capabilities, and a cutting-edge cybersecurity posture for the Department of Defense." (U.S. Department of Defense, 2021)	"Consumption-based services; estimate, plan, and track actual spending" (U.S. Department of Defense, 2021) • Indefinite-delivery, indefinite-quantity (IDIQ) (U.S. Department of Defense, 2020) • $10 Billion
milCloud 2.0	"DISA's milCloud 2.0 portfolio includes an integrated suite of cloud-based infrastructure services. Connecting commercial cloud service offerings to Department of Defense (DoD) networks in a private deployment model, the solution provides mission partners the latest cloud technologies at competitive prices, with uncompromising performance. Approved to support Impact Level 5 data (IL6 authorization is in progress), milCloud 2.0 includes a central cloud portal which provides real-time visibility, payment, and workload provisioning." (U.S. Department of Defense, 2021)	• Pay-As-You-Go cost model • Indefinite-delivery, indefinite-quantity (IDIQ) • $500 Million • 8-year contract • Awarded June 2017

*In addition to the three DoD Enterprise Clouds listed above, there are a myriad of other service-specific cloud computing offerings, however in-depth analysis of these contracts is beyond the scope of this research paper.

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III. LITERATURE REVIEW

This literature review offers a thematic survey of the body of knowledge available for the issues faced by DoD acquisition professionals seeking to procure consumption-based solutions, more specifically cloud computing. Acquisition of cloud computing includes SaaS, PaaS, and IaaS. Singular categorization of IT contracts as either a commodity or a service is not appropriate for cloud solutions and has given rise to the requirement for a consumption-based contract type. The following themes are addressed to answer the central issue of how instituting a consumption-based approach to acquisition will enhance the DoD's ability to procure modern capabilities at fair market prices: misclassification of inherently dualistic defense acquisitions, current structuring of cloud services contracts, oversight and accountability processes affected by consumption-based acquisitions, and changes to laws or regulations that will enable the use of consumption-based solutions.

Rigid defense acquisition methods are failing to recognize the dualistic nature of acquisitions that are not strictly a supply or a service. The Section 809 Panel outlines current issues that government acquisition professionals face when it comes to requirement solutions involving modern technology, and the ensuing static delivery options currently offered in the commercial marketplace—especially when it comes to cloud computing (Section 809 Panel, 2019). Due to the variable nature of cloud computing, acquisitions of SaaS, PaaS, and IaaS would benefit from a more flexible categorization and procurement method.

Commercial software acquisition practices favor the use of build or buy strategies and are well documented in IEEE 0162–1998, Recommended Practice for Software Acquisition (1998). According to Kohl (2012), the *buy strategy* refers to the acquisition of a commercial-off-the-shelf (COTS) item whereby the user gains permanent possession and control over the item. This approach fails to offer updateability without further acquisition; the version purchased is the version possessed (Kohl, 2012). However, for SaaS, use of a rent method is a better representation of the acquisition, as the software is not directly possessed by the user (Kohl, 2012). This can be applied to other "X as a service"

acquisitions, such as PaaS or IaaS. However, for federal acquisition of cloud computing, the FAR's language is inflexible. Legislation such as the Federal Information Technology Acquisition Reform Act (FITARA), as well as the Office of Management and Budget's (OMB) Cloud First policy, place buyers at a disadvantage when selecting the most appropriate contract vehicle. This results in longer procurement lead times, ultimately devaluing and reducing the efficacy of the solution's impact on the end user's requirement (Section 809 Panel, 2019). These outdated contract vehicles result in significant additional costs to the government.

The most recent major acquisitions for cloud services were JEDI and DEOS, which were structured as FFP contracts under a single provider. This strategy reflects the DoD's historically established position in the post-World War II era as a limited consumer of technology with a major focus on industrialized operations instead of positioning itself as a driver of technological requirements, as the battlefield has transitioned into the modern age of multi-domain operations centered around real-time information processing (Schneider, 2018).

The DoD's structuring of the JEDI and DEOS acquisitions does not align with commercial best practices that the private sector has developed. With commercial cloud-based service providers currently offering SaaS, PaaS, and IaaS hosting services based on infrastructure and scalability needs (Bhardwaj, 2010), private organizations have utilized a multiple-cloud provider model for various applications used under an enterprise-wide solution, thereby leveraging the latest offerings in a mature and swiftly evolving cloud computing marketplace (Schneider, 2018).

The private sector has also moved to a subscription-based service model over the traditional software ownership model, as it outsources IT-centric cloud expertise and allows for greater focus on business operations (Raghavan & Nargundkar, 2020). This move also caused a shift in organizational buying behavior as it relates to the cloud-based service acquisition process. Instead of a top-down approach to selecting applications initiated by an organization's chief information officer (CIO), SaaS assessment and selection is driven by the end-user, which shifts the power dynamic due to users possessing more expertise and involvement with a particular SaaS application (Raghavan &

Nargundkar, 2020). Both solicitations for JEDI and DEOS enterprise solutions illustrate that the DoD is using a top-down acquisition strategy that limits its organizations from capturing the latest cloud-based innovations that only a multi-provider agreement could provide.

From the DoD Inspector General's (IG) report on the JEDI cloud procurement, Amazon was provided with a written debriefing that contained sensitive details relating to source selection and proprietary information from the contract awardee. Although DoD leadership (Under Secretary of Defense, Acquisition and Sustainment [USD A&S] and CIO) anticipated an oral debriefing based on their own professional experiences, the procurement contracting officer (PCO) received legal counsel in favor of providing a written brief, showing a clear policy disconnect down the chain of command despite the fact that FAR 15.506 gives the contracting officer (CO) discretion to use either an oral or written debriefing. It is recommended that the DoD act in a unified manner in following through with best practices and enforce debriefings consistent with the FAR, under the Government Accountability Office's (GAO) jurisdiction (Schooner, 2020). Furthermore, the Section 809 Panel acknowledged that delays in implementation prevent the DoD acquisition process from realizing benefits of the proposed reforms.

In the case of JEDI, two propositions could offer reprieve: the 100-day deadline for the GAO or Court of Federal Claims (COFC) to render a decision, or the suggestion to prohibit a company's ability to appeal a GAO decision to the COFC. Application of at least one would have resulted in a decision by November 18, 2018, thereby ending the initial protest of Oracle (Cordell, 2019), one of the offerors. Finally, with JEDI and DEOS being delayed due to controversies surrounding the contract award, various DoD entities are either acquiring individualized commercial solutions or utilizing DoD-approved cloud contracts (i.e., milCloud 2.0 and Cloud One) in the interim, creating a disjointed network of capabilities to meet evolving requirements. This strategy to adopt decentralized cloud solutions creates limitations in both the compatibility of legacy systems and infrastructure security for classified information (Doubleday, 2020).

