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ANALYSIS OF ON-DEMAND FORECASTING METHODOLOGY FOR FUTURE CONTRACT ACTIONS AT NAVAL SURFACE WARFARE CENTER, PORT HUENEME DIVISION (NSWC PHD)

June 2021

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For the past decade and continuing today, Naval Surface Warfare Center, Port Hueneme Division (NSWC PHD) has been in a perpetual state of emergency. Inaccurate forecasting for future contract actions contained in our Long Range Acquisition Forecast (LRAF) has left the NSWC PHD acquisition workforce unprepared to face increasing demands. As a result, more pending contract actions are unknown until the need date arrives and an emergency effort must be initiated to complete the action. This emergent trend can be found throughout the Department of the Navy (DON). It is imperative that a more accurate forecasting model be utilized within NSWC PHD to capture the demand signal of the acquisition workforce.

This thesis reviewed the policy and procedures of the U.S. federal government including those within the Department of Defense (DOD), DON and Navy Sea Systems Command (NAVSEA), and NSWC PHD to understand the procedure for capturing the demand for future contract actions. This research found that the current methodology in place for the LRAF is heavily dependent on the requirement generator and historical references, which do not cover all contracting data at NSWC PHD.

This paper identified a path for the acquisition workforce to incorporate data-driven analytics to its forecasting models to more accurately represent demand for that workforce. This research begins the process of moving toward the data-driven forecasting mentioned and determining the first steps forward.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABPG	Acquisition Best Practice Guide
AFARS	Army Federal Acquisition Supplement
AFF	Adaptive Acquisition Framework
AFFARS	Air Force Federal Acquisition Supplement
CA	customer advocate
CAGE	Commercial and Government Entity Code
CCO	Chief of the Contracting Office
CIMIP	Comprehensive Inventory Management Improvement Plan
CONOPS	Concept of Operations Guide
COTS	commercial off the shelf
CS	contract specialist
DASN(P)	Deputy Assistant Secretary of the Navy (Procurement)
DCCO	Deputy Chief of the Contracting Office
DFARS	Defense Federal Acquisition Regulation Supplement
DOD	Department of Defense
DON	Department of the Navy
DPG	Defense Planning Guidance
FAR	Federal Acquisition Regulation
FPDS-NG	Federal Procurement Data System, Next Generation
FY	fiscal year
FYDP	Future Year Defense Program
GAO	U.S. Government Accountability Office
GWAC	Government Wide Acquisition Contracts
JCIDS	Joint Capabilities Integration and Development System
KO	contracting officer
LRAF	Long Range Acquisition Forecast
MAC	Multiple Award Contract
MASE	mean absolute scaled error
NAICS	North American Industry Classification System
NAVSEA	Naval Sea Systems Command

NMCARS	Navy and Marine Core Acquisition Regulation Supplement
NSWC PHD	Naval Surface Warfare Center, Port Hueneme Division
OSD	Office of the Secretary of Defense
PDF	Portable Document Format
PEO	Program Executive Office
PM	program manager
POM	Program Objective Memorandum
PPBE	Planning, Programming, Budgeting, and Execution
PR	Procurement Request
PSC	Product and Service Code
PSS	Professional Support Service
SAP	Simplified Acquisition Procedures
SOP	Standard Operating Procedure
SPG	Service Program Guidance
SPS	Standard Procurement System
SSM	Component Senior Services Manager
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TLO	Technical Liaison Office
WFC	Warfare Center

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I. INTRODUCTION

For the past decade and continuing to today, Naval Surface Warfare Center, Port Hueneme Division (NSWC PHD) has been in a perpetual state of emergency. Due to unrealistic forecasting for future contract actions as stated in our Long Range Acquisition Forecast (LRAF), the NSWC PHD acquisition workforce has had their demand increase dramatically and as a result more and more contract actions are unknown until the need date arrives and an emergency effort is initiated to complete the action. This emergent trend can be found throughout the DON as highlighted in memorandum No. 4380 dated 24 November 2020 in which the Executive Director of NAVSEA, James H. Smerchansky, emphasized the importance of LRAFs as

> A tool to help industry effectively market their technology, goods, and services, to cognizant components within NAVSEA. In addition, the LRAF acts as an aid for advanced acquisition planning for our customers to gain a better understanding of NAVSEA requirements. Establishing a comprehensive NAVSEA LRAF will foster communication between NAVSEA and industry, increase competition, and promote industry planning by providing advanced knowledge of NAVSEA requirements. (Smerchansky, 2020)

It is imperative that a more accurate forecasting model be utilized within NSWC PHD to capture the demand signal of the acquisition workforce.

Demand Forecasting is an integral part of the Planning, Programming, Budgeting, and Execution (PPBE) Process that the DOD uses for resource allocation. “The PPBE serves as the framework for DOD civilian and military leaders to decide which program and force structure requirements to fund based on strategic objectives” (McGarry & Peters, 2018). We need accurate forecasts to address workforce requirements, organizational and programmatic funding allocations, and schedule constraints. Although the main purpose of the PPBE is to inform Congress of the DOD’s budgetary needs, without demand forecasting, the information that is provided would be useless. All elements must work together in order to ensure they are delivering the best products and capabilities to the warfighter. Contracting officers (KO) and contract specialists (CS), specifically, are charged with protecting taxpayer’s dollars and getting the best deal for the product or

service being procured. Demand forecasting is an essential part of this process that must be improved.

This research is important in identifying a path forward for the acquisition workforce to incorporate data-driven analytics to its forecasting models to more accurately represent demand for that workforce. The purpose of this research is to begin the process of moving toward the data-driven forecasting mentioned, determining how accountability can generate more accurate user inputs, and identifying what those first steps can be with additional research conducted.

A. JOINT APPLIED PROJECT STATEMENT

This joint applied project focuses on research seeking to determine the focus areas that prevent Navy organizations, specifically NSWC PHD, from conducting proper forecasting of demand for future contract actions. Additionally, research will analyze the factors and variables that are necessary for accurately forecasting demand as well as identifying data that could be used to construct an accurate demand forecasting tool. The data collection will focus around current NSWC PHD policies, directives, and briefings regarding current demand forecasting methodology as well as scholarly articles, journals, and other literature to provide the majority of our analysis on the path forward in development of this theoretical forecasting model.

B. RESEARCH AND ANALYSIS METHODOLOGY

This research reviews government documents related to the policy and procedures of the U.S. federal government including those within the DOD, DON, NAVSEA, and NSWC PHD, respectively. The purpose of these reviews is to comprehend the current procedures for capturing the demand for future contract actions. Additionally, this research includes a review and analysis of historical data available within NSWC PHD regarding their results of current existing methodology of forecasting demand through their LRAFs as well as to identify the variables that can be utilized in a data-driven theoretical forecasting tool. These LRAFs were compared with actual data from Federal Procurement Data System, Next Generation (FPDS-NG) to conduct a preliminary analysis regarding the accuracy of the current methodology.

