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### **Establishing Financial Efficiency in the Marine Corps**

March 2023

**Maj Brandan P. Sullivan, USMC**

Thesis Advisors: Dr. Chad W. Seagren, Senior Lecturer  
Philip J. Candreva, Senior Lecturer

Department of Defense Management

**Naval Postgraduate School**

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Prepared for the Naval Postgraduate School, Monterey, CA 93943.

Disclaimer: The views expressed are those of the author(s) and do not reflect the official policy or position of the Naval Postgraduate School, US Navy, Department of Defense, or the US government.



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## ABSTRACT

Financial performance in the Department of Defense (DOD) is measured based on achieving planned consumption, referred to as obligation rates. This technique limits the DOD's ability to accurately measure financial efficiency, leading to wasted financial resources and a less effective fighting force. Measuring performance through the use of consumption rate targets reinforces spending, focusing a commander on exhausting all financial resources instead of attaining anything more meaningful. This thesis contends that financial resources should be measured by the output they generate, shifting leaders' focus from consumption to efficiency. Output variables will likely vary by program, and this study selected readiness as the output variable for the analysis. Using Marine Corps operating forces' spending levels, a Monte Carlo simulation applied research-based improvement metrics to showcase potential impacts to spending quality if an alternative measure of performance were to be adopted. The impacts were applied in two ways: maximizing value and minimizing cost. By changing the way performance is measured, decision-makers can have access to the information required to truly make the best use of financial resources—and do so without substantive administrative and legislative adjustment.



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# TABLE OF CONTENTS

<b>I.</b>	<b>INTRODUCTION.....</b>	<b>1</b>
<b>A.</b>	<b>RESEARCH OBJECTIVE .....</b>	<b>2</b>
<b>B.</b>	<b>THE WAY AHEAD.....</b>	<b>2</b>
<b>II.</b>	<b>BACKGROUND .....</b>	<b>3</b>
<b>A.</b>	<b>POWER OF THE PURSE .....</b>	<b>3</b>
<b>B.</b>	<b>ANTIDEFICIENCY ACT AND APPROPRIATIONS LAW.....</b>	<b>4</b>
<b>1.</b>	<b>Purpose.....</b>	<b>4</b>
<b>2.</b>	<b>Time.....</b>	<b>4</b>
<b>3.</b>	<b>Amount.....</b>	<b>5</b>
<b>C.</b>	<b>STAKEHOLDERS .....</b>	<b>6</b>
<b>1.</b>	<b>Congress.....</b>	<b>6</b>
<b>2.</b>	<b>Commanders .....</b>	<b>7</b>
<b>3.</b>	<b>Comptrollers.....</b>	<b>7</b>
<b>4.</b>	<b>Supply Officers.....</b>	<b>7</b>
<b>D.</b>	<b>OPERATION AND MAINTENANCE, MARINE CORPS.....</b>	<b>8</b>
<b>E.</b>	<b>CHALLENGES.....</b>	<b>8</b>
<b>1.</b>	<b>The Environment .....</b>	<b>8</b>
<b>2.</b>	<b>The Surface Level Issue.....</b>	<b>9</b>
<b>F.</b>	<b>CHAPTER SUMMARY.....</b>	<b>9</b>
<b>III.</b>	<b>LITERATURE REVIEW .....</b>	<b>11</b>
<b>A.</b>	<b>FINANCIAL MANAGEMENT IN THE MARINE CORPS.....</b>	<b>11</b>
<b>B.</b>	<b>THE IMPACT OF MEASURING PERFORMANCE AND GOAL SETTING.....</b>	<b>13</b>
<b>C.</b>	<b>CHAPTER SUMMARY.....</b>	<b>15</b>
<b>IV.</b>	<b>METHODOLOGY .....</b>	<b>17</b>
<b>A.</b>	<b>FINANCIAL EXECUTION DATA .....</b>	<b>17</b>
<b>B.</b>	<b>ANALYSIS .....</b>	<b>18</b>
<b>1.</b>	<b>Performance Multiplier.....</b>	<b>18</b>
<b>2.</b>	<b>Simulation.....</b>	<b>19</b>
<b>C.</b>	<b>SIMULATION SUMMARY .....</b>	<b>20</b>
<b>V.</b>	<b>RESULTS .....</b>	<b>21</b>



A.	<b>SIMULATION OUTPUTS .....</b>	<b>21</b>
B.	<b>CONSOLIDATED FINDINGS.....</b>	<b>22</b>
C.	<b>VALUE-MAXIMIZING APPROACH.....</b>	<b>24</b>
D.	<b>COST-MINIMIZING APPROACH .....</b>	<b>26</b>
E.	<b>SENSITIVITY ANALYSIS .....</b>	<b>28</b>
F.	<b>KEY TAKEAWAYS.....</b>	<b>30</b>
<b>VI.</b>	<b>CONCLUSION .....</b>	<b>31</b>
A.	<b>SUMMARY .....</b>	<b>31</b>
B.	<b>RECOMMENDATIONS.....</b>	<b>32</b>
	<b>APPENDIX. SIMULATION RESULTS .....</b>	<b>33</b>
A.	<b>VALUE-MAXIMIZING APPROACH SIMULATION RESULTS .....</b>	<b>33</b>
B.	<b>COST-MINIMIZING APPROACH SIMULATION RESULTS.....</b>	<b>39</b>
	<b>LIST OF REFERENCES .....</b>	<b>45</b>





## LIST OF FIGURES

Figure 1.	The Federal Budgeting and Appropriations Process. ....	3
Figure 2.	Carbon Pounds Saved per Dollar. ....	15
Figure 3.	Data Cleaning Process .....	17
Figure 4.	Distribution of the Simulated Performance Multiplier .....	19
Figure 5.	Value-Maximizing Approach for I MEF in 2019 .....	21
Figure 6.	Cost-Minimizing Approach for I MEF in 2019 .....	22
Figure 7.	Value-Maximizing Results for the Operating Forces .....	24
Figure 8.	Value-Maximizing Results for I MEF .....	25
Figure 9.	Value-Maximizing Results for II MEF .....	25
Figure 10.	Value-Maximizing Results for III MEF .....	26
Figure 11.	Cost-Minimizing Results for the Operating Forces .....	26
Figure 12.	Cost-Minimizing Results for I MEF .....	27
Figure 13.	Cost-Minimizing Results for II MEF .....	27
Figure 14.	Cost-Minimizing Results for III MEF .....	28



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## LIST OF TABLES

Table 1.	Cleaned Spending Data.....	18
Table 2.	Consolidated Simulation Results .....	23
Table 3.	Sensitivity Analysis .....	29



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## LIST OF ACRONYMS AND ABBREVIATIONS

ADA	Antideficiency Act
DOD	Department of Defense
FY	fiscal year
GAO	Government Accountability Office
O&M,MC	Operation and Maintenance, Marine Corps
RDT&E	Research, Development, Test and Evaluation



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## I. INTRODUCTION

Financial performance in the Department of Defense (DOD) is measured based on achieving planned consumption, referred to as obligation rates. This technique limits the DOD's ability to accurately measure financial efficiency, leading to wasted financial resources, a less effective fighting force, and an alienated general public. To address this problem, evaluating how financial resources are used should focus on the value produced by spending.

The Marine Corps typically manages and grades financial resource employment based on attaining planned consumption rates. Measuring performance through the use of consumption rate targets reinforces spending, focusing a commander on exhausting all financial resources instead of attaining anything more meaningful. Lieutenant General Thomas Spoehr, U.S. Army, Retired, and director of the Army Business Transformation Office, describes similar issues in the Army where the lack of an outcomes-based spending approach disincentivized saving financial resources (Vergun, 2016). Building on this finding, Booz Allen Hamilton (2013) determined that "lack of quality budget estimates and use of financial tracking mechanisms has made it difficult for Marines to strategically allocate budget cuts based on efficiencies or priorities." The purpose of this study is to propose an alternative financial performance measurement mechanism and apply statistical analysis to showcase the impact to financial resources it could have.

Existing literature about the inability of the defense services to accurately measure financial efficiency focuses attention on high levels of spending that occur at the end of the fiscal year, which is the service's last opportunity to take advantage of the funds. In their research on end of year spending, Manol et al. (2017) found that spending rates were 35% higher during the fourth quarter than the rest of the fiscal year. This data leads to a common takeaway, expressed by Captain Mark Higgins in his 2018 article, Wasteful Year-End Spending, "The reoccurring necessity to spend the entire budgeted amount creates a cyclical environment of year-end wasteful spending."



## **A. RESEARCH OBJECTIVE**

The objective of this thesis is to propose an alternative approach to measuring financial resources—one that uses an output variable to measure financial efficiency—providing decision-makers with better information from which the utility gained can be optimized. This insight will help leaders address the perception of financial waste and misused resources by developing metrics to enable informed decision-making, prioritize resources in areas that can best address likely threats, and also provide a straightforward method to communicate funding risks. The findings will also contribute to the discussion regarding overall financial resource use and oversight in support of the DOD’s financial audit by forming a guiding and consolidated method upon which to execute financial resources to achieve DOD-directed objectives.

Using Marine Corps operating forces’ spending levels, a Monte Carlo simulation applied research-based improvement metrics to showcase potential impacts to spending quality if an alternative measure of performance was adopted. The impacts were applied in two ways: maximizing value and minimizing cost. By changing the way performance is measured, decision-makers can have access to the information required to truly make the best use of financial resources—and do so without substantive administrative and legislative adjustment.

## **B. THE WAY AHEAD**

This chapter introduced the topic, provided overarching context, and identified the conversation where this thesis will add meaningful value. Chapter II details the fundamentals of Marine Corps’ financial management, with a focus on the Operation and Maintenance, Marine Corps (O&M,MC) appropriation and its application within the operational forces of the Marine Corps. Chapter III reviews the relevant literature including several proposed solutions the end of year spending issue that garners much of the focus of interested parties. Chapter IV provides an overview of the research approach taken, with the intent of establishing the approach in sufficient detail so that it can be replicated. Chapter V explains the results of the analysis. Chapter VI summarizes this thesis, including key conclusions and recommendations for further research.





## II. BACKGROUND

Financial Management in the Department of Defense (DOD) is just a fraction of a boisterous and expansive function within the government. Many people spend entire careers in financial management focusing only on a tiny aspect of the critical field. This chapter serves as a quick reference guide of foundational themes for the reader with a cursory understanding of financial management, highlighting the broad strokes of a very technical field in a way that enables them to evaluate the merits of my analysis and conclusion.

### A. POWER OF THE PURSE

“No Money shall be drawn from the Treasury, but in Consequence of Appropriations made by Law; and a regular Statement and Account of the Receipts and Expenditures of all public Money shall be published from time to time.”

— U.S. Constitution, Article I, S. 9, Cl. 7.

As a part of the government, the DOD receives its funding from Congress. The funds, which are granted through funding bills based on a DOD-generated budget request, follow the timeline outlined in Figure 1. Congress’s role in the appropriations process is rooted in the Constitution, excerpt above, and is called the power of the purse. It is a foundational aspect of government financial management and leads to many statutory requirements aimed to improve the field’s performance and transparency.



Figure 1. The Federal Budgeting and Appropriations Process. Source: National Science Foundation (n.d.).



## **B. ANTIDEFICIENCY ACT AND APPROPRIATIONS LAW**

The Department of Defense has two bounding means of spending appropriately and in accordance with the ADA. First are the tenets of appropriations law: purpose, time, and amount. These are the constraints—the musts—that all spending must comply with. Second are the restraints—the must nots—which stakeholders, listed later, are responsible for enforcing. These restraints are fraud, waste, and abuse.

### **1. Purpose**

“Appropriations shall be applied only to the objects for which the appropriations were made except as otherwise provided by law.”

(31 USC §1301)

Congress grants money by appropriation. These appropriations are established for a specific purpose. Within the DOD, examples of separate appropriations are research, development, test and evaluation (RDT&E), procurement, and operations and maintenance (O&M). Our discussion will focus on the operating forces which is financially supported by the O&M appropriation. Within the purpose statute is the necessary expense rule, which is used to justify requirements for validity and appropriateness. To apply the rule, a quick analysis is conducted to determine if a requirement meets the following three conditions:

1. Bear a logical relationship to the appropriation charged,
2. Not be prohibited by law, and
3. Not be otherwise provided for, that is, it does not fall within the scope of some. (Office of the General Counsel, 2016)

### **2. Time**

Appropriations are created with an established lifetime, called the period of availability. As long as the period of availability is open, funds can be spent on valid requirements. Once the period ends, however, those funds are no longer available. One nuance of this is called the necessary expense rule which simply states that funds can only be spent on requirements that are valid within the period of availability. The time aspect of appropriations leads to two key issues. First, funds must be spent before the period of availability ends in order to garner any value from them. Second, it restricts spending



within that period. These two issues put upward pressure on spending rates as the availability period ends. Relieving this pressure tends to be the focus of research and analysis in the field (Office of the General Counsel, 2016). Unfortunately, the implementation of any recommendations in this area is limited as it undermines the fundamental idea that budgets are built with a specific period of time in mind. Any increase in time would, in theory, increase the amount required to support the budget, and the same challenges remain inherent to the process.

### **3. Amount**

The amount aspect of appropriations is the most straightforward. It simply states that agencies may not spend more funding than they have available. While this is enforced at the highest levels of the agency, it trickles down to all commands in a similar fashion. For example, a logistics regiment may be a requirement for \$20,000 but an available balance of \$15,000. Although their higher headquarters may have sufficient funds to cover the requirement, the regiment would be unable to pursue procurement until additional coordination to receive more funds is conducted. Amount considerations are typically most relevant at the beginning and end of an appropriation's period of availability. Consider, for example, the recent trend to begin a new fiscal year without a budget enacted. In this instance, any spending would violate the amount aspect of fiscal law. If a continuing resolution were put in place, DOD spending would be limited from the resources requested in the budget process. These situations, which are typically emergent in nature, add complexity to operating in accordance with fiscal law (Office of the General Counsel, 2016).