Significant regulation reform is necessary to permit a flexible contract type that would allow for consumption-based acquisitions. FFP contracts, such as those for JEDI

and DEOS, limit the government's savings and require that the contractor shoulder most of the cost risk, resulting in high proposal and award prices. Fixed price with economic price adjustment (FP-EPA) contract type is recommended by the General Services Administration's (GSA) *Best Business Practices for USG Cloud Adoption* (2016) but is a poor option for the consumption-based modeling needed for cloud computing, as it only offers a means to adjust established prices (Section 809 Panel, 2019). This mismatch of federal regulation to the requirement is further evidenced by the Defense Logistics Agency's (DLA) decision to create new contract types, designed and geared toward the acquisition purpose (Section 809 Panel, 2019). The Section 809 Panel suggested the creation of a new contract type, similar to a time-and-material (T&M) contract, as the structure would offer a decrease in material costs when the technology prices inevitably decrease over time (Duncan, 2019), calling this proposed contract a "Fixed-Price Resource Units" (Garland, 2019). The new contract type would set a base price for the consumable unit of service (e.g., one hour), impose a contract ceiling price, and permit the necessary scalability for consumption to be billed in arrears (Garland, 2019).

The Section 809 Commissioner, Bill LaPlante, offered further insight into the panel's Report on Streamlining IT Acquisition Regulations, emphasizing the need and benefit of removing processes that offer little to no value (Rose, 2019). Certain laws such as the Clinger–Cohen Act (CCA) were applicable when written (Rose, 2019), but Recommendation 44 lists redundant CCA compliance guidance that impeded rapid acquisition and encouraged Congress to exempt the DoD from those requirements (Duncan, 2019).

From the body of literature reviewed and subsequent findings presented previously, it is clear that instituting a consumption-based approach to acquisition will enhance the DoD's ability to procure modern IT capabilities by structuring its contract types in a way that incentivizes performance and encourages access to the latest innovations offered, while embracing the industry standard subscription-based arrangement to obtain market prices. For this approach to be successful, consumption-based solutions will require a more fluid categorization as well as a new contract type supported by the removal of superfluous legislation and user-driven organizational buying behavior that mirrors the private sector.

IV. ANALYSIS

Analysis will include an examination of cloud-based solutions currently miscategorized as either a product or service, the changes needed to enable more flexible contract types for these acquisitions, the oversight processes affected by financing payments post factum, and a summary of the benefits gained from a consumption-based acquisition model.

A. MISCATEGORIZED ACQUISITIONS

1. Analysis of Current DoD Cloud Computing Taxonomy

The DoD's *Taxonomy for the Acquisition of Services and Supplies & Equipment* (2012) includes cloud computing under the PSC D305 in its IT Services Portfolio Category (Office of the Under Secretary of Defense, 2012). Further, the DFARS includes procedures and clauses specifically for cloud computing at Subpart 239.75, under the purview of acquiring IT products or services. In addition, a search for NAICS codes for cloud computing produces only service-related results such as 518210—Data Processing, Hosting, and Related Services (North American Industry Classification System, 2018). All of this illustrates that the DoD has firmly rooted cloud computing in the services acquisition category, but such classification causes unnecessary complexities in the procurement process.

Evidence of the confusion caused by the lack of PSC specification for cloud computing can be seen through a search of FPDS-NG. On 3 April 2021, a search of FPDS-NG for the term "cloud computing" returned 7,605 results. Of the first thirty results, sorted by relevance, the PSCs selected varied wildly, and included a mix of products and services. The results of the first page included the following entries.

Table 2. PSC Mismatch

PSC Code:	PSC Description:	CAR Description of Acquisition
7025	Information Technology Input/Output and Storage Devices	Cloud Computing
7030	Information Technology Software	Cloud Computing
7045	Information Technology Supplies	Cloud Computing
AC61	R&D-Electronics & Comm EQ-B RES	Cloud Computing
DB10	IT and Telecom – Compute as a Service: Mainframe/Servers	Cloud Computing
D305	IT and Telecom – Teleprocessing, Timeshare, Cloud Computing, and High-Performance Computing	Cloud Computing Services
D307	IT and Telecom – IT Strategy and Architecture	Cloud Computing Services
D318	IT and Telecom – Integrated Hardware/Software/Services Solutions, Predominately Services	Cloud Computing Services
D399	IT and Telecom – Other IT and Telecommunications	Federal Supply Schedule Contract & Cloud Computing
L070	Tech Rep SVCS/ADP EQ & Supplies	Cloud Computing

Source: Federal Procurement Data System-Next Generation (2021).

Removing cloud-based solutions from the services taxonomy will be beneficial on all fronts. From a service standpoint, the elimination of cloud computing from the IT Services Portfolio of the DoD's *Taxonomy for the Acquisition of Services and Supplies & Equipment* policy (Office of the Undersecretary of Defense, 2012) will reduce the administrative burden associated with keeping PSC D305 current as it relates to cloud-based service offerings through the marketplace and spend analyses. The resultant cost savings may then be transferred to support more critical portfolio taxonomies in need.

From a product standpoint, although it is not listed in any Product Portfolio Group, removing cloud-based solutions such as SaaS offerings from further consideration as a potential addition ensures consistency in DoD decision-making in terms of structuring the various portfolio groups to maximize buying power, while giving cloud-based solutions the flexibility needed to scale at a more rapid pace without being constrained by the stipulations of a supply contract (e.g., FAR Part 8—Required Sources of Supplies and Services).

Based upon a suggestion from the Section 809 Panel, it is recommended that the highest applicable level of leadership, the principal director of defense pricing and contracting (DPC) within the Office of the Secretary of Defense (OSD), designate a special task force to update the *Taxonomy for the Acquisition of Services and Supplies & Equipment* policy with the addition of a new category, Dynamic Resources, with distinct portfolio categories (Office of the Under Secretary of Defense, 2012). Subsequently, the Defense Acquisition Regulation (DAR) Council should remove all language in DFARS Subpart 239.76 and DFARS PGI 239.76 that designates cloud computing as a service to enable more flexible terms and conditions than what are provided under FAR Part 37 procedures.

2. Methodology for Cost Effectiveness Analysis

The PPI was utilized as a means to measure price escalation for producer output based on demand for services, as no data currently exists for the selected industry, Software Publishers-Primary services. The Software Publishers-Primary services category was selected after a search on the BLS website revealed NAICS code 51, a service-providing information sector that includes industries such as software publishing, telecommunications and data processing. This aligns with DoD's Taxonomy for the Acquisition of Services and Supplies & Equipment, which uses NAICS code 518210 - Data Processing, Hosting, and Related Services for its cloud computing requirements.

The OPM Salary Calculator rates were generated using the minimum locality (Rest of U.S.) and step increases (Step 1) for standardization purposes and to illustrate the minimum for feasibility costs only.

Current DoD Enterprise Cloud offerings were examined to determine the effectiveness of the calculators, and forward funding by analyzing the amount obligated on each call or task order, versus the amount deobligated by the end of the Period of Performance (PoP). For the purposes of this paper, milCloud 2.0 was selected for extensive review due to its classification level, which permitted the authors to access documents necessary to analyze the contract, its successful performance since award in 2017 which provided recent and relevant pricing data, and its purported pay-as-you-go payment model.