The primary research question that will be answered is regarding what focus areas prevent proper forecasting of demand for contract actions. The secondary research question that will be answered in our analysis is regarding the factors or variables necessary for accurate forecasting of contract demand as well as what data can be used from the contracts processes and the technical processes to construct an accurate demand forecasting model. The following chapters describe the background, literature review, research methodology, and analysis used to address the identified research questions.

C. ORGANIZATION

In the subsequent chapters, we will present research and analysis to determine the best methodology for forecasting contract demand for NSWC PHD.

Chapter II provides a background into the history of demand forecasting from a DOD, NAVSEA, and NSWC PHD perspective as well as detailing the source for the data used by NSWC PHD in their forecasting methodology.

Chapter III discusses the literature review of sources identifying the various methodologies of forecasting utilized by U.S. Government agencies including those of the DOD. This literature includes data for NSWC PHD with regard to their LRAFs and actual data for later comparative analysis.

Chapter IV encompasses our analysis, which answers the primary and secondary research questions, which detail the methodology of our research and analysis as well as additional analysis conducted regarding the benefits of a theoretical forecasting tool and the resources available to evaluate the effectiveness and accuracy of the tool.

Chapter V provides a conclusion to our research and analysis and provides some direction in terms of additional research needed for this topic.

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II. BACKGROUND

A. HISTORY OF DOD DEMAND FORECASTING

The Acquisition Process, also known as the big "A" acquisition, incorporates three essential decision support templates in order to identify, budget and procure systems and services. These decision support systems include the Joint Capabilities Integration and Development System (JCIDS), the Adaptive Acquisition Framework (AAF) (often referred to as little "a" acquisition) and the PPBE. The first step in any new procurement is to ensure that the process has clearly identified requirements (usually derived from JCIDS for programs of record and major defense acquisition programs). Once those requirements are identified (either through JCIDS or through directed requirements) then the development and management of those requirements is necessary (through the AFF) and ultimately, the PPBE process provides resources to tie all of these together to get the product to the warfighter. DOD policy mandates that a Program Manager (PM) be assigned to all acquisition programs. According to the PPBE process on the AcqNotes website, "the role of the program manager (PM) is to direct the development, production, and initial deployment (as a minimum) of a new defense system. This must be completed within limits of cost, schedule, and performance, as ratified in the acquisition program baseline" (Brown, 2010).

> The Program Objective Memorandum (POM) is a recommendation from the Services and Defense Agencies to the Office of the Secretary of Defense (OSD) concerning how they plan to allocate resources (funding) for a program(s) to meet the Service Program Guidance (SPG) and Defense Planning Guidance (DPG). The POM is part of the Programming phase of the PPBE process, when planning decisions, programming guidance, and congressional guidance is converted into a detailed allocation of resources. The POM covers the five year Future Year Defense Program (FYDP) and presents the Services and Defense Agencies proposal on how they will balance their allocation of available resources. The POM includes an analysis of missions, objectives, alternative methods to accomplish objectives, and allocation of resources. (PPBE Process, 2018)

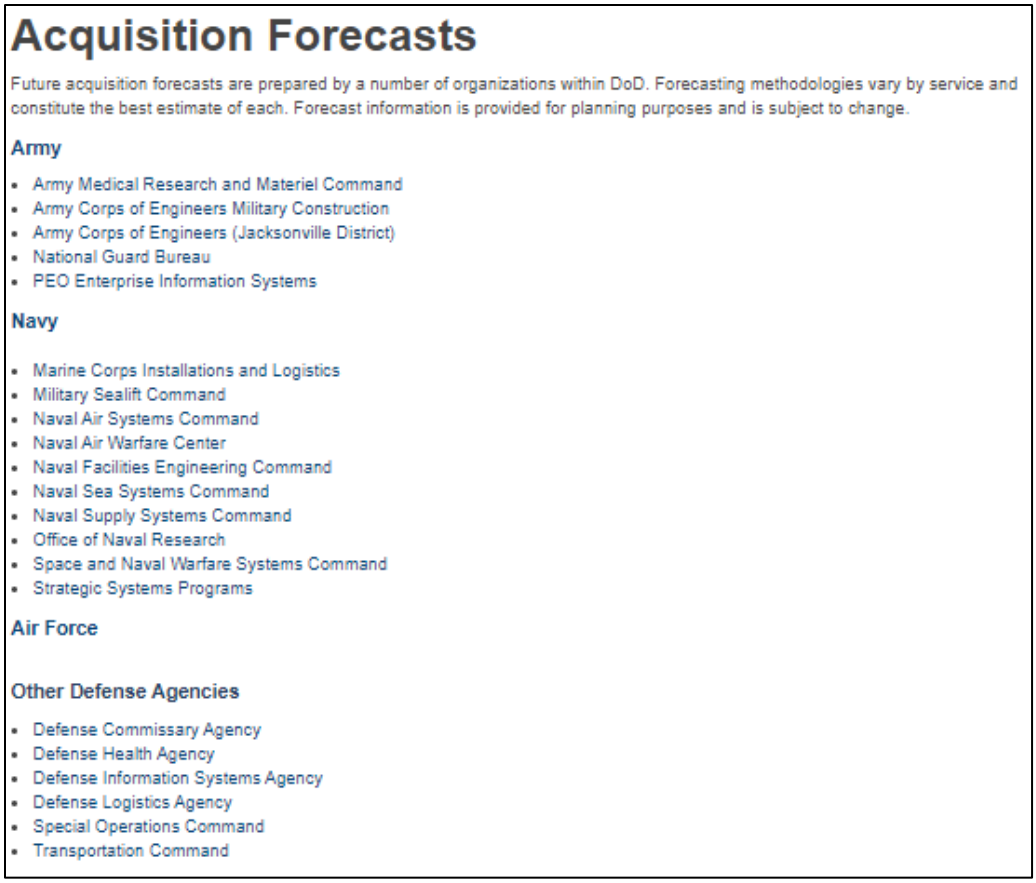
"The PM's role, then, is to be the agent of the military service or Defense agency in the defense acquisition system to ensure the warfighter's modernization requirements are met efficiently and effectively in the shortest possible time" (DAU, 2017).

The PM holds the key to understanding all program requirements and is designated as the party responsible for forecasting development and accuracy. Demand forecasting directly connects to the five-year Future Year Defense Program (FYDP) and is extremely important to the entire big "A" acquisition system.

Within the DOD at large, there is no procedural directive regarding forecasting acquisition demand. There is a mention of demand forecasting in DoDI 5000.74 entitled, "Defense Acquisition of Services." It states that the Component Senior Services Managers (SSMs) should "develop services forecasting tools to predict the renewal of requirements and new requirements in order to support early acquisition planning, budget development, and requirements approval, and to publish the forecast in accordance with the Small Business Act" (Lord, 2020). While this is a directive that instructs SSMs to produce a forecasting tool, this tool was developed for service contracting only in accordance with the Small Business Act. This tool was not intended to be used for total acquisition demand forecasting for any activity. Additionally, there is no procedural direction on how the forecasting tool mentioned in the directive is to be leveraged. This means the demand forecasting methodology between different commands within the DOD can vary greatly.