During these periods of transition, it is critical to remain vigilant and ensure actions are in accordance with the Antideficiency Act, 31 USC § 1301A, which provides the legal founding for the amount considerations.

- Except as specified in this subchapter or any other provision of law, an officer or employee of the United States Government or of the District of Columbia government may not—



- Make or authorize an expenditure from, or creating or authorizing an obligation under, any appropriation or fund in excess of the amount available in the appropriation or fund unless authorized by law.
- involve either government in a contract or obligation for the payment of money before an appropriation is made unless authorized by law;
- make or authorize an expenditure or obligation of funds required to be sequestered under section 252 of the Balanced Budget and Emergency Deficit Control Act of 1985; or
- involve either government in a contract or obligation for the payment of money required to be sequestered under section 252 of the Balanced Budget and Emergency Deficit Control Act of 1985. (31 USC §1341a)

## C. STAKEHOLDERS

When discussing the use of public funds, it is important to identify key stakeholders. The responsibility to make the best use of taxpayer money has led to many layers of oversight, reporting requirements, and scrutiny. This layered complexity of stakeholders makes the outlay of funding both a focus area for improvement and one in which change is often slow. The following are the stakeholders most relevant to the problem this thesis is focused on.

### 1. Congress

Congress has the power of the purse. They determine funding levels by appropriation that fit the government's strategic direction. Congress also has the responsibility to raise and support armies and provide and maintain a navy. This puts them in the position where they both provide funding and hold the responsibility to ensure the DOD's compliance. They also ask hard questions that typically require quick and detailed responses from DOD leadership. Sometimes, to emphasize high priority lines of effort, they pass statutes to ensure the DOD takes steps to meet their expectations (U.S. Marine Corps [USMC], 2015).



## **2. Commanders**

One of the many responsibilities of commanders is to hold proper oversight of funds and use them to achieve mission accomplishments. The two tasks listed below are specified in Marine Corps Order 7300.21b Marine Corps Financial Management Standard Operating Procedure Manual. While the list of responsibilities is long, these are the two most relevant for this paper.

- Retain flexibility to meet the unexpected or unplanned requirements
- Devote the command's financial resources to achieving and maintaining maximum operational readiness. (USMC, 2015)

In essence, commanders are responsible for validating operational requirements against which funds are levied.

## **3. Comptrollers**

Commanders have staff officers to help with the financial aspect of these responsibilities. "In those commands where the complexity of FM requires it, the CMC will authorize assignment of a Comptroller to assist the commander. The Comptroller will be a general staff officer and will have general staff cognizance over the broad area of FM to include appropriated funds" (USMC, 2015). Comptrollers are typically found at commands led by general officers.

The relevant tasks for comptrollers are:

- Provide the commanders with factual data essential for effective management control of the command
- Ensure proper use of appropriations by purpose, time, and amount to include meeting the criteria of bona-fide need. (USMC, 2015)

Comptrollers monitor spending levels to ensure commanders have sufficient financial flexibility to maximize operational readiness without comprising their ability to address emergent operational needs.

## **4. Supply Officers**

In commands where the financial environment does not require a comptroller, supply officers take on the responsibilities of financial oversight. These individuals are



well placed as they typically also oversee purchasing for the command. The ability to track funding levels and purchase supplies allows supply officers to be very responsive to any environment their command has to operate in (USMC, 2015).

#### **D. OPERATION AND MAINTENANCE, MARINE CORPS**

O&M,MC is appropriated by Congress to support day-to-day activities. This includes requirements ranging from base utilities to training exercises. It is the primary funding type used to allow commanders in the operating forces to maximize their readiness. O&M,MC is an annual appropriation which means it is available to be used for a twelve-month period beginning on 1 October and ending on 30 September (USMC, 2015).

#### **E. CHALLENGES**

##### **1. The Environment**

There are fundamental challenges as a result of the DOD financial management ecosystem outlined above. Commanders, for instance, are charged with using financial resources to maximize operational readiness while simultaneously told to maintain financial resources to address emergent events. The opposing nature of these tasks acts as a behavior mechanism that encourages the application of financial resources to extremely valuable and necessary requirements. The downside is that it also may slow spending rates. This becomes an issue as we add our other two challenges. First, that Congress has determined an amount of money to support the DOD in accordance with national priorities. In other words, once funds have been appropriated, it is the DOD's obligation to get as much value out of the funds as possible. The second aspect of this is the period of availability for O&M,MC. As an appropriation with a twelve-month period of availability, O&M,MC balancing the above forces is compressed into a narrow window that will usually appear as nine months of applying resources to highly valuable requirements, two months of applying resources to slightly less valuable requirements, and thirty days of using resources as best as possible. This last period of time, the final stage of fiscal year closeout, often relies upon the idea that any amount of value gained from spending funds is better than the zero value funds can provide once the period of availability is closed.



## **2. The Surface Level Issue**

In the operational forces, these challenges manifest themselves in spending rates that are fairly steady through June before increasing significantly through the end of the fiscal year. As spending rates increase, the goods and services funded often decrease in value to the mission—from mission critical items to mission enhancing items. Instead of appreciating the situation and maximizing the value gained from funds, it is very easy to lose perspective and consider this use of funds wasteful as opposed to inefficient but necessary. One additional consideration is the size of the challenge. The Marine Corps' total 2023 budget request is \$50.3 billion (Office of the Under Secretary of Defense (Comptroller), March 2022). Of this, only \$8.1 billion supports the operating forces, or 16% of the Marine Corps' total requested budget (Office of the Under Secretary of Defense [Comptroller], 2022).

## **F. CHAPTER SUMMARY**

Spending taxpayer money is an extremely important and complex environment comprised of a web of stakeholders working diligently to fulfill their immediate responsibilities. This makes improvement and transparency key goals, despite change often taking a lot of time and coordination between stakeholders as their priorities do not always perfectly align.

Guided by appropriations law and congressional direction, commanders, comptrollers, and supply officers work to maximize their unit's capabilities within available funding levels. The uncertain environment which the DOD operates in, along with Congress's expectations that the funds which are made available are used, tends to result in an increased rate of spending at the end of the fiscal year. This end-of-year rush garners much of the focus of improvement ideas and efforts which will be discussed more in Chapter IV. The importance of spending diligently and in accordance with Congress's direction and the challenge of implementing substantial adjustments due to the complexity of the environment provides an opportunity for simple changes such as changing the way resources are measured to make an immediate and powerful impact.



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### III. LITERATURE REVIEW

#### A. FINANCIAL MANAGEMENT IN THE MARINE CORPS

Marine Corps financial performance is measured based on consumption. When an expiration date is introduced which, in the case of O&M,MC, is a one year period ending on September 30th, there is a natural pressure on spending as time becomes scarce which results in increased spending rates. This occurrence is well documented and has been the focus of much research into DOD spending reform. For example, fourth quarter spending on contracts funded with the Navy's Operation & Maintenance appropriation in 2015 accounted for 35% of the entire year's budget (Manol et al., 2017). This finding is not new. In 1993, spending rates from August to September each year between 1977 and 1990 were found to increase from 6.9% to 10.6% respectively (Kozar, 1993). The longstanding increase in spending rates at the end of the fiscal year has dominated the conversation regarding fiscal reform in the Department of Defense.

The focus on spending rates throughout a given fiscal year has two components—spending and time. To control one, many have looked to lessen the impact of the other. Dimirack and Lott explored the implications of adjusting the obligation period of the Operation & Maintenance appropriation from one year to two years. By imposing several carryover restrictions between year one and two, the authors outline a method that essentially smooths spending rates (2005). This implies that spending rates should be consistent across the period of funding availability. According to Candreva, this illogical assumption conflates obligations and expenditures (Candreva, 2021). Expenditures are the outlay of funds that occur when the government actually receives services. Consistent expenditure rates may be desirable since expenditures can occur after the appropriation's one year period of availability, but it is not appropriate to apply that concept to obligations, especially when a large percentage of obligations are for requisitions or contracts. Additionally, consistent obligation rates would require the organization to defy deadline rush—an organizational behavior in which work, in this case spending, increases exponentially ahead of a given deadline (Konig & Kleinmann, 2010).



Deadline rush may actually be beneficial. The military operates in an uncertain environment. Units must be ever-ready which can encourage resource accumulation. The fiscal year deadline provides an opportunity to maximize the use of financial resources, forcing the system to gain as much utility as possible before funds are no longer available. Consider this phenomenon in terms of the run portion of the annual physical fitness test. Once the finish line comes into view, a runner is encouraged to “empty the tank” as they complete the event. There is no value in saving energy. This same logic can be applied to the end of year “sprint” that drives spending rates up. Though their focus remains on extending the period of availability for Operation & Maintenance appropriation, Dimirack and Lott (2005) touch on this:

Although this spending is potentially on lower priority items, it is physically impossible to determine exactly how much of the spending would be allocated to lower priority items. Past experience in dealing with military budgets and interviews conducted with eight different military officers tell us that a significant percentage is not necessarily wasted, but obligated toward requirements that may not be the highest priority. (p. 2)

While perhaps not a realistic option in 2005, improvements in technology provide an opportunity to thrust this notion squarely into the conversation—the ability to link financial resources which facilitate operational requirements to the impact those requirements have on the force. Addressing the impact of financial resources in this way would pivot the focus away from measuring spending in terms of consumption toward the value received from spending. Though this change in perspective may seem superfluous and would certainly require significant efforts to link data systems, it has the potential to reframe the application of financial resource in a way that maximizes overall value to the force and reduces any current inefficiencies. Without the ability to demonstrate the value financial resources directly provide, the DOD will always be subject to scrutiny and assertions of inefficiency.

In his 2010 testimony to Congress, Todd Harrison, a Senior Fellow at the Center for Strategic Budgetary Assessments, highlighted inefficiencies within the DOD as a necessary first step toward becoming sustainable from a budget perspective.



The first area of savings to explore is achieving greater efficiencies in how DOD spends its money—in other words, getting the same or greater capabilities with fewer resources. As both Secretary Gates and his predecessor have pointed out, there are certainly wasted and misdirected resources within the Pentagon’s budget. And it is prudent to search for and root out waste at all times, not just when budgets are tight. (*Evaluating options for a sustainable defense*, 2010)

## **B. THE IMPACT OF MEASURING PERFORMANCE AND GOAL SETTING**

The U.S. Government Accountability Office (GAO) states that “performance measures may address the type or level of program activities conducted (process), the direct products and services delivered by a program (outputs), or the results of those products and services (outcomes)” (Shipman & Wholey, 2011). The report continues to explain that performance measurement is used to understand if the program objectives have been achieved according to predefined measurable standards. With advances in technology, both data collection and analysis capabilities have grown exponentially, bringing an added emphasis on performance measurement as information and feedback are now significantly more accessible. This has led to the proliferation of performance measurement as both a research and management focal point. In a 2015 paper on the topic, Jie Gao asserted that 87% of performance management articles published between 2000 and 2015 were done so between 2010 and 2013 (Gao, 2015).

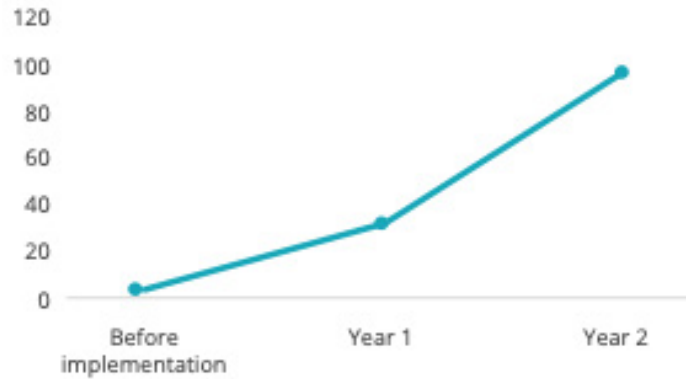
What we measure matters. Which performance measures are chosen by organizational leaders are extremely important because it can bring previously unnoticed efforts into the spotlight. This is where goal setting theory comes in. Goal setting theory states that specific and difficult goals lead to higher performance (Locke & Latham, 1991). If consumption is the dominant method of measurement for financial resources, it is critical to determine the behavior the organization is encouraging. Furthermore, consider the potential benefits of an output-based measure of performance, i.e., measuring the value the financial resources provide. A 2015 experiment into the impact of goal-setting found that performance increased between 12 and 15% (Asmus et al., 2015). That means by simply changing how financial performance is measured, the DOD could realize this level of improved value.



Two underlying drivers of improving performance based on feedback and goal setting are expectancy theory and group-focus. Expectancy theory states that individuals make choices according to the perceived benefits. In the workplace, employees choose what behaviors and actions to follow based on the rewards available to them. (Vroom, 1964). This emphasizes the importance of appropriately identifying goals and why goal setting necessitates a form a responsive feedback mechanism. With reward systems already in place, such as performance evaluations, behavior will naturally move toward the pursuit of identified goals. Group-focus refers to the idea that individual and group goals may not be aligned, which can lead to inefficiency and underperformance of the group. This is where performance feedback mechanisms come into play.