3.   Cost Effectiveness Analysis

The BLS reported an overall increase in the Producer Price Index (PPI) by 2.8% over a 12-month period (Feb 20 – Feb 21), which was the most significant upsurge since a 3.1% increase was recorded during the 12-month period in 2018 (Oct 17 – Oct 18). More specifically, a search utilizing BLS's Data Viewer tool for PPI industry data reveals a 2.6% increase over the same time periods referenced above (Jan 17 – Jan 21) for Software publishers – Primary services. This data establishes a consistent pattern of price escalation within the last five years for services directly related to and involving cloud-computing vendors.

PPI industry data for Software publishers-Primary services, not seasonally adjusted

Click and drag in the plot area to zoom in. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.
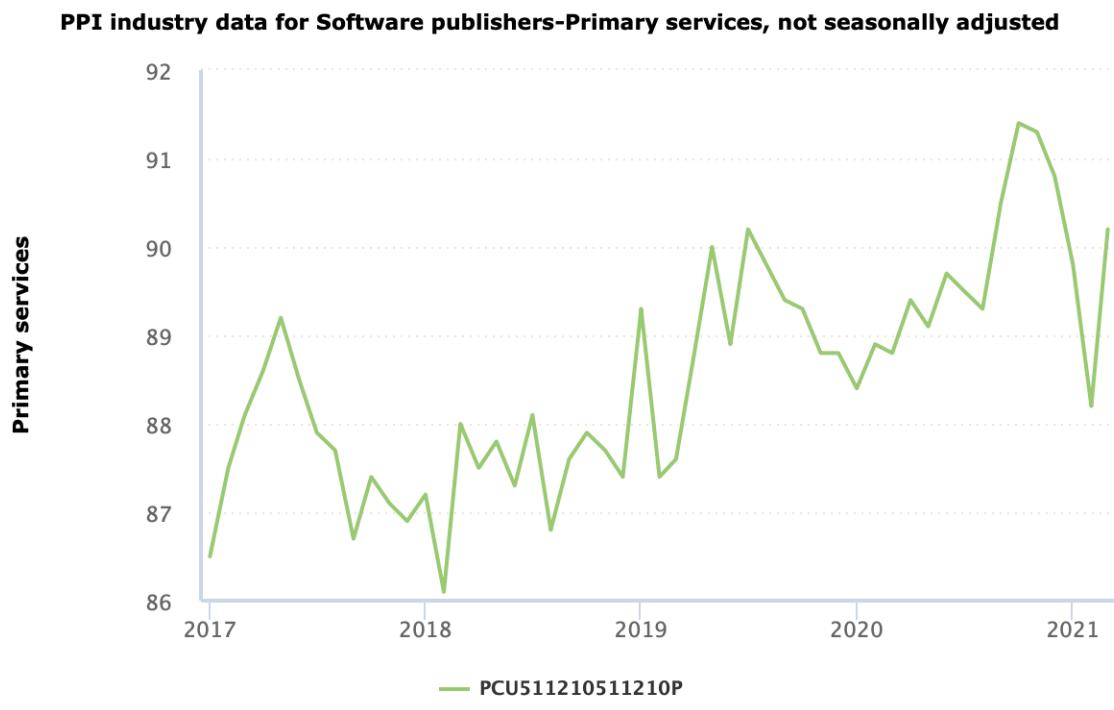
Figure 2.   PPI Data. Source: U.S. Bureau of Labor Statistics (2021).

To quantify the potential risk to mission partners currently employing service contracts for cloud-based requirements, milCloud 2.0's contract (HC102817D0004) will be used as an example to illustrate the impact of a 2.6% price increase. By taking the ceiling price of the subject contract's initial ordering period at $500,000,000 and multiplying it by a 2.6% escalation rate, the resultant amount reflects a $13,000,000 projected increase in producer costs over the next five years. This data indicates that pricing rates will continue

to rise due to inflation over the life of this contract and will require significant administrative oversight to ensure that Anti Deficiency Act (ADA) violations do not occur.

The administrative burden attached to a particular services contract will vary depending upon the length of its period of performance, as well as its complexity. However, as an example, the milCloud 2.0 contract required at least a Contract Specialist, Contracting Officer, Flight Chief and Chief of the Contracting Office, at a minimum, to successfully execute the contract action. Utilizing the OPM's General Schedule Salary Calculator, the salaries for each acquisition-coded position (1102) motioned above were calculated from FY 17 and FY 21 to ascertain the amount the government would have to pay in administrative fees. The resultant pay rates add a total of $23,532 or a 1.07% increase in projected costs to administer the milCloud 2.0 contract over the next five years, which directly contradicts OMB Circular A-76's established policy to achieve cost savings of commercial support services throughout the federal government (Inspector General, Department of Defense, 1994).

Table 3. Federal Acquisition-Coded Personnel Pay Rates FY 17–FY 21 Comparison

Position	Rank	FY 17 Rates	FY 21 Rates	% Increase
Contract Specialist	GS-11	$60,210.00	$64,649.00	1.07%
Contracting Officer	GS-12	$72,168.00	$77,488.00	1.07%
Flight Chief	GS-13	$85,816.00	$92,143.00	1.07%
Chief of the Contracting Office	GS-14	$101,409.00	$108,855.00	1.07%
	Total	$319,603.00	$343,135.00	1.07%

Adapted from U.S. Office of Personnel Management (2021).

OPM's General Schedule Salary Calculator rates were calculated using the minimum locality and step increases for standardization purposes and to illustrate minimum feasible costs only.

The initial DoD IG audit report regarding cost-effectiveness for services, 95–063, found that cost comparisons had not been performed by some of the military branches, despite it being required per DoD Directive 4205.2. As a result, the IG was unable to confirm that the government's service requirements were being fulfilled by the most cost-effective means (Inspector General, Department of Defense, 1994). More concerning is the recent GAO report regarding service acquisitions, 21–267R, which found that the DoD is

still struggling with tracking and forecasting future budget amounts for its service requirements (U.S. Government Accountability Office, 2021).

DoD's situation is made even more problematic as federal policy-makers published a call for comments via the Federal Register that would require contractors to report total dollar amounts invoiced and the total number of direct labor hours consumed under a given contract action for services on an annual basis. This proposed amendment to the DFARS would apply 10 U.S.C. 2330a, which effectively facilitates the collection of service contract data for better management and oversight of budgetary requirements (Defense Acquisition Regulation System, 2020). However, this is still a proposed rule change to the DFARS and has not been written into law yet, which means that the DoD still does not have the means to effectively track its spending for management and forecasting of new or continuing service requirements.

DoD IG's report on the JEDI Cloud Procurement, 20190321-056996-CASE-01, detailed a memorandum from the CO that stated "in a multiple award scenario, competition and source selection for each task order would require significant work from multiple acquisition and programming personnel. For instance, a single task order could take up to a year to complete, creating delays to access cloud services for warfighters." (Inspector General, Department of Defense, 2020, p.44). The estimated cost of administering and executing a task order was calculated to be $127,851.84 for a multiple award versus $2,595.71 for a single award IDIQ format. The CO concluded that over the 10-year contract, with an estimated 4,032 task orders cut annually, the DoD could save at least $500 million in contract administrative costs utilizing a single-award contract (Inspector General, Department of Defense, 2020, p.44). Even though the JEDI procurement team minimized the risk associated with excessive costs, the single award IDIQ will end up costing the DoD approximately $10,465,902.72 in administrative costs per year, and $104,659,027.20 in total administrative costs over the life of the contract, utilizing the same data above that was forecasted by the CO.