B. CURRENT DOD AND DON POLICIES REGARDING DEMAND FORECASTING

From a broader policy approach, Federal Acquisition Regulation (FAR) 5.404 states that in order "to assist industry planning and to locate additional sources of supply, it may be desirable to publicize estimates of unclassified long-range acquisition requirements. Estimates may be publicized as far in advance as possible" (FAR 5.404, 2020). In fact, the DOD Office of Small Business Programs currently provides industry with access to every branch and other defense agencies LRAFs via their website in accordance with United States Code Title 15, Section 637, (A) (12) (c). See Figure 1 for a list of all LRAFs available to industry.



Acquisition Forecasts

Future acquisition forecasts are prepared by a number of organizations within DoD. Forecasting methodologies vary by service and constitute the best estimate of each. Forecast information is provided for planning purposes and is subject to change.

Army

- Army Medical Research and Materiel Command
- Army Corps of Engineers Military Construction
- Army Corps of Engineers (Jacksonville District)
- National Guard Bureau
- PEO Enterprise Information Systems

Navy

- Marine Corps Installations and Logistics
- Military Sealift Command
- Naval Air Systems Command
- Naval Air Warfare Center
- Naval Facilities Engineering Command
- Naval Sea Systems Command
- Naval Supply Systems Command
- Office of Naval Research
- Space and Naval Warfare Systems Command
- Strategic Systems Programs

Air Force

Other Defense Agencies

- Defense Commissary Agency
- Defense Health Agency
- Defense Information Systems Agency
- Defense Logistics Agency
- Special Operations Command
- Transportation Command

Figure 1. Acquisition Forecasts. Source: DOD Office of Small Business Programs (2021).

While DOD's guidance comes directly from the FAR and United States Code, it states that it would be desirable to construct long-range acquisition forecasting tools while providing no direct procedural or direct requirement to produce a forecasting tool. The Defense Federal Acquisition Regulation Supplement (DFARS) specifies that "in order to facilitate planning of peer reviews, the military departments and defense agencies shall provide a rolling annual forecast of acquisitions that will be subject to DOD peer reviews at the end of each quarter to the Deputy Director, Defense Procurement and Acquisition Policy" (DFARS 201.170, 2020). Within the Navy and Marine Core Acquisition Regulation Supplement (NMCARS) 5205.404, it states that activities must "submit an annual long-range acquisition forecast, using the format provided in Annex 25, to Deputy Assistant Secretary of the Navy (Procurement) (DASN(P)) by email with the subject

[Activity Name] FAR 5.404 Long Range Acquisition Forecast by 20 June annually" (NMCARS 5205.404, 2020). This provides a directive on how and when long-range acquisition forecasts are to be produced by Navy and Marine Corps activities.

48 CFR § 5.404 and FAR 5.404 states that in order, "to assist industry planning and to locate additional sources of supply, it may be desirable to publicize estimates of unclassified long-range acquisition requirements" (FAR 5.404, 2020). Ultimately, the forecast is a consolidation of known future requirements given to activity's contract offices through their technical department counterparts. This means that the entirety of our forecasting methodology relies on the construction of LRAFs with contributions solely deriving from information provided by each command's technical departments. Lack of procedural direction on how to produce LRAFs and without competent technical departments providing timely submissions of future requirements to the LRAF, the future demand signal would be inaccurate from the start.

Similarly to the NMCARS, the Army Federal Acquisition (AFARS) Subpart 5101.170(a)(2) and Air Force Federal Acquisition Supplement (AFFARS) Subpart 5301.170(a)(2) prescribe their agencies to facilitate planning for DOD Peer Reviews on a quarterly basis and no methodology is specified. The latest LRAF for fiscal year (FY) 2019 from the Army Medical Research and Materiel Command available at the Office of Small Business Programs website mentioned that their acquisition forecast corresponds to a threshold of greater than $250,000 and includes a disclaimer that the forecast is not all-inclusive and may be subject to change (U.S. Army, 2019).

C. CURRENT NSWC PHD POLICIES REGARDING DEMAND FORECASTING

NSWC PHD issued NSWCPHDINST 4200.3 entitled, NSWC PHD Strategic Acquisition Planning and Execution Process. This instruction directs NSWC PHD employees to utilize the Acquisition Best Practice Guide (ABPG) for the use of planning and executing contracts. The ABPG is hosted in the Wiki pages of NSWC PHD Contracts Department, Code 02 (Acevedo, 2018). The ABPG requires that all contract actions valued over $750,000 be maintained using the SeaPort eMilestones system. NAVSEA complies

with the requirement by posting the LRAF directly on their business partnership website, which is divided among them, NAVSEA Headquarters, and the NAVSEA Enterprise. This includes component commands such as NSWC PHD (NAVSEA, 2020b). These long-range acquisition forecasts are ultimately Microsoft Excel © sheets turned into Portable Document Format (PDF) documents listing requirements known to the activities various contract office divisions and technical departments. This information is given to the contract office based on the use of the SeaPort system. SeaPort is an electronic procurement portal "whose core is a commercial off the shelf (COTS) system, provides a secure automated procurement process that improves processing time, provides the ability to take advantage of numerous acquisition reform initiatives, including award term contracting, reverse auctioning, and electronic signatures, while still allowing PMs the ability to select solutions that meet their Professional Support Service (PSS) requirements" (SeaPort, 2020). Similar to other Government Wide Acquisition Contracts (GWAC), SeaPort is utilized for specific service contracts awards and has a SeaPort eMilestone module that allows for requirements holders to submit information on their requirements at any moment to construct not only a long-term acquisition plan but also provide a systematic roadmap in the solicitation and award of contracts to complete the requirements. The information within the SeaPort eMilestone system is used to complete the required LRAFs.

D. SEAPORT DATA

SeaPort's Concept of Operations Guide (CONOPS) provided this research procedural and policy guidance to support our assumption that SeaPort contract actions are limited to specific thresholds and North American Industry Classification System (NAICS), causing the LRAF to be based on only a portion of all contract actions at NSWC PHD. Per SeaPort's CONOPS, Section 2.1, Seaport is only authorized for non-commercial services. Also according to SeaPort CONOPS, section 3.2.4, SeaPort only allows for solicitation and subsequent task orders with a NAICS of 541330 using exception Military and Aerospace Equipment and Military Weapons (SeaPort PMO, 2016).