The availability and responsiveness of feedback can be used to remove the distance between individual and group goals or desired behaviors. This alignment brings a group's actions together to maximize performance. Additionally, employing a feedback mechanism that is standardized allows the group to proactively pursue the most meaningful opportunities available. A 2017 by the Deloitte Center for Integrated Research case study outlined several methods to mitigate bias in capital decision-making. One example focused on the U.S. Navy's attempt to work towards renewable resources. After decision-making based on a tiered hierarchy representing need and cost failed to yield results, the Navy turned to a universal metric of success. By selecting a proxy to represent success, pounds of carbon reduced per dollar in their case, all funding requirements could be evaluated according to the same standard. Visualized in Figure 2, the approach led to a first-year savings to cost of 224%, improving to 316% in year two (Alsdorf et al., 2017). This case study provides key parallels to the research objective of this thesis. It leveraged simple and accessible data to enable more informed decision making. It showed that adjusting the measure of performance could be implemented rather quickly without major administrative or legislative change. Finally, it demonstrated that the implementation of a universal metric can lead to improved performance in a military organization.





Performance improved significantly in response to the implementation of a universal metric for capital budgeting to meet energy goals.

Figure 2. Carbon Pounds Saved per Dollar. Source: Alsdorf et. al. (2017).

### C. CHAPTER SUMMARY

The financial performance of the U.S. Marine Corps is evaluated based on consumption, resulting in pressure to increase spending rates as time runs out. Studies indicate that a significant portion of the yearly budget is spent during the fourth quarter. The rush to meet deadlines can push the organization to pursue utility maximization before funds run out, however, this could lead to resources allocated to low priority requirements. Much research focuses on this challenge, but generally disregards the deadline rush as an inherent part of the process.

To allocate financial resources effectively, the focus should shift towards linking them to operational requirements and their impact on the force rather than measuring spending in terms of consumption. The use of performance measures is crucial, and the type of measures selected by leaders can highlight previously ignored efforts. With technology advancements, performance measurement has become more accessible, and goal setting theory emphasizes that specific and challenging goals lead to better performance than vague or easy goals. This approach harnesses the power of both expectancy theory and group-focus, ideas of organizational behavior, which represent ways to improve performance collectively across a workforce. Once case study involving the Navy's attempt to attain energy goals used a universal performance metric to make budgeting decisions which resulting in significant improvement to the pursuit.



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## IV. METHODOLOGY

### A. FINANCIAL EXECUTION DATA

The data for this research was obtained through the Marine Corps and consists of information available from Defense Agencies Initiative (DAI), the Marine Corps' financial management system. The data includes comprehensive financial execution data across all Marine Corps components from fiscal year 2019 through fiscal year 2022. The data was then filtered by the following three parameters: appropriation, budget line item (BLI), and suballotment recipient identifier (SRI). Data that satisfied these parameters was of appropriation O&M,MC, fell under the BLI "Operating Forces," and aligned to one of the three SRIs which represent each Marine Expeditionary Force (MEF). This data established an approximate annual financial execution figure for all three MEFs across each of the four fiscal years and represents readiness expressed in dollar terms. It is important to note that the obligation figures as of the date of the report may vary from the total obligation figures on the last day of each fiscal year. Figure 3 provides a visual representation of the data cleaning process, followed by Table 1 summarizing the cleaned data used as a basis for the analysis.

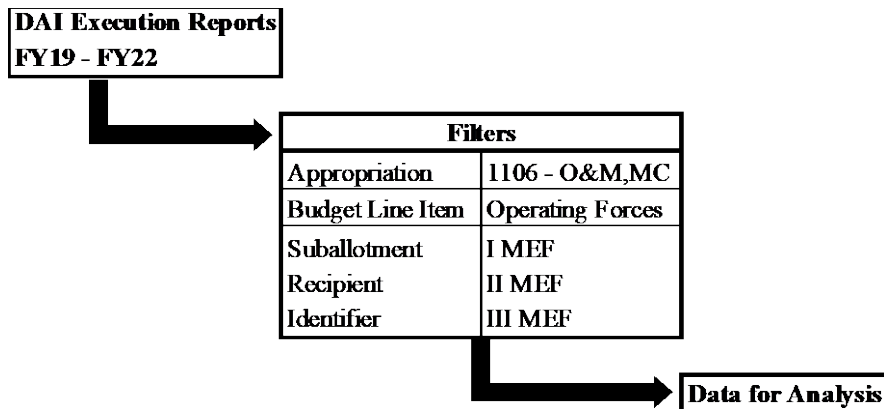


Figure 3. Data Cleaning Process

Table 1. Cleaned Spending Data

Unit	FY	2019	2020	2021	2022
I MEF		\$ 257,138,513	\$ 300,156,670	\$ 291,289,845	\$ 335,699,152
II MEF		\$ 294,540,769	\$ 290,735,031	\$ 270,972,098	\$ 256,071,923
III MEF		\$ 226,060,037	\$ 236,674,004	\$ 245,160,080	\$ 261,486,222

## B. ANALYSIS

This analysis models the process of using financial resources to achieve readiness. The process begins with operational requirements represented as financial execution data—the amount of money used to pursue requirements. A performance multiplier was then applied which results in the outcome of completing the requirement—readiness expressed in dollars. Since the performance multiplier’s impact is not constant, a Monte Carlo simulation was used to capture the distribution of outcomes consistent with the estimated variation.

### 1. Performance Multiplier

The performance multiplier was taken from Asmus et. al’s experiment into goal setting theory and measurable impacts in a work environment. The study found the establishment of goals responsible for an increase in performance between 12% and 15% (2015). These findings were used as the basis for the distribution shown in Figure 4 representing the potential impact on readiness over time as part of a Monte Carlo analysis. In the context of this simulation, which focuses on the Marine Corps operating forces, improvements in performance represent changes in readiness expressed in dollar terms.





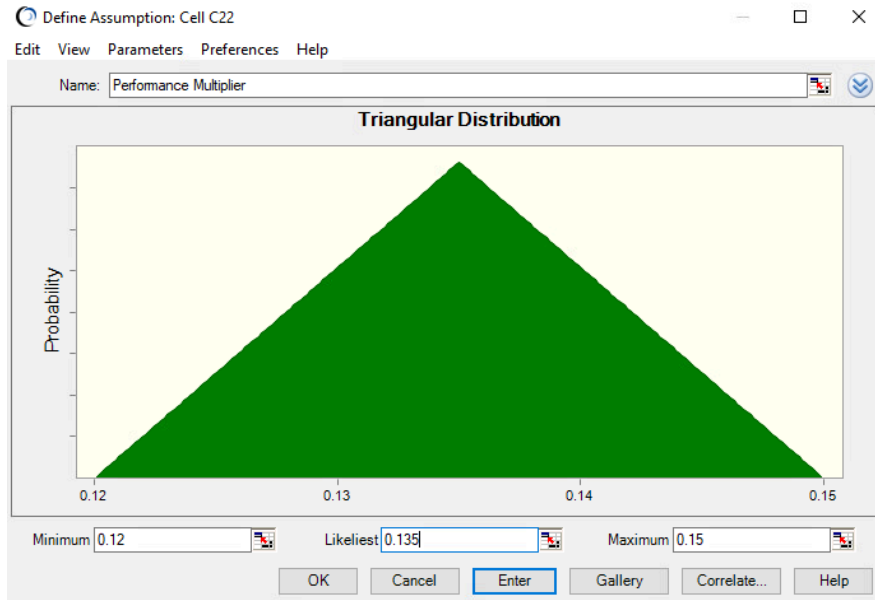


Figure 4. Distribution of the Simulated Performance Multiplier

## 2. Simulation

A Monte Carlo analysis was conducted in Crystal Ball to simulate the potential benefits to the Marine Corps operating forces if a more appropriate financial performance measurement system was in place. Performance data was used as the basis for a triangle distribution and 10,000 trials were run to analyze the data in two separate ways—a value approach and a cost approach. Simulated benefits were applied to the MEFs by fiscal year to demonstrate the benefits while considering the one-year availability period of funds resulting in twenty-four unique forecasts. The actual spending levels were used as the outcome variables of these simulations.

### a. Maximizing Value

To approach the analysis from a value-centric perspective, the simulated performance impact was applied as a multiplier to each MEFs' financial execution total by individual fiscal year. This shows the total equivalent value in dollar terms that could be achieved. In other words, funding levels remain the same but there is more bang for the buck.

$$\text{Financial Cost} * (1 + \text{Performance Impact}) = \text{Total Value}$$



***b. Minimizing Cost***

The cost-centric approach considered the annual funding levels as the desired amount of value gained in dollar terms. The performance impact was then applied as a cost-reducer to the funding levels in order to determine the actual cost required to achieve that level of value. In other words, the desired value is the target and can be attained with fewer financial resources.

$$\frac{\textit{Total Value}}{(1 + \textit{Performance Impact})} = \textit{Financial Cost}$$

**C. SIMULATION SUMMARY**

Using Crystal Ball, an assumption was defined which represented the benefit that may be expected with a more appropriate financial performance metric in place. Monte Carlo simulations of 10,000 trials were run for each fiscal year to forecast an annual performance improvement impact. As part of the simulation, these performance impacts were applied to the actual spending levels of each unit between fiscal year 2019 and 2022. This treated the spending levels as the outcome variables of the simulations. The first application of the performance impact maximized value. That is, the performance impact increased spending levels to represent the equivalent maximum value of output that would have been received. The second application impact minimized cost. To represent this, the actual spending levels were considered the target value level and divided by the performance impact to find the minimum cost required to achieve an equivalent level of value.



## V. RESULTS

### A. SIMULATION OUTPUTS

Two Monte Carlo simulations were conducted based on fiscal year spending totals—a value-maximizing approach and cost-minimizing approach—which produced forecasts by MEF and fiscal year for a total of twelve outputs per approach. The resulting value and cost approach forecasts for I MEF in fiscal year 2019 can be found in Figures 5 and 6. Instead of the \$257 million I MEF actually spent in 2019, the outlined approaches show that a level of readiness equivalent to \$292 million using the value approach could have been achieved, or the 2019 level of readiness could have been achieved using only \$227 million. The remaining twenty-two graphical forecasts are available in the appendix.

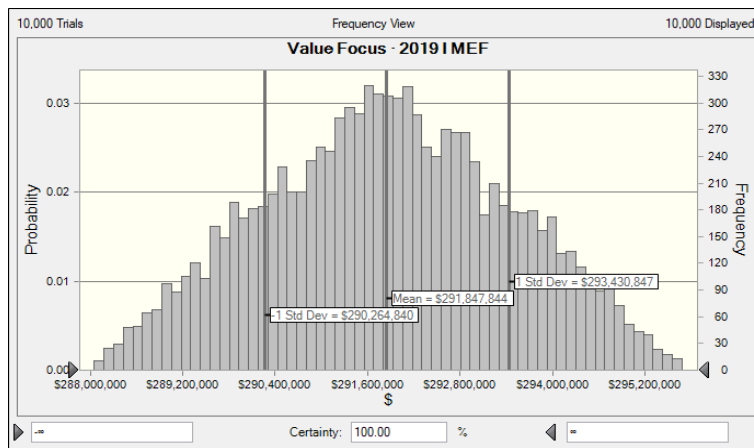


Figure 5. Value-Maximizing Approach for I MEF in 2019

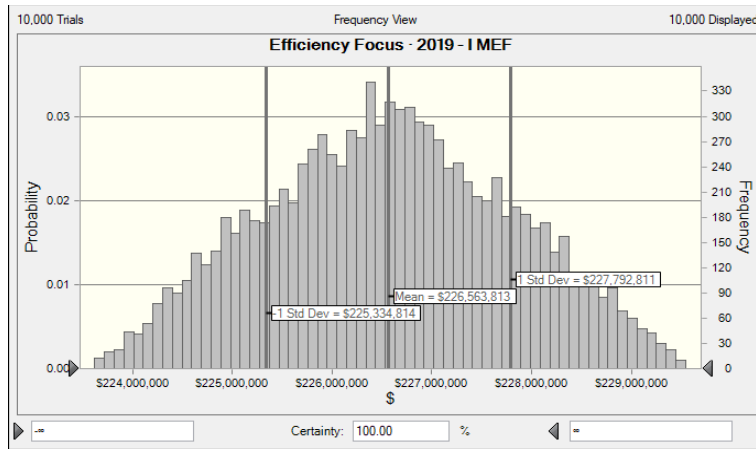


Figure 6. Cost-Minimizing Approach for I MEF in 2019

## B. CONSOLIDATED FINDINGS

The Monte Carlo simulation forecasted the average spending levels by year and unit according to the simulated performance impacts shown in Table 2. Spending levels one standard deviation above and below the mean for both approaches have been included for reference, while the detailed analysis continues based on the mean levels.

The simulation resulted in performance impacts between 12.3% and 13.1%. Since the performance impacts are applied to the same baseline spending levels, comparative benefits are greatest in those years and units that have the highest initial spending levels. With this in mind, the analysis resulted in the greatest resource benefit available in the following order: I MEF, II MEF, and III MEF. The value-maximizing approach determined the level of readiness achieved over fiscal year 2019 to 2022 to be equivalent to spending close to \$450 million more than the actual spending levels. The cost minimizing approach determined that the same level of readiness between fiscal year 2019 and 2022 could have been achieved with approximately \$387 million less than the actual spending levels.