4. Case Studies of DoD Enterprise Cloud Solutions

a. *JEDI*

A study of the JEDI contract is not appropriate for this paper. Due to delays caused by protests, and the Court of Federal Claims' Preliminary Injunction Order, which was issued on 13 February 2020, there have been significant delays to the award of this contract (U.S. Department of Defense, 2021). As of 4 September 2020, the award has been reaffirmed and will be granted to Microsoft (U.S. Department of Defense, 2021). Though sustainment of the award is significant, the contract is too new to accurately analyze the amount of funds expended over a substantiable PoP.

b. *DEOS*

The DoD recently announced its re-award of the DEOS Blanket Purchase Agreements (BPA), with a lower ceiling of $4.4 billion dollars and inclusion on the GSA IT Schedule 70 contract vehicle, (General Services Administration, 2020) under the GSA eLibrary SIN 518210C, Cloud and Cloud-Related IT Professional Services (General Services Administration, 2021). The award of the agreement was made to CSRA LLC, as well as its "contractor teaming partners Dell Marketing L.P. and Minburn Technology Group" (General Services Administration, 2020). A search of Electronic Data Access (EDA) revealed that CSRA LLC (BPA number GS35F393CA) has 8 calls to date. Dell Marketing L.P. (BPA number GS35F059DA) has 410 calls, of which only 8 had an obligation value greater than the simplified acquisition threshold. Minburn Technology Group (BPA number GS35F309AA) has 31 calls. The orders occasionally utilized incremental funding, though none inspected included a modification for deobligation.

c. *milCloud 2.0*

A search of EDA revealed that since June 2017, when milCloud 2.0 was awarded, twenty-two modifications have been made to the IDIQ, contract number HC102817D0004. Eight TOs have been cut from the IDIQ, with a total of thirty-two modifications across all TOs. The primary purpose of the modifications is to obligate and deobligate funds, as well as make administrative changes such as reallocation of funds across Contract Line Item Numbers (CLIN) via Military Interdepartmental Purchase Request (MIPR), or corrections to the pay office. Of the thirty-two modifications made to the eight TOs, sixteen were actions for the obligation of additional funds or deobligation of unused funds. Table 4

depicts the TOs, the amount obligated, the amount deobligated by modification, the total amount of funds remaining after deobligation, and the percentage the TOs total funding decreased through deobligation.

Table 4. milCloud 2.0 Task Order Obligations and Deobligations

| Task Order	Modification	Obligation / Deobligation Amount	Date
HC102817F0647	Order P00002	+$600,000.00 -$200,000.00 *Total: $400,000.00* *Decrease by Deobligation: 33.33%*	09 JUN 17 21 FEB 19
HC102818F0589	Order P00002	+$2,102,700.00 -$2,052,320.52 *Total: $50,379.48* *Decrease by Deobligation: 97.60%*	10 APR 18 04 FEB 19
HC102818F0857	Order P00003	+$600,000.00 -$600,000.00 *Total: $0.00* *Decrease by Deobligation: 100%*	07 JUN 18 04 FEB 19
HC108419F0001	Order P00001	+$600,000.00 -$600,000.00 *Total: $0.00* *Decrease by Deobligation: 100%*	18 OCT 18 17 SEP 20
HC108419F0004	Order P00002 P00003 P00005	+$4,770,500.00 -$400,000.00 -$2,889,642.99 -$28,824.47 *Total: $1,452,032.54* *Decrease by Deobligation: 69.56%*	18 OCT 18 03 SEP 19 16 OCT 19 21 DEC 20
HC108419F0136	Order P00001 P00002 P00005 P00007	+$4,495,069.37 +$2,200,000.00 +$5,000,000.00 -$4,004,500.00 -$593,768.39 *Total: $7,096,800.98* *Decrease by Deobligation: 39.32%*	28 MAR 19 29 MAR 19 31 JUL 19 13 FEB 20 22 DEC 20
HC108420F0003	Order P00002 P00003 P00005	+$11,599,345.00 +$4,150,000.00 +$12,764,000.00 -$8,822,335.95 *Total: $19,691,009.05* *Decrease by Deobligation: 30.94%*	04 OCT 19 14 JAN 20 23 MAR 20 22 DEC 20

Task Order	Modification	Obligation / Deobligation Amount	Date
HC108420F0294	Order	+$19,405,000.00	01 OCT 20
	P00001	+$495,000.00	01 OCT 20
	P00003	+$10,597,973.16	30 DEC 20
		Total, Year-to-Date: $30,497,973.16	

Adapted from General Dynamics Information Technology (2021).

It is important to note that in Table 4, deobligation for all task orders occurred outside of the fiscal year in which the obligation took place. Depending on the appropriation category and year, funds are potentially susceptible to expiration. DoD finance procedures and regulations as well as funding appropriations categories are beyond the scope of this project, and further analysis is necessary to identify and accurately quantify potential monetary losses caused by appropriation classifications and the obligations/deobligations occurring across fiscal years.

In order to visually understand the amount of funds removed from each TO, Figure 3 depicts a bar graph of each TO, sequentially, comparing the amount of funds remaining after deobligation. The funds actually used are depicted in blue, the amount deobligated are represented by grey, and the total height of the bar indicates the total amount of funds obligated to the TO during its entire PoP. The current TO, HC108420F0294, was not included in Figure 3 or 4 as its PoP is still ongoing as of 22 April 2021 and no deobligation has occurred yet. It is evident that the procuring office has improved their calculation of the amount of service necessary, decreasing the percentage deobligated from each TO over time. However, this highlights the inaccuracy of the usage calculators, and represents an egregious amount of funds that are obligated and ultimately unused for the purpose for which they were certified. Each task order was over-funded by at least a third, at a minimum.