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III. LITERATURE REVIEW

A. THE CURRENT PROBLEM AND BACKGROUND INFORMATION

The Navy's acquisition community is in a perpetual state of emergency when it comes to acquisitions within their respective organizations. For NSWC PHD, the majority of the workload is rapid development of contract actions due to inconsistent demand signals from the technical departments (NAVSEA, 2020a). The authors theorize that the Navy, specifically NSWC PHD, is not conducting thorough demand forecasting to ensure the acquisition community is prepared for the real-time demand signal. This theory is based on the construction of the LRAF for NSWC PHD through inputs solely provided by the technical departments. NSWC PHD constructs their LRAF in a two-step process. First, NSWC PHD utilizes the SeaPort tool provided by NAVSEA. This tool consists of an eMilestones module where all large contracts over a certain threshold are planned through set milestones and tracked to their completion by the acquisition community and technical departments. NSWC PHD constructs its LRAF partially by taking all the available data in the eMilestones module and adding this to a forecast of upcoming large contracts for NSWC PHD. The second process to construct LRAF consists of technical department "portfolios." NSWC PHD requires the technical departments to provide a self-constructed portfolio, which should include all contract actions that will be needed in a five-year window. This data is also added to the LRAF to generate what can be known as NSWC PHD's forecast of contract demand. The current problem resides in the dependence of accurate data provided by the technical departments concerning both steps of the LRAF construction process. Without any additional perspective on forecasting accurate demand signals, the LRAF consistently does not account for contract actions that are emergent in nature due to ineffectiveness in the technical department's ability to forecast their own demand signals (Acevedo, 2018). This literature review evaluates the accuracy of the forecasting model that is utilized by NSWC PHD currently by conducting an analysis of how professional forecasting methodology is used in other government agencies and how that compares in its accuracy to what NSWC PHD utilizes for their demand forecasting. Finally, we will discuss the potential benefits of the development of a more accurate LRAF

utilizing methodology that is widely accepted amongst the available professional forecasting literature.

B. CURRENT DEMAND FORECASTING DOCUMENTATION

Within the DOD at large, there is no procedural directive regarding the forecasting of acquisition demand. Additionally, there is nothing within the DOD that provides the acquisition community with a forecasting tool to determine future acquisition demand. This literature review explores the methods currently being used for forecasting demand, the common issues making forecasts inaccurate as well as methods of forecasting that have been found to be successful.

In accordance with 48 CFR § 5.404 and FAR 5.404, long-range acquisition estimates "may be desirable to publicize estimates of unclassified long-range acquisition requirements. Estimates may be publicized as far in advance as possible" (FAR 5.404, 2020). As a result, the DOD and other federal agencies utilize long-range acquisition forecasts to facilitate industry planning as well as find additional sources of supply. The Rand Corporation published a study that identified and analyzed 18 forecasting models and 59 automated and hard copy data resources. The study suggested, "A profitable adaptation of the realist theory to long-range planning could be accomplished by assessing the factors of national power, forecasting their likely future status on a national and regional basis, and then evaluating the likely political impacts on that future environment. This approach, deriving forecast from projected "levels of threat," is a direct application of the method used and recommended by personnel at the Army War College" (Miller et al., 1989). A report published by The Quarterly, describes the method used by the DOD in preparation of one- and two-year expenditure forecasts for long-range forecasts (Ackerman & Presby, 1967). The method consists of four steps. The first being express expenditures, by month, as cumulative portions of Obligated Authority. The second step is to plot percent cumulative expenditures versus time. The third step is to estimate the pattern factors by computing the percent of total expenditures in each year subsequent to appropriation with an adjustment for the ultimate expenditure factor. The final step is to estimate the pattern factors by computing the percent of total expenditures in each year subsequent to

appropriation with an adjustment for the ultimate expenditure factor (Ackerman & Presby, 1967). Another study published by the Rand Corporation recommends using a structured set of simulation models to properly assess probability since the further the predictions are, the more the uncertainties multiply, the more intuitive the prediction becomes, and confidence in prediction degrades (Gordon & Helmer, 1964). Therefore, long-range forecasts should make an effort to obtain intuitive judgement as systematically as possible from recognized experts in the area of concern until a satisfactory predictive theory of the phenomena in question becomes available (Gordon & Helmer, 1964). This shows that a more data-driven simulation model of forecasting contract demand will produce a more accurate LRAF for NSWC PHD than its current state, which will include more prospective information than what is currently provided by technical departments. It is clear through the data regarding the accuracy of demand forecasting within NSWC PHD that this new data-driven simulation model that utilizes regression analysis has the potential of increasing the accuracy of that demand forecast.

C. NSWC PHD DATA REGARDING ACCURACY OF DEMAND FORECASTING

Locally, NSWC PHD issued NSWCPHDINST 4200.3 entitled, NSWC PHD Strategic Acquisition Planning and Execution Process. This instruction directs NSWC PHD employees to utilize the ABPG for the use of planning and executing contracts. The ABPG is hosted in the Wiki pages of NSWC PHD Contracts Department, Code 02 (Acevedo, 2018). The ABPG is an all-encompassing guidance document produced by the contracts department of NSWC PHD in order to provide its customers with a procedural document that follows requirements from cradle to grave with supporting documentation to allow technical customers the ability to support the contracts department with the awarding and administration of contracts for their respective requirements. The ABPG requires that all contract actions valued over $750,000 be maintained using the SeaPort eMilestone system. This limits the ability for NSWC PHD to produce an all incorporating demand forecasting tool for the acquisition workforce. While the percentage of contract actions that are not accounted for varies with each LRAF produced comparative to the actuals, one LRAF for FY 2017 highlighted that 75% of contract awards were not

accounted for within that specific LRAF alone (NAVSEA, 2017a). The need for a more inclusive tool that can accurately forecast the entire demand for the acquisition community is needed. The magnitude of this problem once again varies with each published LRAF. The LRAF for FY 2017 shows that 63 contract awards valued at hundreds of millions of dollars of contract values were not identified when compared with actual contract awards for that FY. (NAVSEA, 2017a). Furthermore, the accuracy of the data within the SeaPort eMilestone system is in question because the data is entirely driven by user inputs provided by the technical department for future requirements. This contributes to the aforementioned problem of unaccounted for requirements within the LRAFs. Currently, the LRAF provided by NSWC PHD does not accurately reflect the anticipated requirements for the contracting office at NSWC PHD due to the inability of the technical departments to communicate all their future requirements. The main reason for this miscommunication is yet to be determined definitively. The data shows that technical departments are not communicating all their requirements in SeaPort and their department portfolios and thus missing within the LRAFs. The technical departments may be deficient in experienced customer advocates (CA) that are crucial in communicating future requirements from the program offices to the technical departments within NSWC PHD.

Data regarding the LRAF for NSWC PHD is sparse. The repository for LRAFs within NSWC PHD has many missing files. Recently, these LRAFs have had a resurgence in priority and thus LRAFs for FY 2020 contain the most dependable data. However, we will evaluate FY 2017 as well. During FY 2017, LRAFs were updated monthly. The authors conducted an analysis of FY 2017 for the months of March and October to see the evolution of these LRAFs as time progresses and compare that to the known actuals. We will do the same for the last completed LRAF conducted in FY 2020.