Table 2. Consolidated Simulation Results

CONSOLIDATED RESULTS					Value Maximizing			Cost Minimizing		
Year	Simulated Performance Impact	Simulated Performance Standard Deviation	Unit	Financial Data	Low	Mean	High	Low	Mean	High
2019	13.0%	0.15%	I MEF	257.14	290.18	290.57	290.95	227.25	227.56	227.86
			II MEF	294.54	332.39	332.83	333.27	260.31	260.66	261.00
			III MEF	226.06	255.11	255.45	255.79	199.79	200.05	200.32
2020	12.4%	0.35%	I MEF	300.16	336.33	337.38	338.43	266.21	267.04	267.88
			II MEF	290.74	325.77	326.79	327.80	257.86	258.66	259.47
			III MEF	236.67	265.19	266.02	266.85	209.91	210.56	211.22
2021	13.1%	0.55%	I MEF	291.29	327.85	329.45	331.05	256.30	257.55	258.81
			II MEF	270.97	304.98	306.47	307.96	238.43	239.59	240.76
			III MEF	245.16	275.93	277.28	278.62	215.71	216.76	217.82
2022	12.3%	0.55%	I MEF	335.70	375.14	376.99	378.84	297.47	298.93	300.40
			II MEF	256.07	286.16	287.57	288.98	226.91	228.02	229.15
			III MEF	261.49	292.21	293.65	295.09	231.71	232.85	233.99

\*All figures are in millions (\$)



### C. VALUE-MAXIMIZING APPROACH

Under the value maximizing approach, the operating forces could have achieved a comparable spending level of \$3.7 billion between fiscal years 2019 and 2022. This is equivalent to a \$450 million increase over that period. Figure 7 depicts the simulation findings for the operating forces.

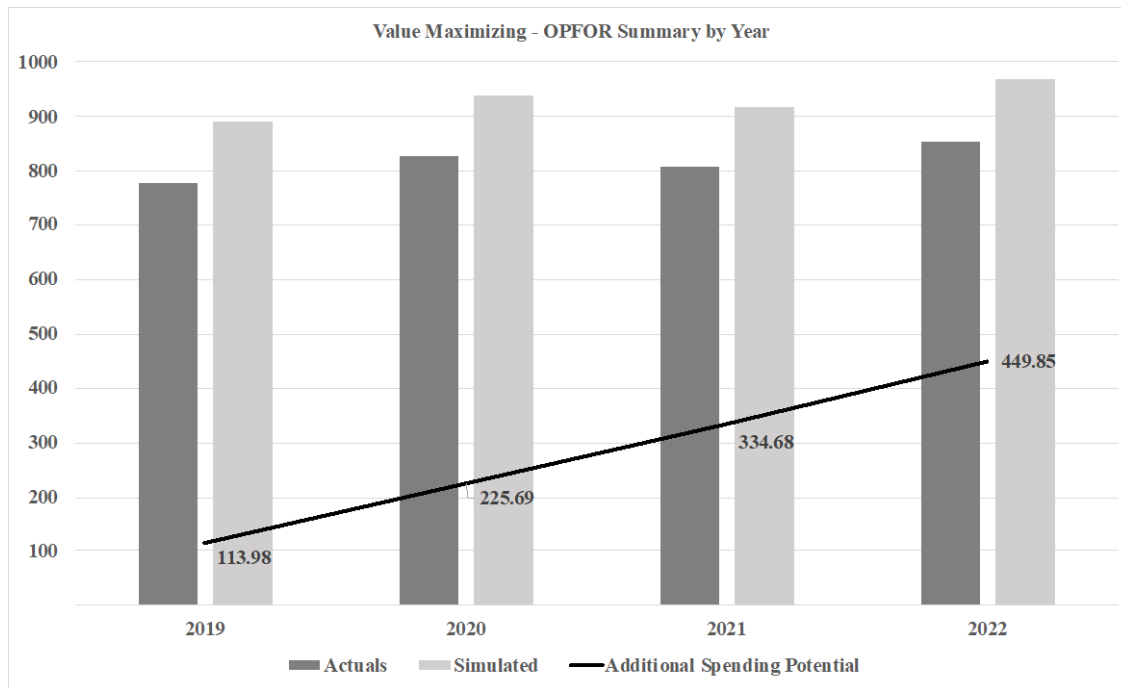


Figure 7. Value-Maximizing Results for the Operating Forces

The simulation results were further divided in figures 8 through 10 to showcase the forecasted resource impacts across each MEF by year. Since the benefits are based on the initial spending levels, the findings show the greatest available value increase with I MEF, which had the largest budget over the time period.



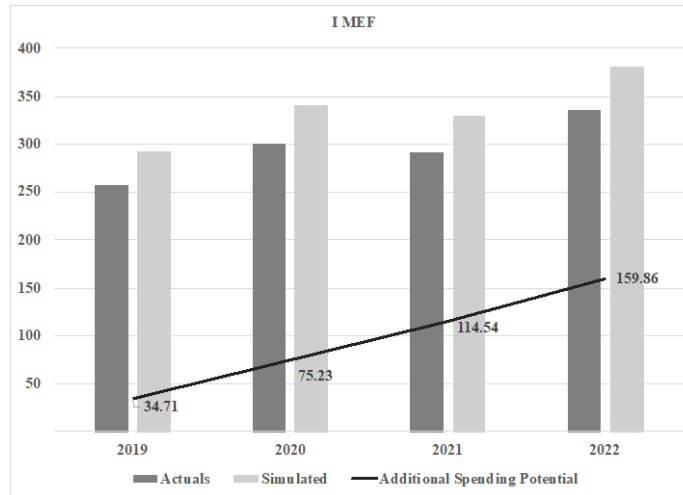


Figure 8. Value-Maximizing Results for I MEF

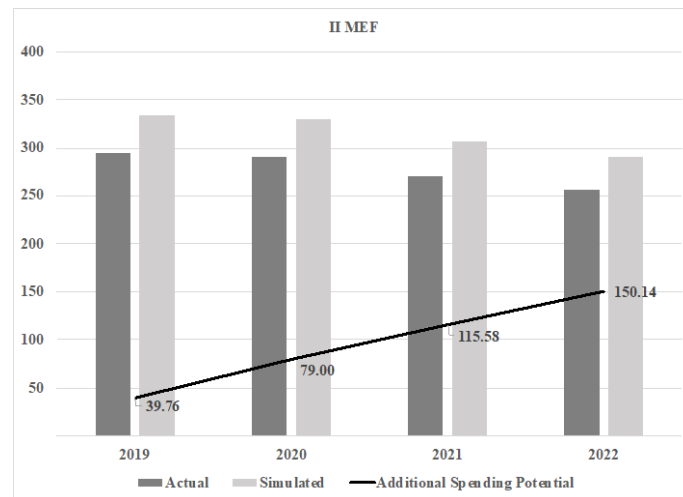


Figure 9. Value-Maximizing Results for II MEF

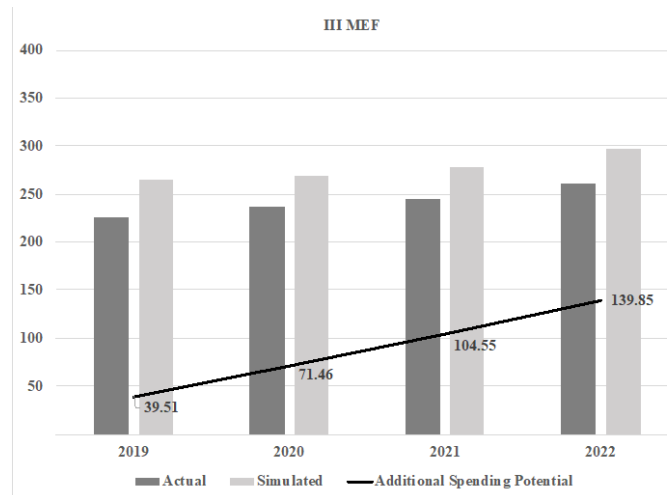


Figure 10. Value-Maximizing Results for III MEF

#### D. COST-MINIMIZING APPROACH

Under the cost-minimizing approach, the operating forces could have attained a comparable level of readiness while spending \$2.9 billion between fiscal years 2019 and 2022. This is equivalent to a \$387 million cost savings over that period. Figure 11 depicts the simulation findings for the operating forces.

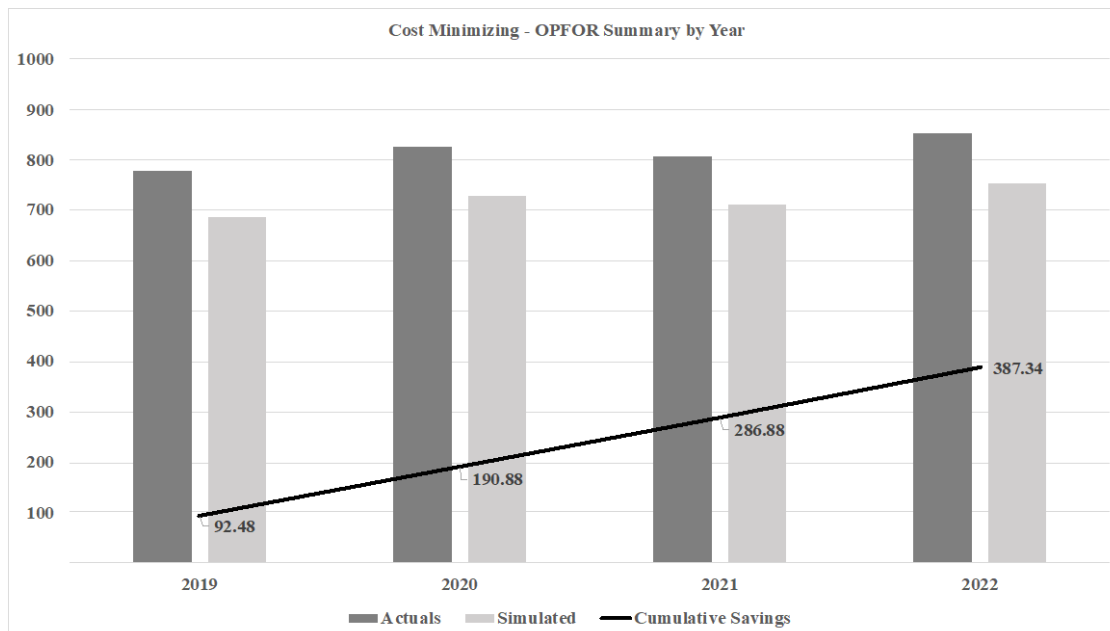


Figure 11. Cost-Minimizing Results for the Operating Forces





As with the value approach, the efficiency results were further divided in Figures 12 through 14 to showcase the forecasted resource impacts across each MEF by year. The savings again sits with I MEF due to having the largest budget over the period of analysis.

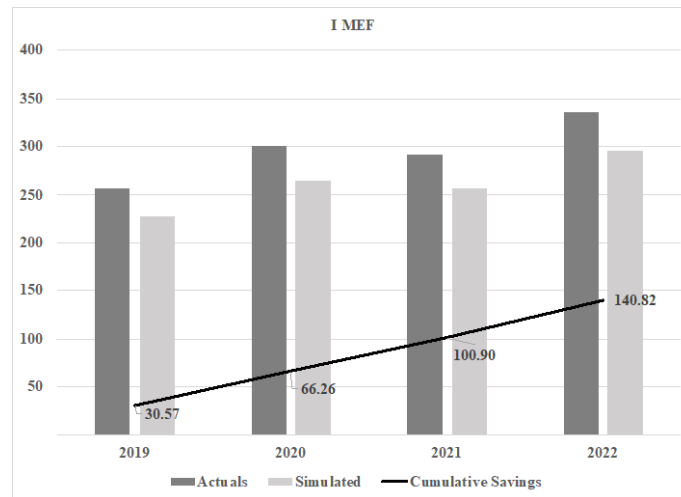


Figure 12. Cost-Minimizing Results for I MEF

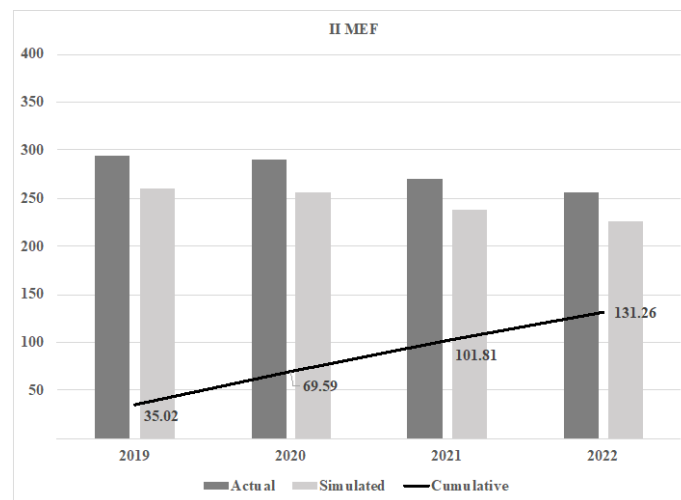


Figure 13. Cost-Minimizing Results for II MEF



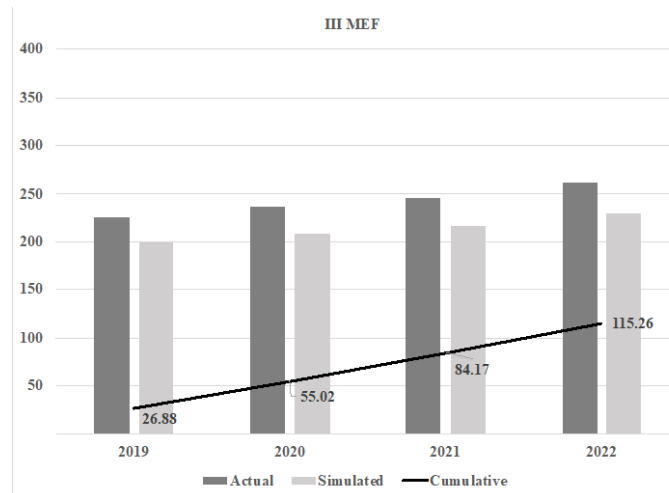


Figure 14. Cost-Minimizing Results for III MEF

### E. SENSITIVITY ANALYSIS

A sensitivity analysis was conducted to identify potential impacts to financial resource usage if the realized improvements vary in effect. Since the relative benefit of either approach is based on the actual spending levels, a single sensitivity table is sufficient to outline the possible outcomes under variation. When considering the value approach, the numbers in the table represent potential additional readiness. When considering the cost-minimizing approach, the numbers in the table represent cost savings. Table 3 shows the financial outcomes by unit and fiscal year based on simulated performance benefits varying between 4% and 21%.