COMPARISON OF REMAINING FUNDS
AFTER DEOBLIGATIONS FOR
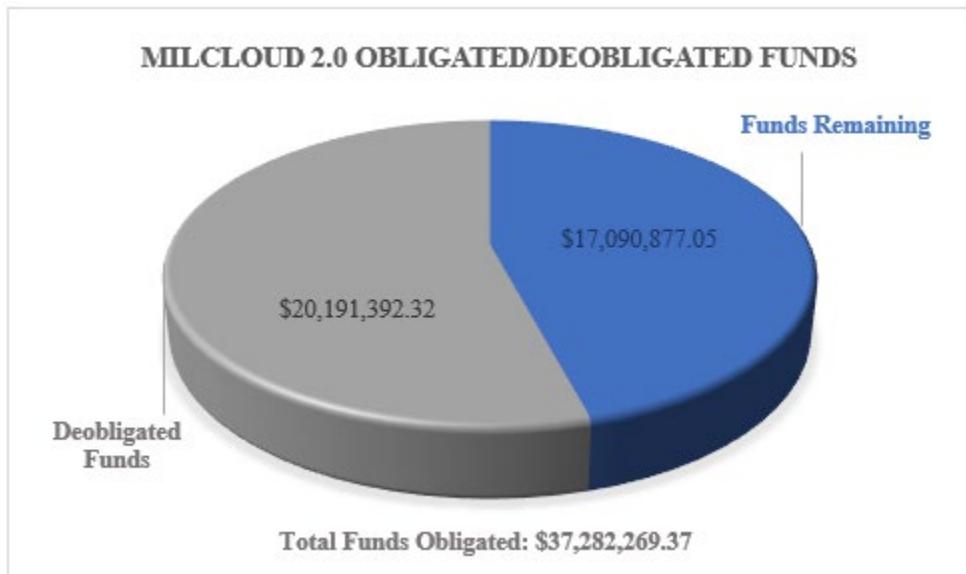MILCLOUD 2.0 TASK ORDERS
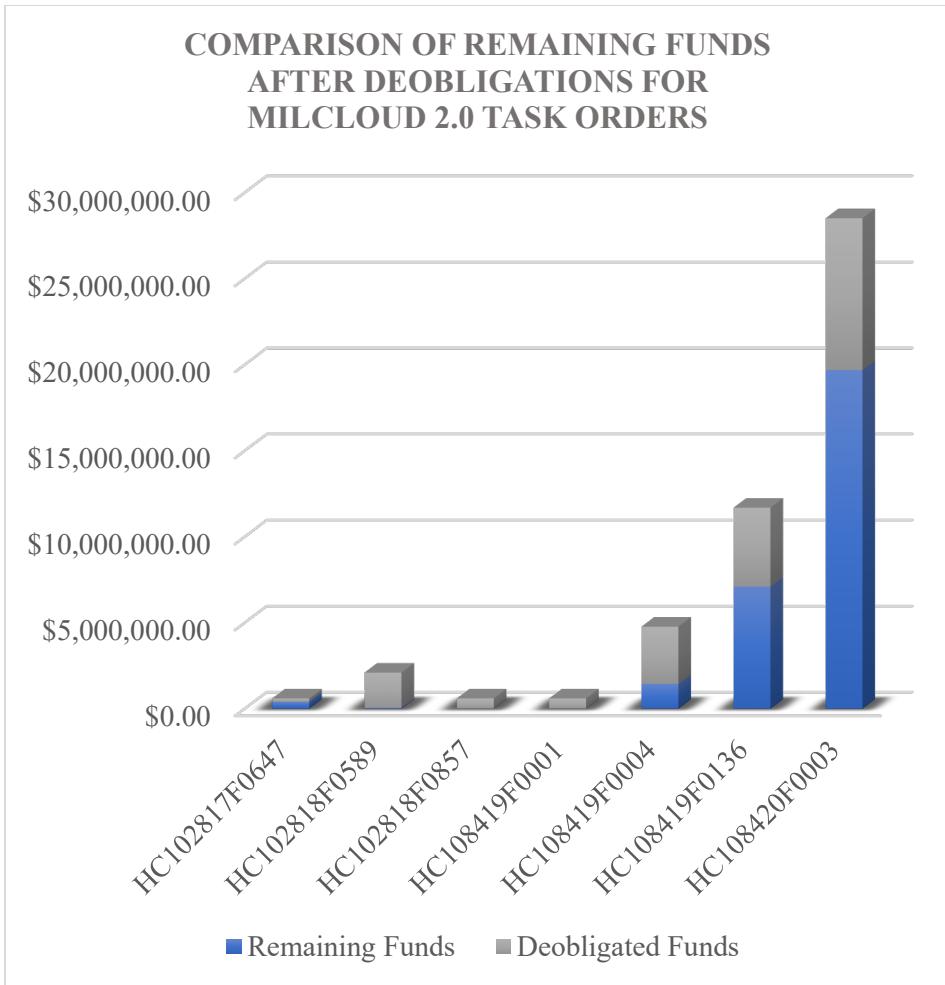
Adapted from General Dynamics Information Technology (2021).
Figure 3. Bar Graph of Remaining Funds and Deobligated Funds,
Compared to the Total Amount Obligated on the Task Order

When viewed cumulatively, as represented in Figure 4, it becomes apparent that the current structure of forward funding contracts is not efficient, leading to the government essentially parking funds on a contract or order, until those funds are deobligated and made available for other use. Figure 4 highlights the fact that for all milCloud TOs, more than 54.16% of the funds obligated ultimately were removed from the TOs. This chart only represents one of the DoD's many contracts. As long as forward financing is mandated for federal contracts, any procurement with a variable need will continue to require deobligation of unused funds, thereby increasing the administrative burden and restricting the government's access to the funds as long as they are still obligated to another contract.

Adapted from General Dynamics Information Technology (2021).

Figure 4. Pie Chart of Cumulative Amount of Funds Remaining after Deobligation, Compared to the Total Amount Obligated Over the Life of the Task Order

5. Cost Effectiveness Analysis Findings

Cloud-based solutions are not cost effective as a service-based acquisition and need to be classified as a new acquisition category with greater flexibility. At the very least, those cloud-based agreements should be structured as a BPA to minimize the administrative burdens as outlined above.

B. NECESSARY CHANGES TO IMPLEMENT

1. Contract Type—Time-and-Materials

Recommendation 43 (2019) states the need for the ability to procure new technology that becomes available after the award of the contract (Section 809 Panel, 2019). The Panel also suggested that a new contract type be established using time-and-materials contracts as its basis. In fact, it concludes that the "optimal contract type for consumption-based solutions will function more like a time-and-material than a firm-fixed-price contract and will automatically capture price reductions in contractors' commercial pricing" (Section 809 Panel, 2019). JEDI addressed this issue by including a "clause in the JEDI RFP and GSA's order-level materials rule that permits up to 33.33 percent of the value of an order to be used for supplies or services not known at the time of award"

(Section 809 Panel, 2019, p.12). Another option would be the inclusion of price lists or schedules, such as those used for IDIQ contracts and BPAs which offer significant flexibility. Inclusion of newly developed technology, whether materials or services, could be accomplished rapidly through modification of an existing contract and ensure that the government obtains commercially available price rates, or discounts through leveraging purchasing power, similar to federal supply schedules. Finally, inclusion of a means of rapidly obtaining contracts at the agency level is essential to scalability.

Time-and-materials contracts and labor-hour contracts are not classified as FP contracts per FAR 16.201(b) and FAR 16.600. Application of a time-and-materials contract suits the requirement for cloud computing. The FAR goes on to state that "A time-and-materials contract may be used only when it is not possible at the time of placing the contract to estimate accurately the extent or duration of the work or to anticipate costs with any reasonable degree of confidence" (Federal Acquisition Regulation, Section 16.601(c), 2021). Due to the evolving, variable nature of direct costs associated with the materials necessary for cloud computing and the inability to estimate the number of labor hours necessary to meet the government's needs for rapid scalability, a time-and-materials contract seems to be a viable solution.

Unfortunately, the existing regulations around time-and-materials contracts were written to the strictest definition of services—labor being performed. For example, FAR 16.601(c)(1) requires government surveillance of contractor performance, as there is no incentive provided to the contractor to control costs or labor performed. Surveillance would be unnecessary for cloud computing if proper performance-based metrics were established, and incentives provided.