For FY 2017, the LRAF for March and October both contains forecasted contract awards ranging in value from $1M to $100M by the FY of anticipated award. There are 22 estimated contract awards for FY 2017, 7 contract awards for FY 2018 and 6 contract awards for FY 2019 (NAVSEA 2017a). We can compare this to the October's LRAF of that same year to see the evolution of how these actions are estimated. For October 2017, the LRAF contained 8 contract actions for FY 2018 and 12 contract actions for FY 2019

(NAVSEA, 2017b). The actuals for the fiscal years contained within these LRAFs show the inaccuracies of the methodology used to construct these LRAFs. The actual contract awards included 85 contract awards for FY 2017, 117 contract awards for FY 2018 and 115 contract awards for FY 2019. These actuals account for all contract awards. With regard to only large contract awards, the actual large contract awards included 60 contract awards for FY 2017, 37 large contract awards for FY 2018, and 72 large contract awards for FY 2019. It is clear, through this basic analysis of comparing the forecasted awards to the methodology used in FY 2017 that is still being used today, that this methodology does not produce the most accurate results. However, these LRAFs did not include the newly generated department portfolios. By comparing the most recent LRAF with actuals, we can see if the use of department portfolios has increased the accuracy of the forecasting methodology used by NSWC PHD to the point of being completely accurate or if there is a need for a different methodology.

The NSWC PHD LRAF corresponding to the first quarter of FY 2020 contained a list of 50 service and material requirements with anticipated award dates ranging from the first quarter of FY 2020 to the fourth quarter of FY 2024. The anticipated dollar value of these requirements ranged from $1M to over $250M. The last published NSWC PHD LRAF corresponding to the last quarter of FY 2020 contained a list of 40 service and material requirements with anticipated award dates ranging from the first quarter of FY 2021 to the fourth quarter of FY 2024. The anticipated dollar value of these requirements ranged from $1M to over $250M. At the same time, total award data published on FPDS-NG revealed that NSWC PHD awarded a total of 249 contract actions in FY 2020. FPDS-NG also revealed that, out of the 249 actions awarded in FY 2020, 33 contract actions corresponded to large contract awards with total dollars obligated ranging from $0 to $25.4M. In addition, 215 contract actions were awarded under Simplified Acquisition Procedures (SAP) with total dollars obligated ranging from $105 to $2.9M. NSWC PHD's LRAF for the first quarter of FY 2020 only listed a total of 17 contract actions to be awarded during FY 2020 (NAVSEA, 2020a). It is clear that the current procedures for long-range forecasting of contract actions by NSWC PHD does not include all anticipated contract actions and thus does not provide maximal benefit to the acquisition community.

Additionally, it shows that the technical department driven data on large contract actions alone is inaccurate excluding the vast inaccuracies regarding total contract actions including SAP actions. This shows that there is an opportunity within the existing procedures for improvement through the utilization of a more data-driven simulation model for forecasting contract actions.

D. THE STAKEHOLDERS WITHIN NAVY AND NSWC PHD THAT COULD BENEFIT FROM DEMAND FORECASTING OF CONTRACT ACTIONS

Within NSWC PHD, the stakeholders that could benefit from demand forecasting of contract actions include the entirety of individuals within the command who must utilize this information to anticipate and balance workload within their respective departments. Specifically, those who would most benefit from a more accurate demand forecast for contract actions are the Chief of the Contracting Office (CCO) and the Deputy Chief of the Contracting Office (DCCO). The CCO and DCCO represent the leadership of the acquisition department for NSWC PHD and are primary responsible for the execution of the portfolios of the technical departments within the command. With a more accurate forecasting model, the CCO and DCCO could staff the acquisition department more adequately to ensure this new demand signal is executed efficiently. This will ensure that the acquisition community is not overloaded with emergent contract actions that were not anticipated by current demand forecasts. The individual acquisition community employees would benefit through more realistic workload management ability through their department leadership and thus more balanced and representative workload for each individual community member. This will have a direct impact on retention rates of the acquisition department because the community members will not be overworked to the point of departure from the command. The additional benefit of this retention continues with the community retaining more individuals with the experience associated with the procurements needed by the command. A more efficient and happier workforce can provide better services to the technical departments. These technical departments will benefit as well with this model as it will provide a detailed report of potential deficiencies with their self-identified anticipated contract actions garnered through the SeaPort system. The technical departments could use this new forecasting model to see that there are more

or less contract actions that are anticipated for the following FY compared to what is established by the departments themselves. It will stimulate more thoughtful assessments of future contract actions by the technical departments and will bolster their ability to provide the full demand signal in SeaPort as well as their individual department portfolios.

Within the DON more broadly, the stakeholders that could benefit from demand forecasting of contract actions include those mentioned above but taken to the logical extension of the DON at large. Each contracting office within the DON can benefit of the utilization of this theoretical data-driven forecasting model. The DON can see efficiencies with regard of the staffing of the various contract offices. This includes their workload balance as well as the quality of the end products provided by the contracts office given that these offices will no longer be in perpetual states of emergency given the decrease of unknown emergent contract actions that were not accounted for in the current forecasting model. The various Program Executive Offices (PEO) will see significant increases in the satisfaction of the various contracts offices that they utilize for their needs directly because of the benefits of this theoretical forecasting model. This thought process could be extended indefinitely to highlight the benefits of the model. With an accurate forecasting model, technical departments and PEO will see the benefit of a model to compare their requirements with to ensure no contract actions are overseen and not included. The contracts office will see more accurate demand signals from their technical departments and will be able to staff themselves to anticipate this accurate demand signal. The customers and the Fleet will see contracts that are more efficient and effective because these contracts are no longer rushed due to emergent environments. Leadership of each command as well as the upper echelons of the Navy will have more accurate demand signals and thus be able to construct more accurate budgetary requests based on this data. Additionally, the leadership of DON will have accurate data to bolster these requests. Congress will benefit with a more accurate representation of the needs of the DON and more broadly the DOD if adopted by this theoretical model. Finally, the taxpayer will benefit with more efficient representation of their tax dollars as the DOD becomes better stewards of the taxpayer dollars due to these efficiencies. The result of this exercise of identifying stakeholders that will benefit showcases that the entire system and all the

moving parts of the system of DOD acquisition would benefit through the utilization of this theoretical data-driven demand forecasting model using regression analysis. This model will benefit the country as a whole and provide for better mission readiness.

Thus, a new approach to acquisition demand forecasting is needed that can utilize available data and variables to produce a more accurate estimate of acquisition demand and circumvent the apparent communication breakdown from the technical department to the contracting office. In a future state, this theoretical data-driven forecasting tool can be used to ensure the accuracy of the tools mentioned above and to certify the demand signal listed in the LRAF is accurate while also forecasting the specific contract actions of future requirements as well.