Table 3. Sensitivity Analysis

%Impact	I MEF			
	2019	2020	2021	2022
4.0%	\$ 10,285,541	\$ 12,006,267	\$ 11,651,594	\$ 13,427,966
5.5%	\$ 14,142,618	\$ 16,508,617	\$ 16,020,941	\$ 18,463,453
7.0%	\$ 17,999,696	\$ 21,010,967	\$ 20,390,289	\$ 23,498,941
9.5%	\$ 24,428,159	\$ 28,514,884	\$ 27,672,535	\$ 31,891,419
11.0%	\$ 28,285,236	\$ 33,017,234	\$ 32,041,883	\$ 36,926,907
13.5%	\$ 34,713,699	\$ 40,521,150	\$ 39,324,129	\$ 45,319,386
15.0%	\$ 38,570,777	\$ 45,023,501	\$ 43,693,477	\$ 50,354,873
16.5%	\$ 42,427,855	\$ 49,525,851	\$ 48,062,824	\$ 55,390,360
18.0%	\$ 46,284,932	\$ 54,028,201	\$ 52,432,172	\$ 60,425,847
19.5%	\$ 50,142,010	\$ 58,530,551	\$ 56,801,520	\$ 65,461,335
21.0%	\$ 53,999,088	\$ 63,032,901	\$ 61,170,867	\$ 70,496,822

%Impact	II MEF			
	2019	2020	2021	2022
4.0%	\$ 11,781,631	\$ 11,629,401	\$ 10,838,884	\$ 10,242,877
5.5%	\$ 16,199,742	\$ 15,990,427	\$ 14,903,465	\$ 14,083,956
7.0%	\$ 20,617,854	\$ 20,351,452	\$ 18,968,047	\$ 17,925,035
9.5%	\$ 27,981,373	\$ 27,619,828	\$ 25,742,349	\$ 24,326,833
11.0%	\$ 32,399,485	\$ 31,980,853	\$ 29,806,931	\$ 28,167,912
13.5%	\$ 39,763,004	\$ 39,249,229	\$ 36,581,233	\$ 34,569,710
15.0%	\$ 44,181,115	\$ 43,610,255	\$ 40,645,815	\$ 38,410,788
16.5%	\$ 48,599,227	\$ 47,971,280	\$ 44,710,396	\$ 42,251,867
18.0%	\$ 53,017,338	\$ 52,332,306	\$ 48,774,978	\$ 46,092,946
19.5%	\$ 57,435,450	\$ 56,693,331	\$ 52,839,559	\$ 49,934,025
21.0%	\$ 61,853,561	\$ 61,054,357	\$ 56,904,141	\$ 53,775,104

%Impact	III MEF			
	2019	2020	2021	2022
4.0%	\$ 9,042,401	\$ 9,466,960	\$ 9,806,403	\$ 10,459,449
5.5%	\$ 12,433,302	\$ 13,017,070	\$ 13,483,804	\$ 14,381,742
7.0%	\$ 15,824,203	\$ 16,567,180	\$ 17,161,206	\$ 18,304,036
9.5%	\$ 21,475,704	\$ 22,484,030	\$ 23,290,208	\$ 24,841,191
11.0%	\$ 24,866,604	\$ 26,034,140	\$ 26,967,609	\$ 28,763,484
13.5%	\$ 30,518,105	\$ 31,950,991	\$ 33,096,611	\$ 35,300,640
15.0%	\$ 33,909,006	\$ 35,501,101	\$ 36,774,012	\$ 39,222,933
16.5%	\$ 37,299,906	\$ 39,051,211	\$ 40,451,413	\$ 43,145,227
18.0%	\$ 40,690,807	\$ 42,601,321	\$ 44,128,814	\$ 47,067,520
19.5%	\$ 44,081,707	\$ 46,151,431	\$ 47,806,216	\$ 50,989,813
21.0%	\$ 47,472,608	\$ 49,701,541	\$ 51,483,617	\$ 54,912,107



## **F. KEY TAKEAWAYS**

The simulation results show two possible applications of improved resource usage. Separating the approaches helps illustrate the benefit of an appropriate financial performance metric, but they are by no means mutually exclusive. The value maximizing approach determined that an equivalent increased value of \$450 million could have been achieved between fiscal year 2019 and 2022 while holding spending levels constant. The cost-minimizing approach determined that the same value could have been achieved while spending \$387 million less. More important is the potential to apply both approaches simultaneously. In practice, these can be used in concert to balance priority units and missions, along with managing requirements throughout challenging periods across the fiscal year such as a continuing resolution or end of year closeout. The annual benefit of the new approaches will surely vary from year to year which made a sensitivity analysis vital. The sensitivity analysis could enable an informed decision regarding implementation once associated implementation costs are determined.



## VI. CONCLUSION

### A. SUMMARY

What you measure matters. It drives behavior. Using consumption as a measure of performance reinforces spending. While usage is one way to take advantage of funds, it does not encourage resource employment based on quality (i.e., maximizing the value gained from those resources).

Measuring performance based on an output variable, that is, what the resources result in (equivalent readiness in this example) will focus behavior from exhausting funds to using them efficiently. The relative improvement based on empirical goal setting research is 12 to 15%. Based on the simulation results, it was found that improved resource usage could be applied in two different ways, each with its own advantages. While these two approaches are distinct, they are not necessarily exclusive of one another, and could be used in tandem to achieve even greater benefits. The first approach, which focuses on maximizing value, showed that it would be possible to increase the overall value by \$450 million between fiscal years 2019 and 2022, without any increase in spending. The second approach, which focuses on minimizing costs, showed that the same value could be achieved with a spending reduction of \$387 million. However, it is important to note that both approaches can be applied simultaneously, allowing for a more balanced approach to managing priority units and missions, as well as meeting requirements during challenging periods such as continuing resolutions or end-of-year closeouts. By applying both approaches together, organizations can achieve even greater benefits and optimize their use of resources.

In times of fiscal uncertainty, it is necessary to make the best use of the funds appropriated by Congress. This can only be possible with the ability to understand how effectively funds are utilized—an efficiency metric.

While this change in performance measurement may seem nuanced, the potential benefit is significant when applied across the entire DOD enterprise. In addition, it can be used to establish a baseline of resource efficiency to assist in future planning and force



development initiatives as it will enable resource requirements and resource impacts to be defined in terms of the outcome, such as a unit's capability. For example, "unit x will be 80% of its desired capability," as opposed to the traditional method which looks more like "unit x will do two less major training events." This insight provides leaders with higher quality information from which to maximize the value and capability of their force.

## **B. RECOMMENDATIONS**

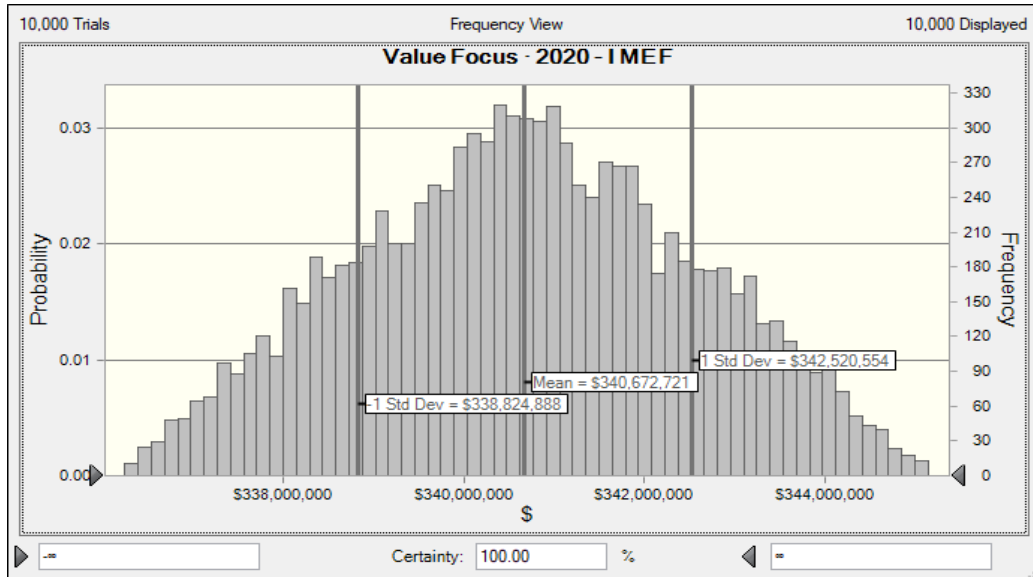
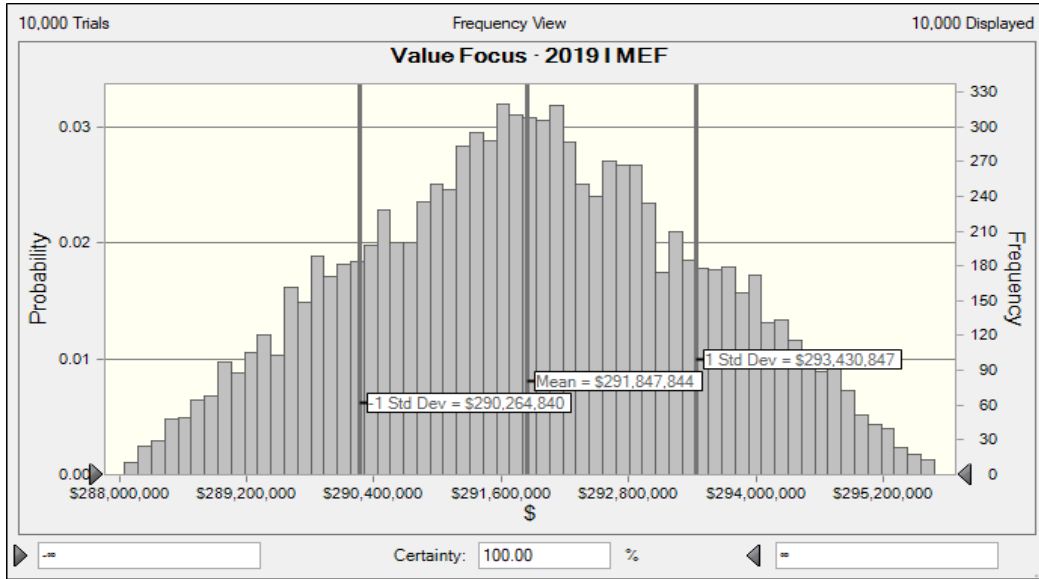
This thesis proposes a new approach to financial resource measurement. By measuring the quality gained from financial resources, overall improvements in spending quality can be expected. To better understand the expected benefits of this change, additional research is suggested in the following areas:

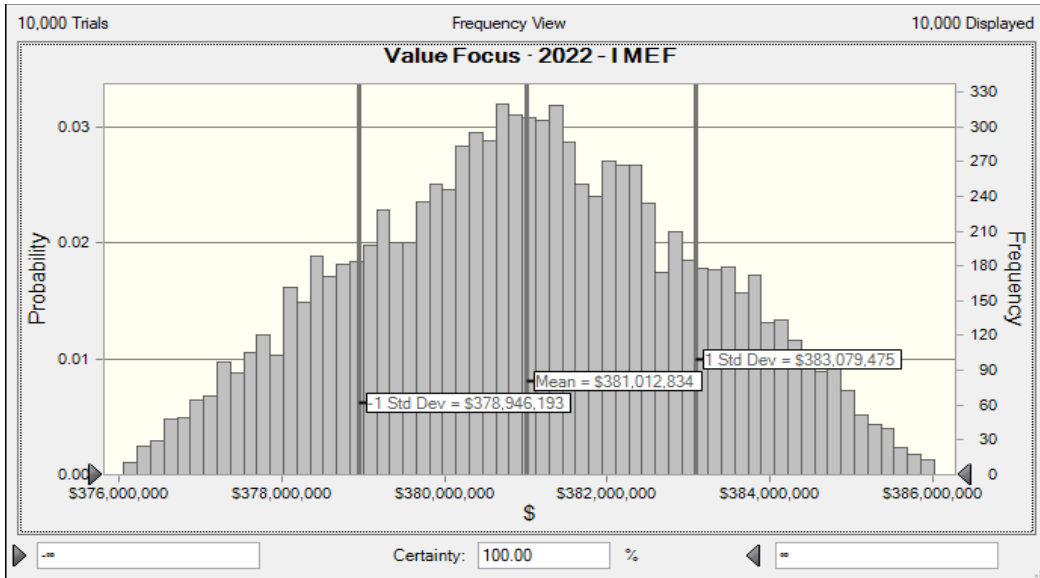
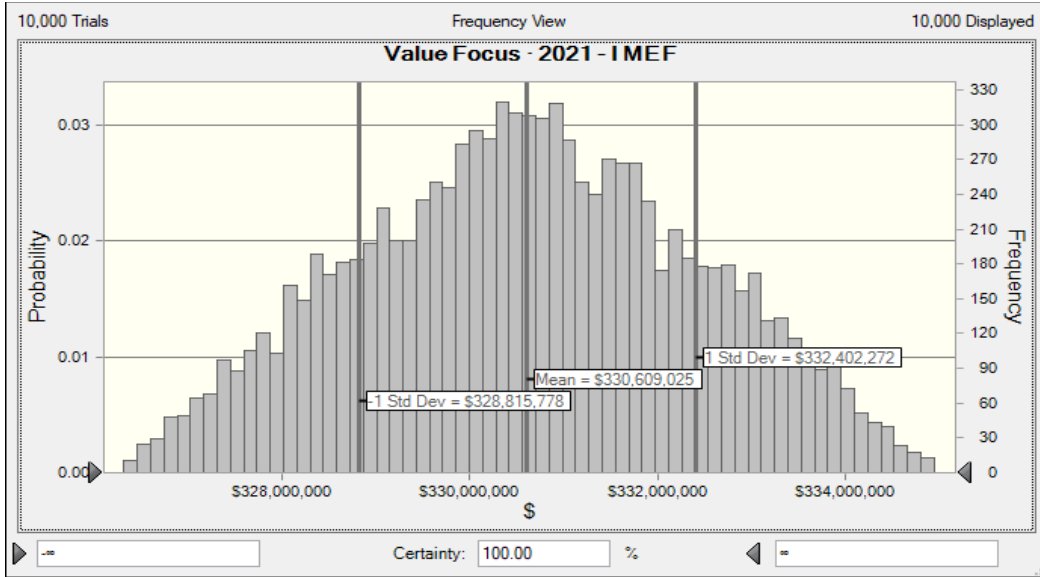
- alternative approaches to measuring financial resource quality
- identify output variables for each program element number (PEN)
- investigate the statistical relationship between financial spending and output variables
- analyze the relationship between financial spending and output variables over time to establish baseline efficiency levels
- use financial resource efficiency to forecast funding level impacts, to include the impacts of continuing resolutions
- cost-benefit analysis of implementation
- implementation plan to include information system efforts