Use of time-and-materials contracts in acquisition of commercial items further constrains these contracts to services, requiring either competitive procedures or offers from two or more responsible offerors when using other than full and open competition, according to FAR 12.207(b)(1)(i). Furthermore, the CO must execute a determination and findings stating that no other contract type is suitable, per FAR 12.207(b)(1)(ii)(A). For these reasons, the existing time-and-materials contracts are insufficient for consumption-based acquisitions.

Due to the current structure and limitations of time-and-materials contracts, a new type of contract is necessary to procure consumption-based solutions. To highlight the capabilities and potential applications of this contract, the proposed name is the consumption-based variable price (CBVP) contract type. This consumption-centric contract type, similar to the time-and-materials contract, would be added as a section under FAR 16.6 Time-and-Materials, Labor-Hour, and Letter Contracts, in the same manner that indefinite-quantity contracts fall at FAR 16.504, under FAR 16.5, indefinite-delivery contracts. Supplementation of the language in FAR 16.6, especially expansion of the definitions of hourly rate and materials, would permit consumption-based procurements of commercial items, not limit the applicability of time-and-materials contracts to cloud computing. Implementation would require the FAR Council to modify the content under FAR Part 16 to include the new contract type CBVP, which incorporates characteristics of both time-and-materials, as well as labor-hour contract terms and conditions that are more favorable to the government than FFP arrangements.

2. Contract Type—Modular Contracting

The FAR relates that "when acquiring information technology and related services, consider the use of modular contracting to reduce program risk" (Federal Acquisition Regulation, Section 16.505(a)(5), 2021). The FAR proceeds to define modular contracting as the "use of one or more contracts to acquire information technology systems in successive, interoperable increments" (Federal Acquisition Regulation, Section 39.002, 2021). Modular contracting offers a means to reduce the risk inherent in rapidly evolving IT procurements while incentivizing contractor performance, per FAR 39.103(a). More importantly, this paragraph establishes the basis for agencies to be able to procure IT services in the increment necessary to their requirement—it is not constrained to major systems acquisitions. FAR 39.103(b) goes on to suggest that modular contracting be used to divide an IT system into smaller increments. Furthermore, the FAR emphasizes a need to procure IT rapidly, and states that "to void obsolescence, a modular contract for information technology should, to the maximum extent practicable, be awarded within 180 days after the date on which the solicitation is issued" (Federal Acquisition Regulation, Section 39.103(e), 2021)

The FAR is silent regarding the policies that may be used for its acquisition and only dictates that "solicitations must not describe any minimum experience or educational requirement for proposed contractor personnel" with some exceptions (Federal Acquisition Regulation, Section 39.104, 2021). This section of the FAR would be the ideal location to place a new contract type policy and provide further guidance for modular contracting methods to be used in the acquisition of IT services. Inclusion of recommendations for selection of the proper contract type would significantly reduce Procurement Administrative Lead Time (PALT), as well as reduce the unnecessary administrative burden caused by unwieldy contract types that are ill-suited to the flexible world of IT acquisitions and cloud computing.

3. Contract Type—Utilities

Utility acquisitions are not exempt from the ADA and require an entire payment to be charged to the funding appropriations that fall on the end of a given service's billing cycle, despite fluctuating quantity usage. If a requirement covers several fiscal years, the charge will be prorated to prevent metered costs from exceeding a 1-year period (Government Accountability Office, 2006). Despite this appropriations-related limitation, utility contracts include the contract clause 52.241-8, Change in Rates or Terms and Conditions of Service for Unregulated Services, which allows either party to request a change in the rates of an unregulated service at any time after an established period (Federal Acquisition Regulation, Section 52.241, 2021). This protects the Government from volatile market conditions, but also allows it to take advantage of cost savings during periods of relative stability. Unfortunately, this clause does not extend to the rest of the service-based contracts and consequently, cloud-based services are unable to capitalize on market fluctuations.

C. AFFECTED OVERSIGHT / ACCOUNTABILITY PROCESSES

1. Contract Financing

Cloud computing does not function like a standard service contract. Demand for cloud computing is wildly variable, depending on the consumption of the user throughout the month or year. In order to execute a contract, certified funds must be attached at the award of the contract or task order. For traditional service contracts with a consistent,

quantifiable need this makes sense. The contractor knows the number of personnel needed to perform the service, the number of hours the employee will perform that service monthly, and the rate of pay required by their applicable area wage determination. Contractors then are able to propose a monthly rate, leading to a highly attractive FFP contract for the Government. The consistency also protects the expending unit from loss of access to funds due to deobligation, if performed outside of the fiscal year for which it was appropriated. Other service contracts, especially those with a high amount of variability use FFP contract with NTE CLINS. On these contracts, the funds are allocated, and the contractor bills upon actual usage. This method works for service contracts with a variable demand but can cause problems in administration. Usage must be closely monitored to ensure services are not rendered in excess of the funds available. Sudden or high demand will result in the need to quickly secure additional funds and execute a modification.

This becomes especially troublesome when considering the application to information technology, especially cloud computing, where these services are rendered via automation. The FAR recognized the potential issue caused by the automated service being performed, stating:

> Many supplies or services are acquired subject to supplier license agreements. These are particularly common in information technology acquisitions, but they may apply to any supply or service. For example, computer software and services delivered through the internet (web services) are often subject to license agreements, referred to as End User License Agreements (EULA), Terms of Service (TOS), or other similar legal instruments or agreements. Many of these agreements contain indemnification clauses that are inconsistent with Federal law and unenforceable, but which could create a violation of the Anti-Deficiency Act (31 U.S.C. 1341) if agreed to by the Government. (Federal Acquisition Regulation, Section 32.705, 2021)

Several Cloud service providers claim to offer consumption-based or pay-as-you-go cost models, including JEDI, milCloud 2.0, and the Air Force's Cloud One (U.S. Department of Defense, 2021). The benefit touted for such models is the potential cost optimization, ensuring that users only pay for what they consume. In concept this seems to offer users the ability to pay for actual use, after the use occurs. However, this is not the case – just because the models are called consumption-based, does not mean that they truly are. When the government procures cloud computing services, the contract is funded in

full, upfront, upon award (Garland, 2019). A commercial customer would not accept the same when purchasing cellular phone plans without unlimited minutes. The user cannot accurately forecast the number of calls, text messages, or megabytes of internet data they will use throughout the month, much less a year. It is far more reasonable for the provider to invoice at the end of a billing cycle, for the amount of data they consumed at a rate they agreed to pay. Commercial utility billing is modeled the same way, whether it be for electricity, gas, water, etc. The bills fluctuate with the user's demand but are based on actual usage rather than a forecasted model. Payment in arrears is not a radical concept to anyone but the government. The problem with forward payment of cloud services is that the government is essentially locking themselves into a certain type of hardware and a limited amount of data, for which they can potentially be overpaying. Garland noted that forward payments "[have] little ability to take advantage of service changes or innovations that occur mid-contract, despite dynamic innovation being one of the most important value propositions of cloud" (Garland, 2019, p.2). To continue the comparison to cellular services, forward payment is equivalent to buying a phone, not being permitted to purchase a new model when it arrives and having no way of ensuring that the data paid for is the amount needed or if it will be enough.