IV. ANALYSIS

A. PRIMARY RESEARCH QUESTION

1. What Focus Areas Prevent Proper Forecasting of Demand for Contract Actions?

NSWC PHD heavily relies on SeaPort's eMilestones module in order to produce a LRAF for service and materials acquisitions. Due to NSWCPHDINST 4200.3 and local policy found in the ABPG, only a portion of contract actions are being recorded in SeaPort's eMilestones module. In addition, a separate SeaPort module is currently utilized as a tool to award service contracts in 23 functional areas including Engineering, Financial Management and Program Management (SeaPort, 2020). As a result, only portions of NSWC PHD's service contracts are awarded in SeaPort's contract awarding module. In addition, according to SeaPort's CONOPS, section 2.1, Seaport is only authorized for non-commercial services (SeaPort PMO, 2016). Standard Procurement System (SPS) is currently used for every other contract action and award that does not meet SeaPort's requirements. Therefore, NSWC PHD utilizes SPS to award other Services, Large Material Purchases, Simplified Acquisitions, and Credit Card Purchases. SPS does not have a module to keep track of contract actions. Therefore, the list of pre-awards that are not recorded in SeaPort's eMilestones module is unknown for LRAF purposes.

As a result, NSWC PHD only monitors limited Large Materials and Service Requirements above a $750,000 threshold through SeaPort's eMilestones module. The threshold was set to match the cost and pricing data threshold at the time the NSWCPHDINST 4200.3 instruction was signed. However, in accordance with FAR 15.403-4, "the threshold for obtaining certified cost or pricing data is $750,000 for prime contracts awarded before July 1, 2018, and $2 million for prime contracts awarded on or after July 1, 2018" (FAR 15.403-4, 2020).

As mentioned before, SeaPort's eMilestones module is capable of generating reports that are later used to forecast acquisitions for NSWC PHD, including but not limited to the LRAF. The following paragraphs will provide an analysis of NSWC PHD's

Strengths, Weaknesses, Opportunities, and Threats (SWOT) for their current LRAF methodology.

Strengths: Due to local policy, SeaPort's eMilestones module is a centralized repository to keep track of new requirements and their progress until award. This module helps the acquisition team control the time and effort needed to execute labor-intensive pre award activities. SeaPort's eMilestones module is also utilized to keep track of large material requirements that meet the threshold established by local policy despite DoDI 5000.74 recommendation to forecast service acquisitions only. The NAVSEA eMilestone strategic acquisition planning and execution process is a shared responsibility/ownership between NAVSEA Contracts and NAVSEA Directorates and affiliated PEOs. The PM is responsible for the timely acquisition of their Program Office's requirements detailed in the Program Objective Memorandum or comparable budgetary document. Therefore, the PM is responsible for identifying these requirements and initiating the acquisition process. This includes the creation of the draft eMilestone form, including a description of the required supplies or services, estimated value, criticality rating and populating the planned completion dates for the first 27 advance planning eMilestone events through the Procurement Request (PR) submission to the Contracts Office, as a Program Office representative is listed as the accountable person for these events on the form (Seaport, 2021). Additionally, the SeaPort's eMilestones module generates reports on demand for milestones progress and variations that are later used by the command's leadership to identify areas of improvement and monitor requirements' progress. In essence, SeaPort's eMilestones module not only assists the acquisition team in tracking milestones, but also identifies, at a minimum, the acquisition personnel required to perform pre-award activities and that is important for leadership to forecast acquisition demand as well as demand for acquisition personnel.

Weaknesses: Due to local policy and SeaPort's Standard Operating Procedures (SOP), only a portion of service and large material requirements are being logged in SeaPort's eMilestones module. According to SeaPort CONOPS, section 3.2.4, SeaPort only allows for solicitation and subsequent task orders with a NAICS of 541330 using exception Military and Aerospace Equipment and Military Weapons (SeaPort PMO, 2016).

The remaining portion of service and material requirements, including simplified acquisitions, is awarded in SPS. SPS does not have a milestone module; all SPS Contracts planned for in the future must be manually imported into the Seaport eMilestones system. Therefore, the current LRAF methodology is not considering all the contracts awarded by NSWC PHD. The eMilestone system was designed to be initiated and managed, up to PR generation, by the PM/PEO/Technical teams in order to ensure accountability and resources allocation (Seaport, 2021). Despite this, NSWC PHD has stripped this responsibility from them and placed it squarely on the shoulders of the KOs and CSs who now have to act as liaisons between the program office, technical community and acquisition office (Acevedo, 2018). This places the burden on the KO/CS to ensure acquisition schedules are "realistic and achievable," that all milestone deadlines are maintained, and it removes all accountability from the technical teams, who are the owners of the requirement. In fact, the instruction that is intended to foster a more effective five-year demand signal and develop a "Team-Sport" mentality, does exactly the opposite and poses one of the most significant threats to ensuring accurate acquisition forecasting.

Opportunities: LRAFs covering recurring requirements can give industry an opportunity to plan and mitigate risk as early as possible. The more accurate or close to accurate LRAFs are the better industry and, more specifically, small business can seek opportunities to bid or create strategic partnerships. Early identification of ongoing requirements can potentially open discussions amongst other commands or even other divisions within NSWC PHD to consolidate efforts and utilize acquisition resources more efficiently. Once consolidation opportunities are identified, NSWC PHD could issue a Multiple Award Contract (MAC) in SeaPort and reduce the time and effort required to award subsequent task orders.

Threats: SeaPort awards are not only limited to specific engineering services but also available to MAC holders. This reduces opportunities for qualified non-MAC holders to compete for recurring requirements that are expected to be awarded in SeaPort. In addition, if the threshold limitation of $750,000 will continue to be based on cost and pricing data thresholds, the policy should be updated to the latest cost and pricing data threshold of $2M in accordance with FAR 15.403-4. If the threshold is updated

accordingly, it would further restrict the service and material requirements logged in SeaPort's eMilestones module that will simultaneously affect NSWC PHD's LRAFs. See Table 1 for a summary of this SWOT analysis.