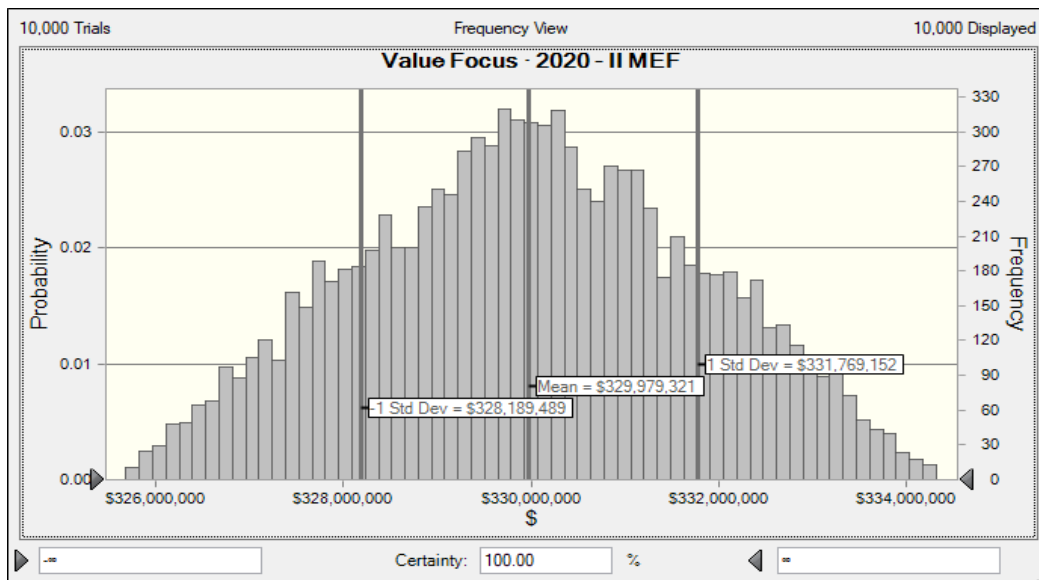
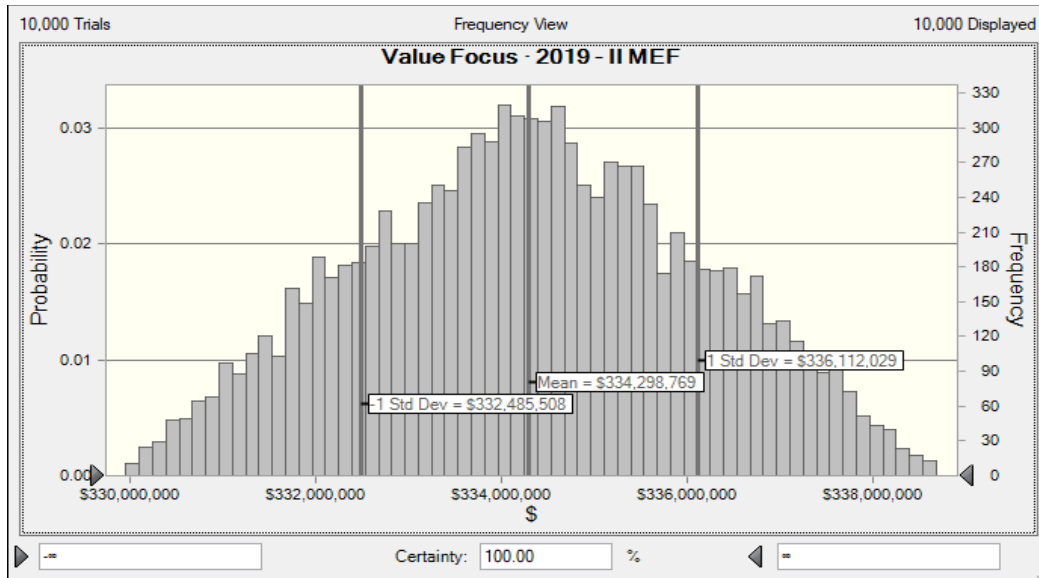
# APPENDIX. SIMULATION RESULTS

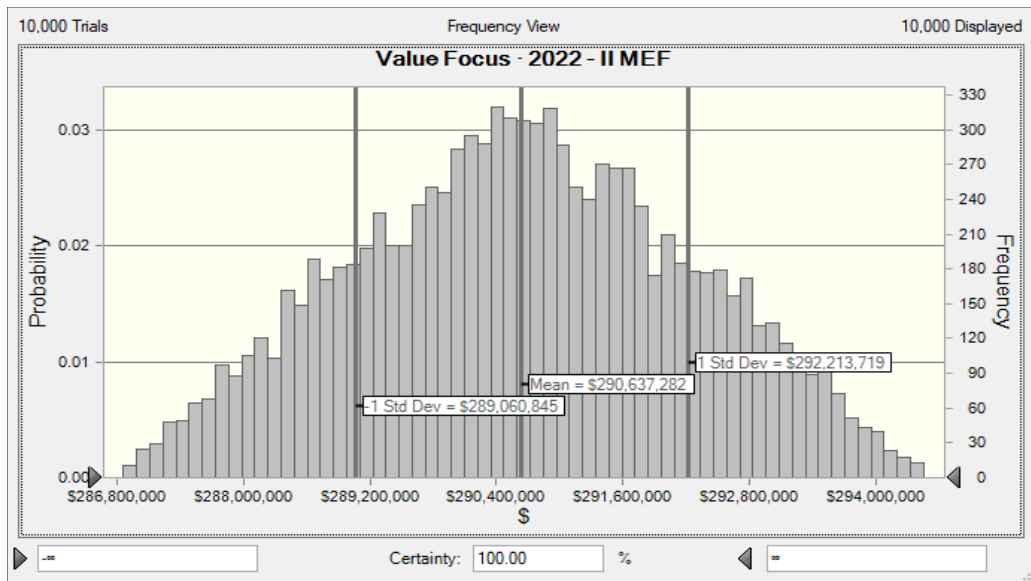
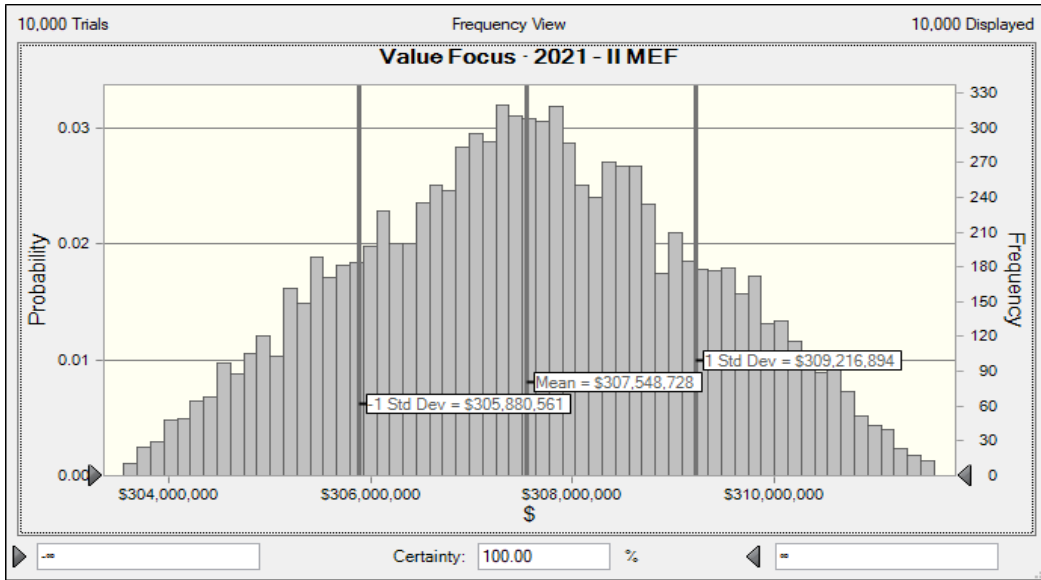
## A. VALUE-MAXIMIZING APPROACH SIMULATION RESULTS

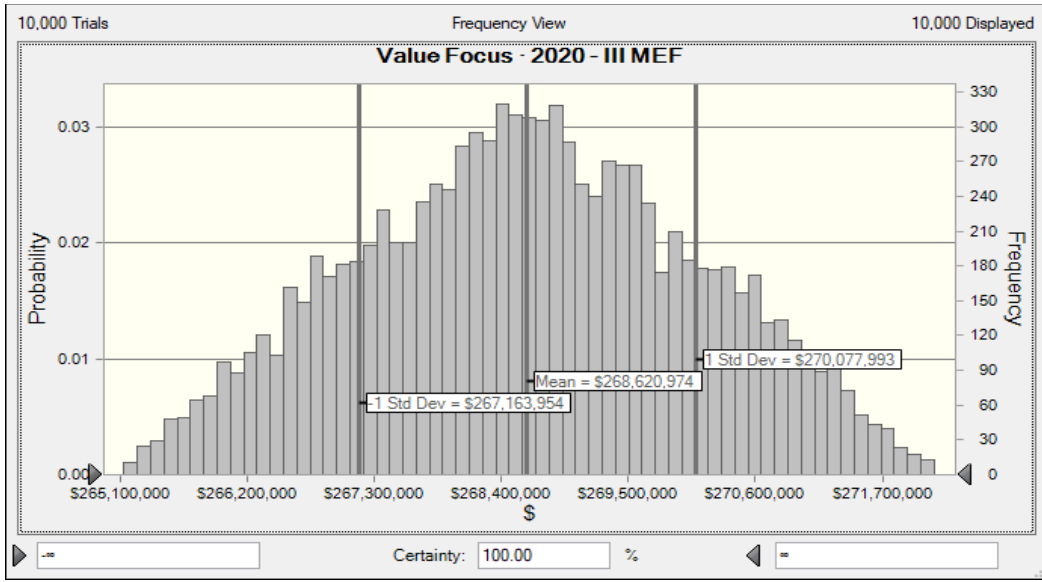
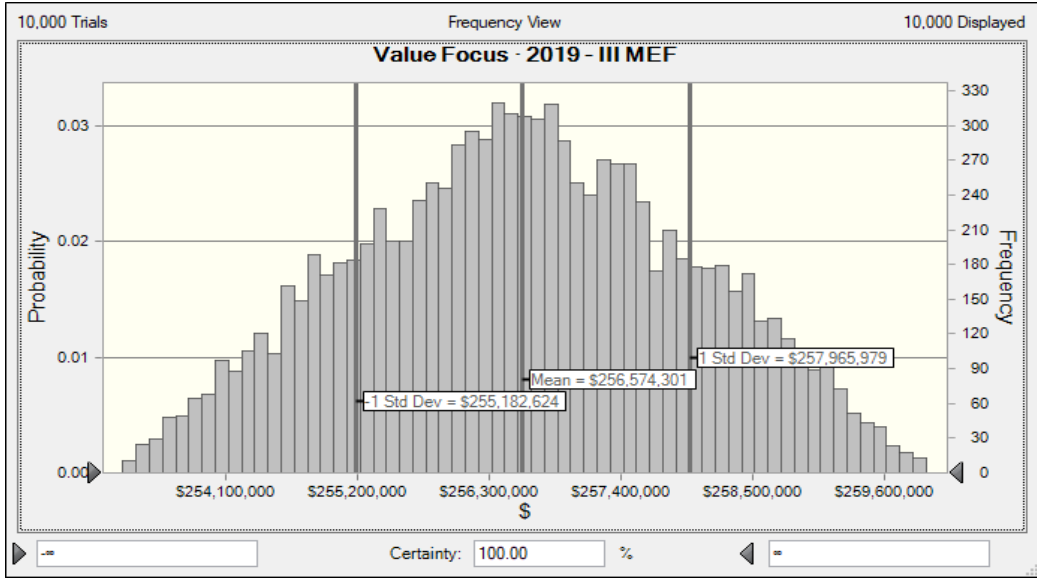