The webpage for milCloud 2.0 touts that DoD agencies can "purchase cloud services in as few as 48 hours" (General Dynamics Information Technology, 2021). However, when examined, the actual means of placing an order with an Enterprise Cloud is complex and in no way represents a true consumption or pay-as-you-go model. To place an order through milCloud 2.0, authorized administrators browse for the services that meet their requirement and submit a request (General Dynamics Information Technology, 2021). A calculator is used to estimate their projected total need for the PoP, broken down by the processing speed and memory necessary to meet their need (U.S. Department of Defense, 2021). The projected cost works as a government estimate, for which the user must then secure funding, and load to their account. This creates a stair-stepped funding approach, seen in Figure 5, and requires constant monitoring to ensure that an over run does not occur, thereby creating an Anti-Deficiency Act violation, as the Government exhausted the funds obligated for that action. Although all funds may be expended over time and new funds loaded when necessary, the Government experiences significant, unmeasured monetary

losses by utilizing this model. The most obvious loss is to contract administration and the writing of task orders.

These contracts cannot take advantage of the scalability that the pay-as-you-go model purports to offer or realize the reductions in technology prices as upgrades constantly emerge. Figure 5 presents a visual representation of the funding losses incurred by using forward funding practices.
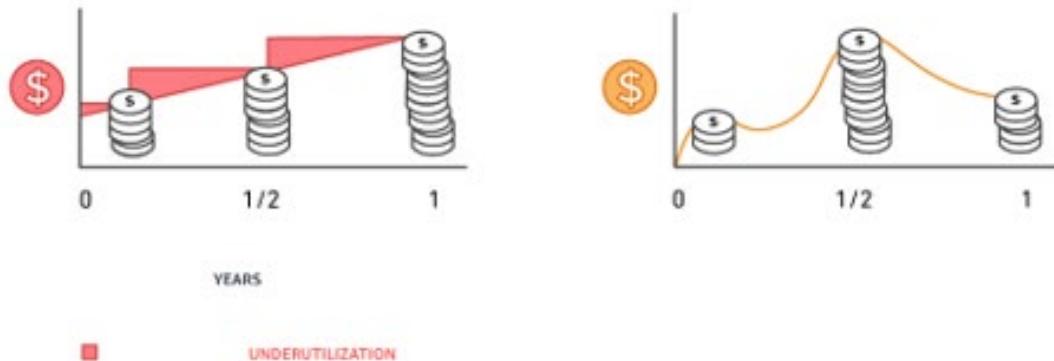
Adapted from Amazon Web Services (2021).
Figure 5.   Stepped Funding versus Consumption-Based Payment

2.   Contract Financing—Government Purchase Card

One of the best tools that the government can utilize for rapid procurement is the government-wide commercial purchase card (GPC). In fact, for micropurchases, the GPC shall be the preferred method of payment, per FAR 13.201(b). *The GPC Expanded Use Guidebook,* dated March 2019, has greatly expanded the threshold for acquisitions with a GPC. For special designations, these thresholds jump significantly, such as permission for GPC use up to $800,000 for Contingency Operations. It is recommended that language be added to the aforementioned *Guidebook* and FAR 13.201 to permit GPC as a means of payment on IT and consumption-based pre-priced contracts. Additionally, a specified higher threshold is imperative for recognizing the powerful flexibility offered as a rapid means of funding orders under these pre-priced contracts. This is further supported by the FAR, which relates that "The Government-wide commercial purchase card may be used to place a task or delivery order if authorized in the basic contract, basic ordering agreement, or blanket purchase agreement" (Federal Acquisition Regulation, Section 13.301(c)(2),

2021). This presents a compelling argument for the GPC as a means of funding and executing orders due to its rapid and flexible procurement method. Additionally, reclassification of consumption-based IT procurements into a new category would remove the threshold constraints imposed by the Service Contract Labor Standards found at FAR Subpart 22.10. Use of GPC as a funding means for consumption-based payment offers an innovative application that could be leveraged to meet federal requirements in a cloud environment, as well as numerous other consumption-based applications, under the GPC expanded use program.

3. Anti-Deficiency Act

The most significant impediment to the federal government realizing the benefit of consumption-based payments is the Anti-Deficiency Act (ADA). Funds must be preloaded to ensure that the Government is not committed to an unlimited liability, and that it is not receiving a service for which it has not yet paid. Steven W. Feldman, retired Attorney Advisor, U.S. Army Engineering and Support Center, noted that

> Violations can occur in a wide variety of factual circumstances, such as: (1) recording an obligation in excess of available appropriations; (2) making payments against an exhausted or insufficient appropriation; (3) making a firm commitment for a multiyear contract absent compliance with the multiyear contracting procedures; and (4) committing the government to a contingent or unlimited liability. (Feldman, 2020)

In order for the DoD to truly gain the benefit of consumption-based payments, significant reform is necessary to the ADA, as well as the methods for ensuring that finances are available. Under current contract financing law, all contracts must have certified funds available, requiring that "before executing any contract, the contracting officer shall (a) Obtain written assurance from responsible fiscal authority that adequate funds are available or (b) Expressly condition the contract upon availability of funds in accordance with 32.703-2" (Federal Acquisition Regulation, Section 32.702, 2021). This method is utilized to ensure that the government does not obligate itself for an acquisition when funding is not available. However, the constraints imposed have created significant administrative burden and caused the government to operate in a manner much different from public entities. In the digital age, it is time for the government to adopt a new means of ensuring that funds are available. The 809 Panel recommended implementation of the

congressional carry-over measure for certain Defense Health Agency IDIQ services (Duncan, 2019). If implemented "for IT contracts, the risk to agencies of overestimating IT services would go down, making budgeting easier for these unique and important services" (Duncan, 2019, p.2). This is a good step toward reform, but the government could benefit from further innovation in its finance practices.

In examining the ADA, the policy's intent is to safeguard the government from overspending by verifying that funds are available. It is recommended that the DoD implement commercial accounting practices, which would ensure a faster and more accurate process of authenticating funding availability. Application of these commercial practices is necessary to permit payments on a consumption basis, post factum.

D.   BENEFITS OF CONSUMPTION-BASED ACQUISITION

1.   Reduced Procurement Acquisition Lead Time

Eliminating cloud computing from the IT services portfolio will lower the number of factors contributing to services related Procurement Acquisition Lead Time (PALT) and aid in the Undersecretary of Defense for Acquisition and Sustainment's efforts of achieving a 50% reduction in PALT from an average of 2.7 years to 1.3 years (U.S. Department of Defense, 2019). It will also enable a more innovative approach to be taken with cloud-based solutions regarding selection of contract type, rather than the order of precedence outlined in FAR 37.102(a)(2), Service Contracting Policy. This proposed strategy also aligns with the Office of Federal Procurement Policy Administrator's directive on reducing PALT through the utilization of innovation practices within acquisition (U.S. Office of Management and Budget, 2021). Though it is not presently included in the memorandum's Frictionless Acquisition Strategies to Reduce PALT, the recategorization of cloud computing solutions could easily be added as Category Modernization under the Acquisition Action section within the initial Acquisition Phase classification.