Table 1. SWOT Analysis Matrix

Internal	**Strengths**	**Weaknesses**
	• Current methodology supported by local policy and SOPs. • Designed to keep Acquisition Team accountable. • On Demand reports available to keep track of progress, acquisition personnel, and areas of improvement.	• Current methodology is not all-inclusive. • In practice, KO and CS are responsible for keeping track of milestones for which PM/PEO/Technical Teams are accountable increasing their administrative burden.
External	• Risk mitigation opportunities. • Enhance small business participation and strategic partnerships. • Open discussions amongst industry and other commands or divisions to simplify and consolidate requirements.	• SeaPort awards are limited to MAC holders only. This reduces the opportunities for qualified non-MAC holders. • Current threshold limitation of $750,000 should be updated to the most recent cost and pricing data threshold per FAR 15.403-4. The new threshold could further reduce the scope, restricting more service and material requirements.
	Opportunities	**Threats**

B. SECONDARY RESEARCH QUESTIONS

1. What Factors or Variables Are Necessary for Accurate Forecasting Demand?

In order to identify what factors or variables are necessary for forecasting demand, we must understand the inherent issues that forecasting faces in general. In our literature review, a few common themes surrounding forecasting inaccuracies are apparent. These included ontological, psychological, and technical issues (Naess et al., 2015), bureaucratic

processes and failure to communicate at the highest level (GAO, 2016), and failure to understand and utilize prediction markets (Dishmon, 2011). In Forecasting Inaccuracies (Naess et al., 2015) the authors find that even with the best data and resources is affected by the realities of the human element that tends to skew thinking and planning in a partisan way. By overestimating the benefits and underestimating the costs and challenges, tendencies exist to create unrealistic forecast models and therefore perpetuate unachievable milestones. This is due to the human tendency toward "optimism bias." Additional biases that may contribute to these variances may also include "systematic bias" in that poor technical model quality is widely held as a source of inaccuracies (Naess et al., 2015). This shows that individuals may trust in the system in place and the processes thereof to support particular outcomes. Thus, there may be no scrutiny of data within a particular system due to this bias resulting in inaccurate data. Whether individuals trust in the existing system or naturally want their program to win and attempt to be overly optimistic when asked to develop "realistic and achievable" forecast models, the results clearly point to inaccurate data. Human nature further compounds the issue when we are asked to deal with and plan for unexpected events. Depending on the nature of their position, individuals tend to skew the outcome in their favor. Be it negatively, for those who do not wish the plan to succeed, or positively for those who the plan means promotion and accolade (to simplify). This is not always done in a way that is obviously manipulative; it is simply a psychological impact of the human optimism bias. In order to assist in subverting this bias, strong data collection and communication efforts, policies and guidelines should be put in place. Unfortunately, individuals tend to fail at this level as well. Multiple agencies collect data to prepare forecasting models that they can use to see what they need short term rather than what they need in the long term. Often, agencies assume that this data would be recorded in a sharable, uniform system so that organizations across the department could use it to build robust forecasting models. These assumptions often prove to be wrong. The DOD obligated $190 billion on service acquisitions in FY 2019 that accounted for nearly half of the DOD's total contract obligations (GAO, 2021). A large portion of the acquisition community's time and effort is focused on service acquisitions rather than on product acquisitions. "Without a roadmap of future service contract spending needs, Congress has limited

visibility into an area that constitutes more than half of the DOD's annual contract spending" (GAO, 2016). Furthermore, because there is no oversight happening at the upper levels, collaboration between departments cannot take place and this leads to redundant contracting and poor forecasting at all levels of acquisition across the DOD. The idea of prediction markets as a tool to improve forecasting is wonderful as well, however, without extensive data, markets cannot be developed with any accuracy. Ultimately, because there is very little archival forecasting being done across the DOD, it is easily manipulated and rarely accurate.

Review of the available literature provides an opportunity to view the comparisons to the various forecasting methods to determine which one is the most effective. With regard to the topic of inventory forecast demands, Michael Rigoni and Wagner Correia de Souza used the mean of absolute scaled errors analysis to determine the accuracy of a forecasting method (Rigoni & Correia de Souza, 2016). During this study, it was shown that the Navy's forecasting method of a comprehensive inventory management improvement plan (CIMIP) provided the best results when using the mean absolute scaled error (MASE) analysis. The elements of the CIMIP provide a forecasting method that took into consideration a bias metric and a signed error metric (Rigoni & Correia de Souza, 2016). This shows that forecasting method in general should consider the bias and error rates into its model and account for those parameters. Ignoring these parameters and remaining stagnant in their forecasts will result in inaccuracies. Moving more toward a forecasting model geared more toward workload vice inventory, a Master of Business Administration professional report described the development of an auto-regressive integrated moving average model, which accounts for several parameters together including exponential smoothing and moving averages as well as decomposition of trends and seasonality (Chonko et al., 2014). This data-specific approach allows for real-time smoothing to provide more accuracy as time progresses by incorporating a moving average to the model as well. This proves that the most effective forecasting models provide for flexibility as well as sound data to provide accurate results. Finally, this solution was shown as the most beneficial back in 1971 with the thesis provided by John Coventry that conducted an essential comparison of forecasting methods (Coventry, 1971). The results

of this comparison showed that it was strongly recommended that using smoothing for demand forecasting under the assumption that other methods are explored and results compared would provide the most accurate results. The basis for data-driven forecasting with smoothing is well established with research back in 1971 pointing to this type of forecasting method to produce the most accurate models in existence. The acquisition community should also use the available data to them to develop a similar model to create a demand forecast that accurately depicts upcoming requirements.

NSWC PHD's Contracts Department has a Technical Liaison Office (TLO), which is directed to provide support to the requirement generators, and the technical team submitting their acquisition forecast for validation. The process managed by the TLO involves forecasting, planning, tracking, managing, and executing. Currently, however, the TLO does not support any of these functions and simply consolidates data from the technical community into reportable metrics and holds acquisition health assessments based upon these technical inputs. Our research shows that the factors and variables specific to data available to the acquisition workforce can provide the data-specific approach that allows for real time smoothing and continuous accuracy of the model. With this information, it is recommended that the NSWC PHD TLO should reinforce demand forecasts from information given by technical departments with data-driven forecasting models that can be used to ensure accuracy of our estimated demand for contract actions.

2. What Data Can Be Used from the Contracts Processes and the Technical Processes to Construct an Accurate Demand Forecasting Model?

NSWC PHD's methodology to forecast demand can be based on a variety of factors or variables including focusing on recurring procurements, reviewing historical data, and other data markers that can provide a forecasting methodology that is more accurate than current estimates. The following variables are based on a combination of methodologies found in our literature review and reliable sources of information available to NSWC PHD. First, an all-inclusive list of current procurements provided by technical teams should be the basis to any forecast methodology of this kind and should identify, at a minimum, their potential to be recurrent per historical data. Second, the information provided by technical

departments should be validated against a reliable source of contract awards to validate the assumptions made by the technical team on the first step. Third, other data marks such as budget and expenditures should be the basis to validate assumptions made on the first and second steps. The following paragraphs provide further details of the variables we recommend for the purposes of NSWC PHD's LRAF methodology.