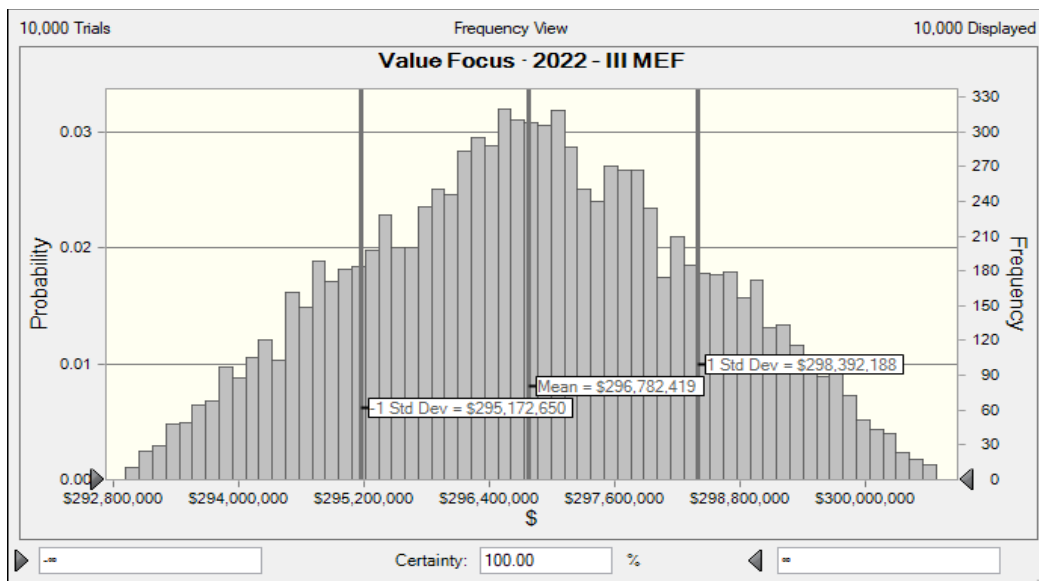
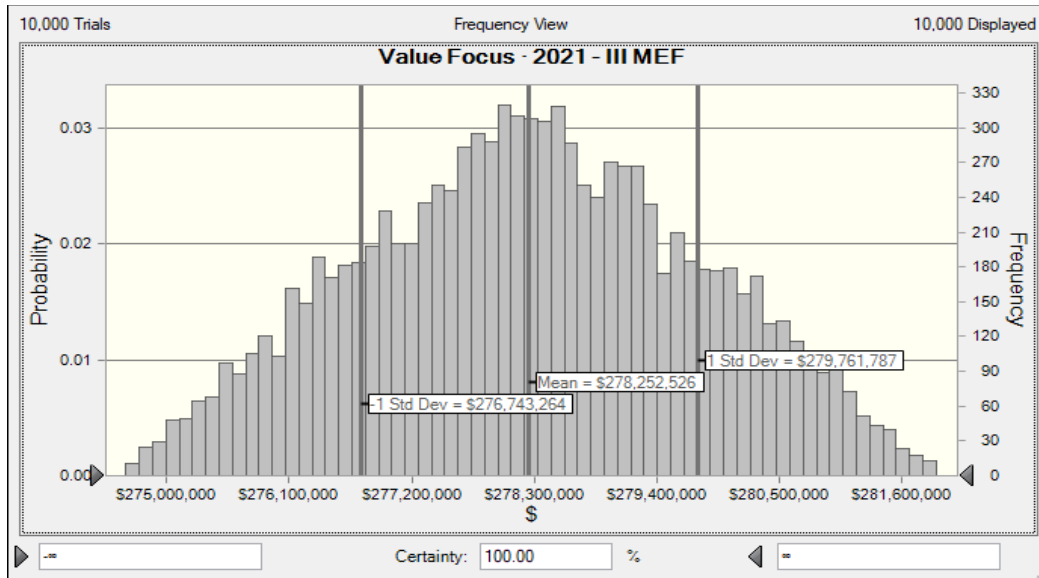




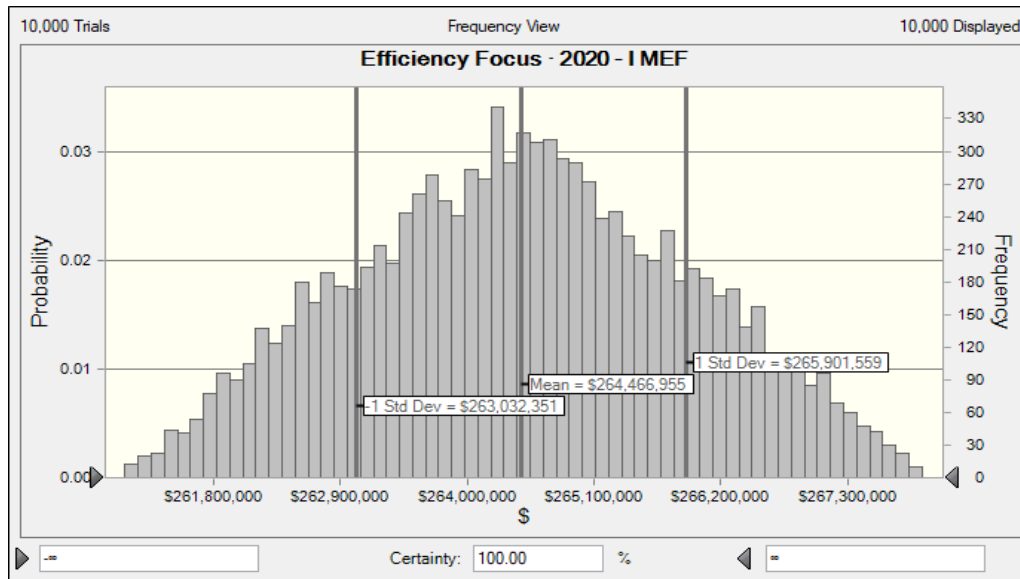
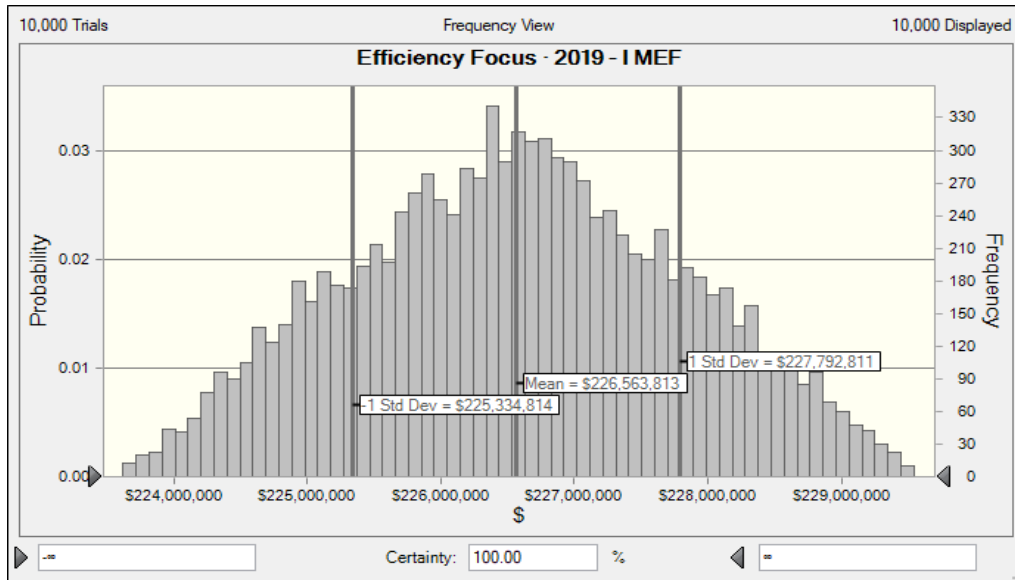


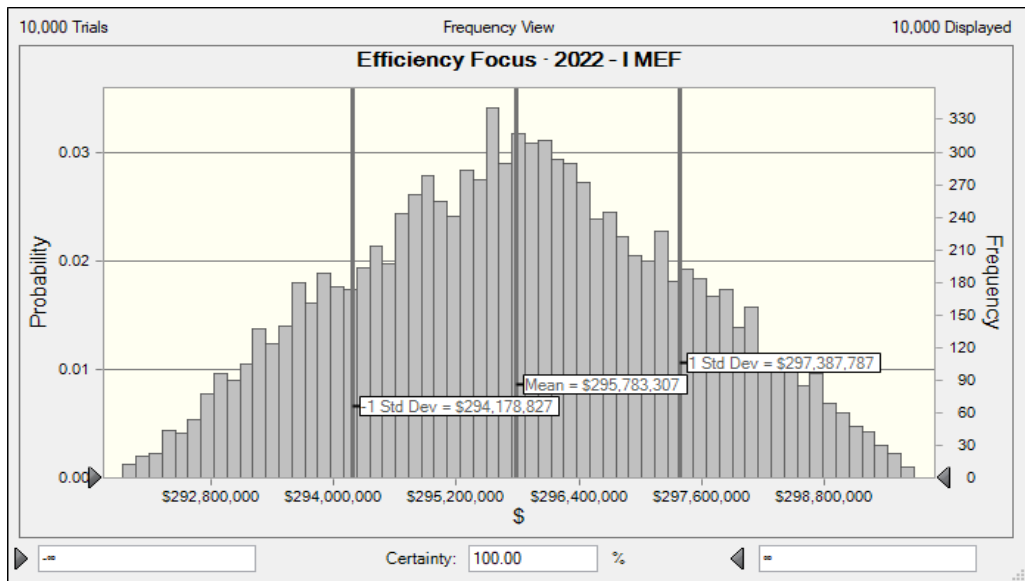
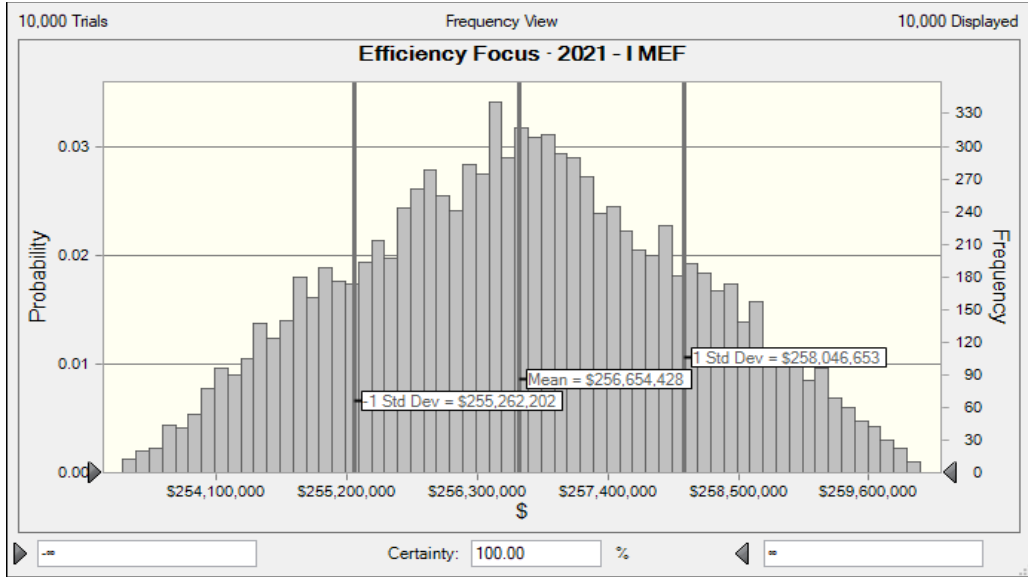


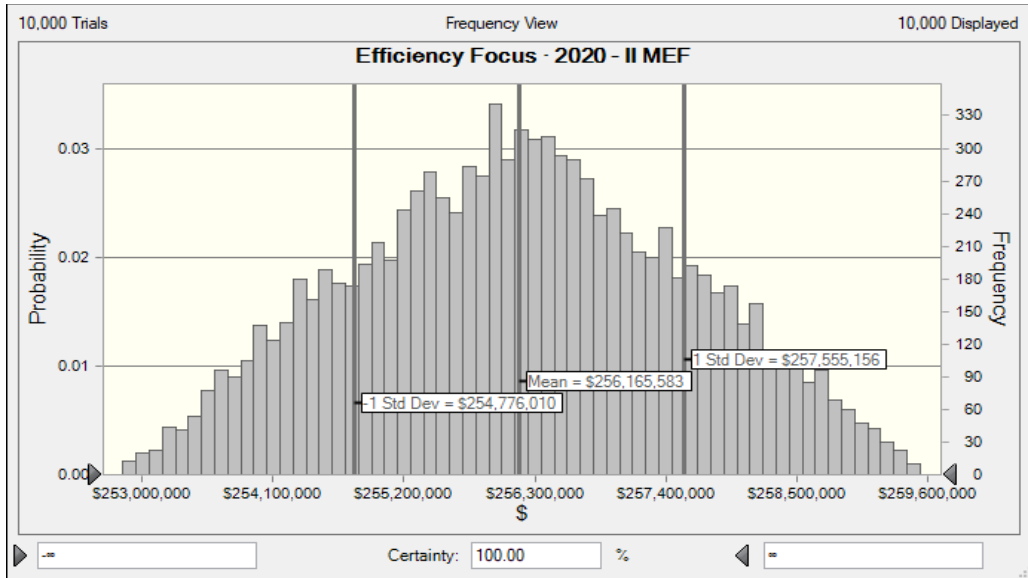
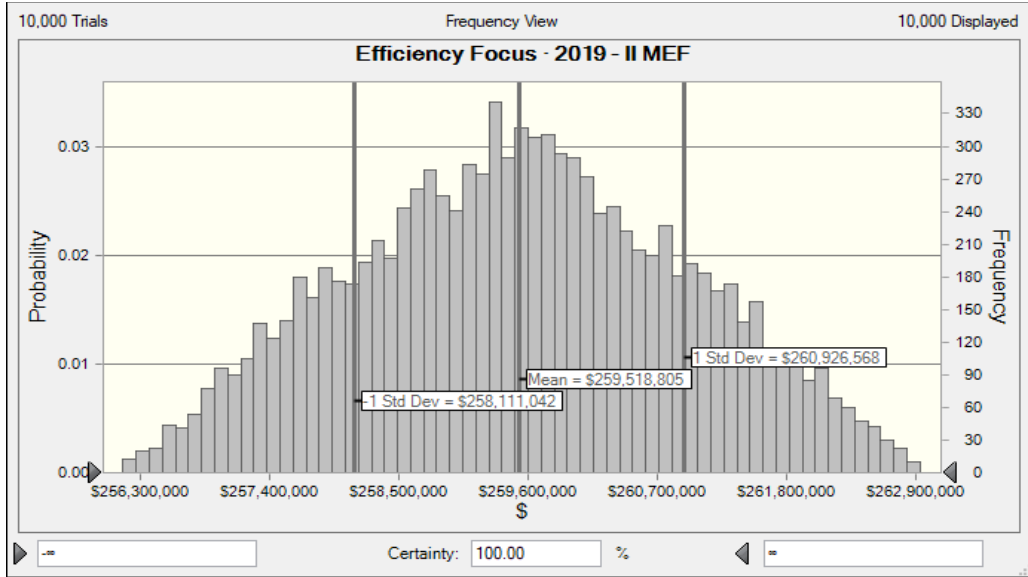