2.   Leveraged Purchasing Power

By leveraging its purchasing power and stability as a customer, the DoD can negotiate with contractors to gain savings through economies of scale. When corporations send invoices for services that were consumed during a certain billing period, they must wait for the invoice to be received and processed, leading to a delay in payment for services

rendered. There is also a concern about employing debt collectors when these payments are late or suffering a loss of payment if that individual or company suffers a bankruptcy, or other significant delay in ability to pay. The DoD already has a means of receiving invoices and rapidly issuing payments, ensuring that the contractors providing consumption-based services will not endure a significant delay in payment. It is not just cloud services that stand to benefit from the DoD employing consumption-based payments. Utilities, cellular services, and services with a variable need are just a few areas that could be positively impacted by the institution of consumption-based acquisitions.

3.   Actual Usage and Upgradability

With three DoD Enterprise Clouds, and eighteen service specific cloud contracts listed on the DoD Enterprise Cloud Contract Site, it is clear that the DoD has a significant amount of money invested in cloud computing. However, as demonstrated by the case study of milCloud 2.0 above, the DoD is not effectively estimating the demand. This is causing a significant administrative burden, which by the estimates set forth in the cost effectiveness analysis above, equates to a significant loss. Implementation of consumption-based payments would remove the waste associated with the inaccurate calculators, monitoring the amount used to ensure that there was no ADA violation, and modifying TOs to add or remove funds before expiration. Consumption based payments would finally permit the government to pay for the actual amount used.

More importantly, it would permit the DoD to rapidly obtain access to upgraded features without the burdensome need to reprocure or modify the existing contract. If the contractor upgrades their servers, but the current contract includes a certain memory or processing speed in the specifications, the government is constrained by the current conditions of the contract. By implementing consumption-based acquisition, the government would be able to accept the improved service and features offered by the ever-evolving future of information technology.

V.   CONCLUSION

Cloud-based solutions should not be classified as a product or service under the DoD's existing PSC taxonomy but should instead be placed under the purview of a newly created acquisition category. Though the DoD has made progress toward achieving parity with its public sector equivalents, greater acceleration is required if the U.S. Armed Forces are to maintain a competitive edge over the United States' near-peer adversaries.

In examining the structure of recent large contracts for cloud services (e.g., Defense Enterprise Solutions, Joint Enterprise Defense) and comparing them to commercial best practice methods, it was revealed that multiple contract types were being utilized, including IDIQs, BPAs, BOAs, and their associated TOs and calls. Existing Enterprise Cloud solutions also took different approaches, including awards to single and multiple contractors. Multiple award contracts were proven to have a significantly higher price for award and administration versus single award contracts. Additionally, examination of available contract types revealed that no existing structure is the optimal means of procuring cloud computing. Adoption of a new contract type, proposed herein as the Consumption-Based Variable Price (CBVP) type, offers the ability to acquire items that are neither strictly products nor services on an actual usage, in the same manner that such items are procured commercially, by paying after-the-fact.

A review of DoD's taxonomy for supplies and services revealed that cloud computing solutions are currently categorized as a service, yet the PSCs utilized for the most recent contract actions involving cloud-based requirements in FPDS-NG indicated that a combination of both product and service codes were being selected. This mismatch in PSC usage impairs the contract reporting accuracy required by FAR Subpart 4.6 and interferes with the government's effort to measure the influence of contract actions on the national economy.

The Anti-Deficiency Act was identified as being the most significant barrier to instituting a consumption-based billing model for cloud computing solutions. Although the government attempted to take innovative steps towards procuring IaaS solutions on an enterprise level with milCloud 2.0, their billing model still requires end-users to forecast

usage and commit funding upfront, as opposed to a true consumption billing model in which charges are based on actual usage. It is recommended that the government institute commercial accounting practices to posture towards payment methods following consumption of cloud-based solution offerings.

There are several oversight and accountability processes that could be affected by consumption-based acquisition. Analysis indicated that the most significant necessary reforms are to current contract financing laws. In order to implement consumption-based acquisition for the DoD, the requirement for forward funding a contract must be revised. The ADA is the reason that contracts must have certified funds attached upon award, but this law is resulting in unnecessary losses to the DoD through administrative burden, as well as loss of access to funds over-allocated for a particular contract. The DoD should leverage technological advances to create a new means of ensuring funds are available, without needing to forward-fund contracts. The GPC was suggested as a viable means of funding consumption-based acquisitions, in arrears, under the Expanded Use program. For example, adoption of the same threshold for Contingency Operations ($800,000.00) would be more than sufficient for consumption-based payments of cloud computing, based upon the forward-funded award prices currently seen on most of DEOS' 410 calls. Additionally, the GPC offers a rapid payment means that would be attractive to contractors, while reducing the overall administrative burden caused by funding modifications.

Through investigating the potential benefits of instituting a consumption-based approach to acquisition to enhance the DoD's ability to procure modern capabilities at market prices, it was revealed that consumption-based acquisition will reduce PALT, allow the DoD to leverage their purchasing power, and finally pay based upon actual usage, while gaining the benefit of rapid upgradeability. It is imperative that the DoD reduce PALT in order to keep up with the warfighter's requirements. For cloud computing, simple changes to the *Taxonomy for the Acquisition of Services and Supplies & Equipment,* and removal from the IT services portfolio would allow cloud computing to be recognized as an independent category. Recategorization would discharge burdensome requirements imposed in services contracting and allow for a more rapid acquisition process. By leveraging purchasing power, the DoD can gain discounts from economies of scale. Contractors can rest assured that their payment, after delivery, will not be disrupted as the

contract carries the full faith and credit power of the government. Most importantly, implementation of consumption-based acquisition procedures would allow the DoD to invoke commercial practices—paying based upon actual usage and allowing for more rapid acquisition of upgraded technologies.

To achieve the acceleration needed, it is imperative that the DPC, within the OSD, create a special committee to revise the current *Taxonomy for the Acquisition of Services and Supplies & Equipment* policy to add a Dynamic Resources category (Office of the Under Secretary of Defense, 2012). Next, the language in DFARS Part 239 should be amended to eliminate any language that would identify cloud computing solutions as a service. Further, a new contract type, CBVP, should be introduced to FAR Part 16 and recommended as the preferred vehicle in FAR Part 39. Finally, the GPC should be the alternate payment method for the new CBVP contract type. Until such time as the CBVP is created, temporary implementation of higher thresholds for IT requirements in FAR 13.201 would permit use of the GPC as the means to execute TOs from existing IT IDIQs.

Once completed, these changes will optimize the DoD's bargaining position and finally allow its components to leverage the latest evolutionary benefits that the cloud-computing marketplace has to offer as they become available. In keeping with the action orders of the current Air Force Chief of Staff, Gen. Charles Q. Brown, regarding the *Accelerate Change or Lose* strategic initiative (2020), Air Force leadership's adoption of the "Why not?" mentality empowers Airmen to identify and overcome unproductive bureaucratic processes to affect the successful defense of the United States for posterity.

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