The first variable is the recurring procurements. NSWC PHD can use the requirements for which are reoccurring for decades to establish future demand for contract actions associated with these requirements. Since there are no procedural instructions for forecast methodology at NSWC PHD, the authors assume that there is no formal methodology for identifying recurring requirements. Even though recurring procurements are determined by technical departments and their customers, NSWC PHD should build an all-inclusive list, without thresholds distinction, of current contracts that have potential to continue to be required in the future. This list should be provided by each technical department to be consolidated and analyzed by the TLO. The criteria for determining a recurring requirement should be based on customer needs, availability of funds, and command's strategy. In addition, open lines of communication between contracts department, technical departments, customers, and sponsors are highly encouraged to determine future demands. NSWC PHD's TLO currently holds quarterly portfolio reviews with technical departments and those reviews include identification of current requirements, but no criteria for identifying recurring requirements is available or specified in local policy.

The second variable is reviewing historical procurements. NSWC PHD can review data points including number of actions, types of requirements, dollars obligated/awarded, etc. This data is publicly available via the FPDS-NG and should be the basis for validating recurring requirements. The criteria for identifying applicable historical requirements should be based on at least the last five–ten years of data since most service contracts have a standard period of performance of five years. At the same time, contracts department, technical departments, customers, and sponsors should maintain open lines of communication in order to validate historical data and build on the data gathered on the previous variable.

The third variable includes other data markers that can be utilized to establish demand. NSWC PHD should review budgetary data available to validate and forecast future requirements in the same manner as the previous variables. Currently, the DOD is not required to project service acquisitions beyond the current budget FY and, as a result, has not been doing so. This has been a Government Accountability Office (GAO) finding for quite some time and, the GAO is still reviewing DOD efforts to address this finding (GAO, 2021). Budgetary data and historical expenditures can provide additional support needed to validate assumptions throughout the demand forecast identification process.

Ultimately, we found that the TLO could and should hold a more significant role in acquisition milestone management and development of an acquisition forecasting model; and provide a more robust analysis of all requirements, past, present and future, across NSWC PHD and the Warfare Center (WFC) Enterprise.

A. ADDITIONAL ANALYSIS

1. Increased Accuracy

The purpose of developing an acquisition forecasting model is to improve and increase the accuracy in the development of realistic and achievable milestones leading to contract award. Developing a forecasting model may also provide opportunities to improve planning and training on the technical side, better understand cost planning and controls, eliminate events of fraud, waste and abuse, support the preparation of an effective staffing plan, and improve the ability to work more effectively with our industry partners. All these benefits are supported by current policy found at DOD, NAVSEA, and NSWC PHD level as shown in previous sections.

The main disconnects found at NSWC PHD begin with the program office counterparts and the technical departments. There is also disconnects between the technical departments and the contracts office. This disrupts the process of managing and maintaining the requirements, communicating that data and the timeliness of when the data is delivered to the appropriate party. The result is the mismanagement of requirements and is reflected in the LRAFs. This research indicates that more program office and technical department accountability is needed for setting achievable and realistic requirements. This

research also indicates areas for further review regarding the local policy that establishes limits to utilize only SeaPort eMilestones to generate LRAFs. SeaPort eMilestones depend on acquisition team's manual input and communication from program office and technical counterparts, which is highly susceptible to user error. Our analysis identified data variables that could help NSWC PHD in building a proper forecast model based on reliable sources of data instead of relying only on program office and technical department counterparts. Understanding all the areas where the current forecast methodology misses the mark, can help NSWC PHD identify the data needed and when or how it is to be collected.

Accurately developing realist and achievable milestones will greatly improve the entire acquisition cycle and increase processing time from start to finish. Currently, department technical teams are responsible for reporting their five-year demand signal through the SeaPort eMilestone system. A majority of the contracts at NSWC PHD uses the Base Plus Option period design and from those, most fall within the five-year renewal period. Furthermore, the SeaPort System specifically utilizes SeaPort MAC contracts, which have a five-year base period with two five-year option periods (Seaport, 2020). This makes reporting on these specific requirements straight forward. However, for any new requirements that are being discussed or any requirements that do not fit into a five-year cycle or thresholds limits set by local policy, this system does not work and would benefit greatly from a more inclusive forecasting tool. As previously discussed, the LRAF is pulled from the SeaPort eMilestone module, which only allows for manual manipulation and data entry. The forecasting data is entered into eMilestones (which populates the LRAF) utilizing a milestone tool that auto-populates dates via an Excel spreadsheet. Although each "deliverable" in the schedule is linked to a responsible party, which includes the program management office and technical team members who own the requirement, the KO and CS are held responsible and evaluated on the milestone completion and effective rates. This system issue decreases actual accountability on the technical side and inhibits the desire of the technical team from gaining valuable training and knowledge on how to properly document and manage their requirements.

An accurate forecast model will help all stakeholders understand the true mission requirements and better prepare training and staffing plans to ensure all departments are ready to take on the workload that is expected on the horizon. Last, but certainly not least, an accurate forecast model with more accurate data would certainly give small business an opportunity to anticipate and prepare for requirements on a timely manner.

2. Resources Available for Evaluation.

NSWC PHD can evaluate the benefit of the theoretical forecasting tool by utilizing the historic milestones effectiveness and completion rates against the new rates once the tool is implemented. Additionally, by utilizing the forecasting tool, NSWC PHD should see a decrease in emergent requirements. Emergent requirements are those requirements that were not previously planned for and require an accelerated acquisition cycle due to its urgent need. These emergent requirements cause an undue burden on the contracting team as they are faced with a truncated timeline to complete all phases of contract execution.

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V. CONCLUSION

In conclusion, we determined that the development of a robust, Navy-wide, acquisition forecasting tool would greatly improve how NSWC PHD, and the Navy as a whole, executes their contracting responsibilities. Development and implementation will improve milestone completion rates, increase accountability, manage cost planning and controls, support workforce retention, staff management and training, and increase effective communication and collaboration with industry.

Our recommendations for this forecast model tool is that it should be utilized in a top-down manner, with the program office providing program and budget information which is then cross checked and expanded upon by the CA. This would be done at each WFC to ensure an enterprise approach to contract management is obtained. By requiring the CA to become a part of the acquisition phase process, it ensures a level of accountability that NSWC PHD do not have currently. The portfolio of each department within NSWC PHD and within each WFC will be connected via NAICS, Product and Service Code (PSC), Commercial and Government Entity Code (CAGE) and general requirement descriptions to connect the requirements and ensure a more effective way to collaborate and consolidate efforts across NSWC PHD and the WFC Enterprise. Furthermore, the eMilestone schedule would shift earlier in the process to include realistic and achievable deliverable deadlines for technical team training and document creation, and the milestone creation, management and accountability would be returned to the technical team, as intended, to ensure that those who are responsible for these programs are actively engaged in developing executable contract actions.

Further research will need to be conducted to study the various data elements that provide the best approach to the data-driven theoretical forecasting model. This includes an analysis on the linkage between the program office's budget development and how each PHD Department manages early program contract requirement planning and preparation. By identifying areas where "potential" requirements could develop, we can find new ways to ensure these are planned for and do not become emergent in the future. The disconnect

between the Program Office, Technical Office and Contract team members can therefore be significantly reduced with the use of a forecasting tool.

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