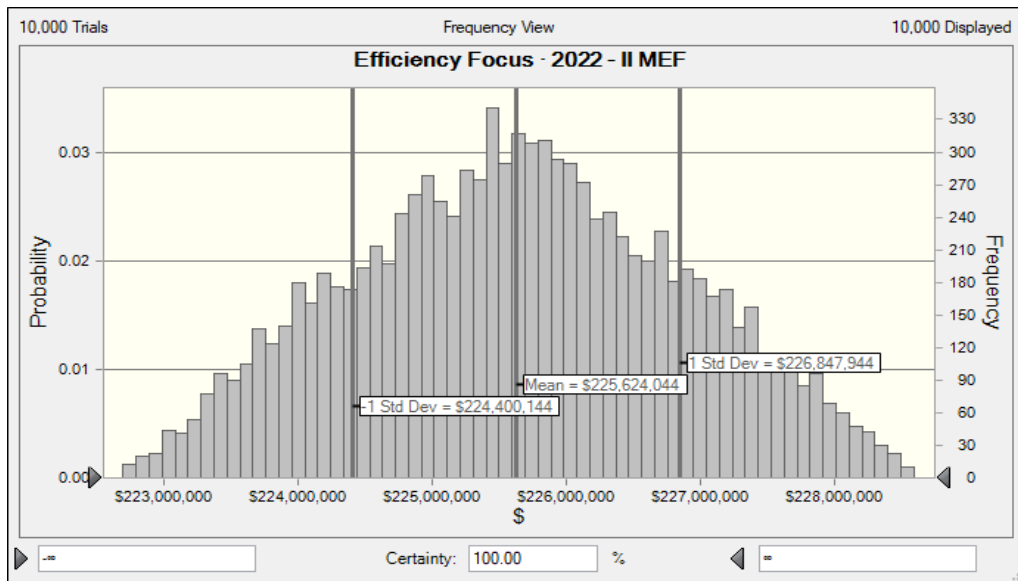
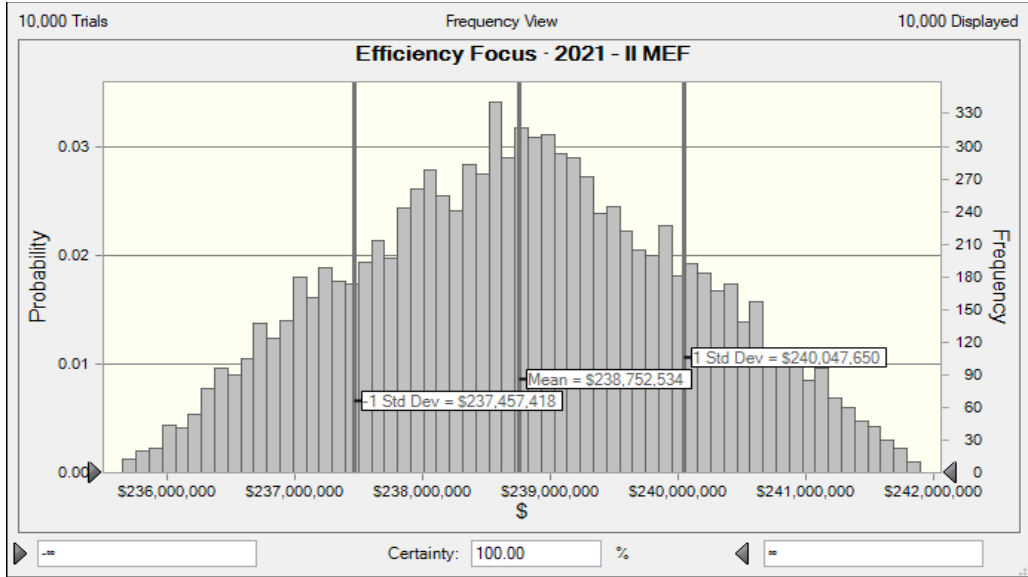


## B. COST-MINIMIZING APPROACH SIMULATION RESULTS

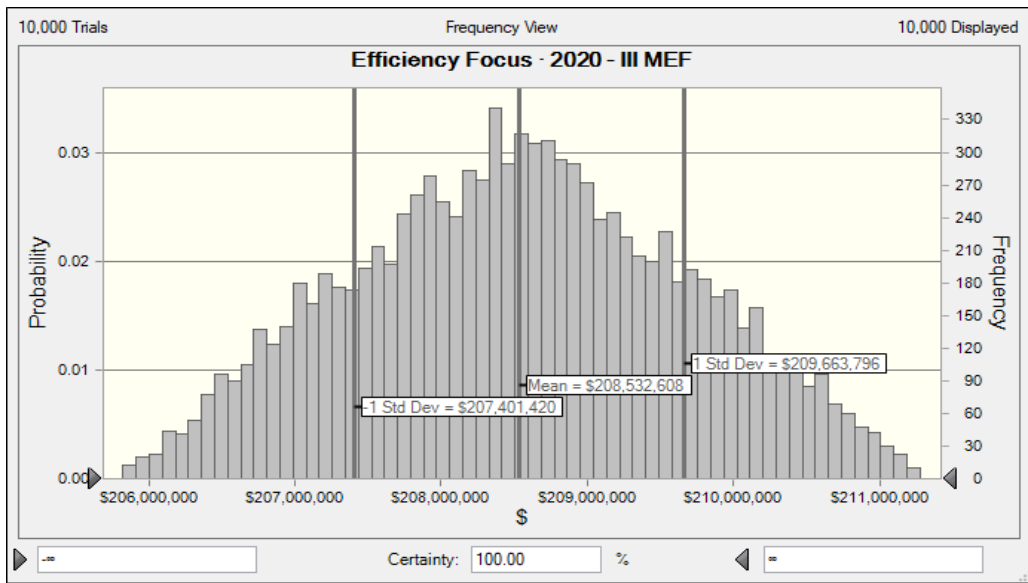
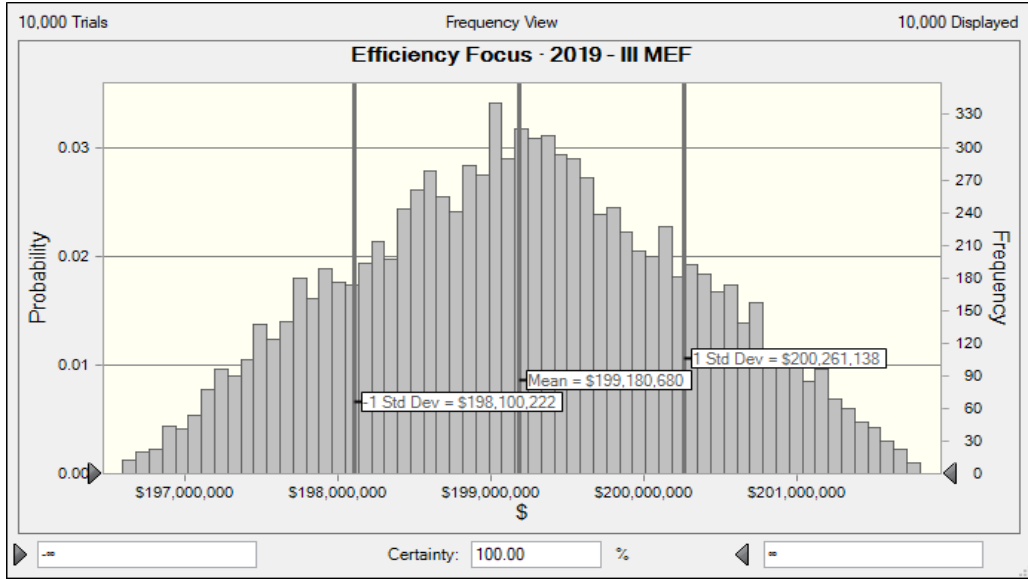


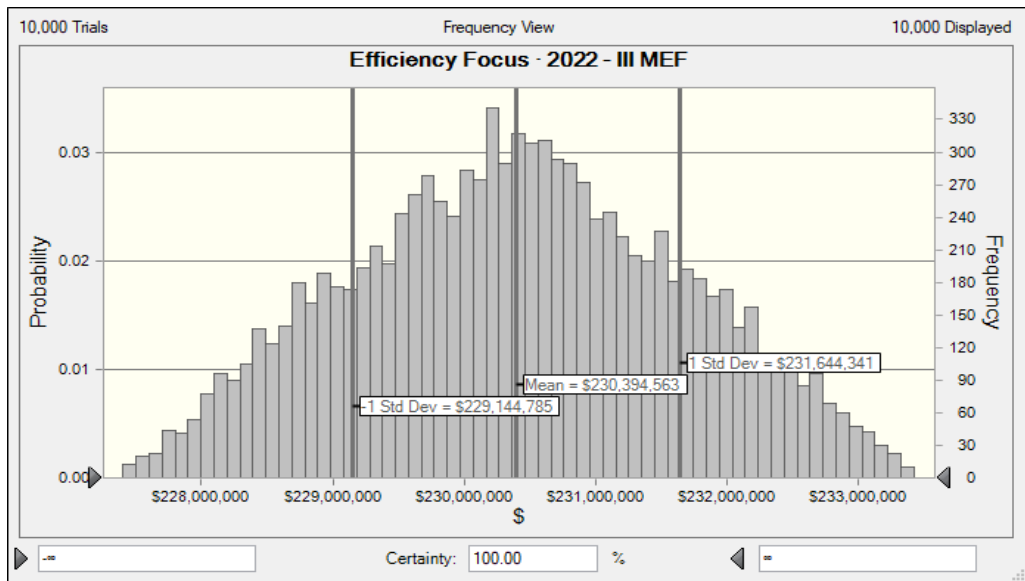
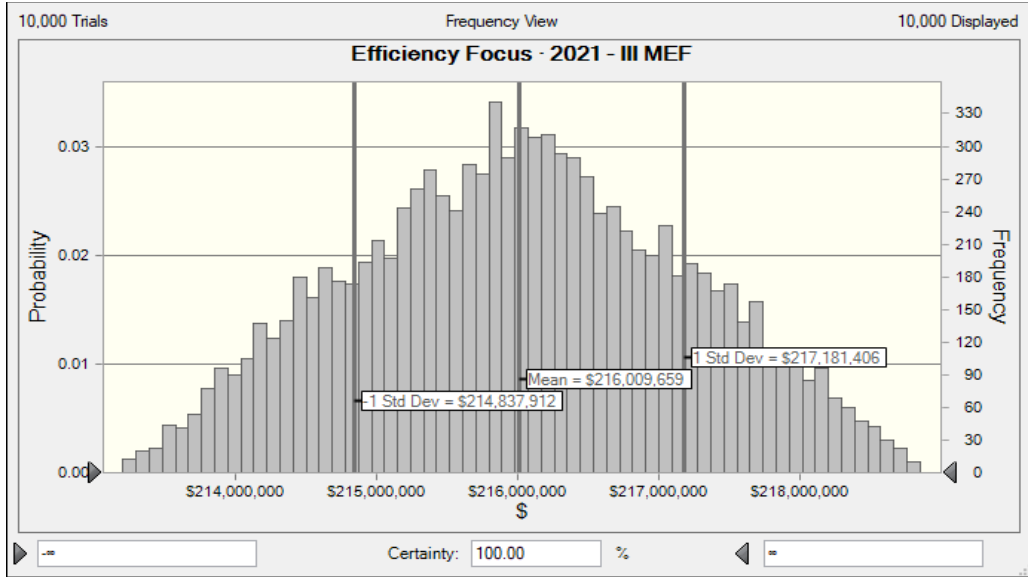












## LIST OF REFERENCES

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ACQUISITION RESEARCH PROGRAM  
NAVAL POSTGRADUATE SCHOOL  
555 DYER ROAD, INGERSOLL HALL  
MONTEREY, CA 93943

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