NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

A COMPARATIVE ANALYSIS FOR THE USMC: LEASING VERSUS PURCHASING FOR A NOVEL AUTONOMOUS LOGISTICS SYSTEM

by

Andre E. Esquibel

June 2022

Thesis Advisor: Raymond R. Buettner Jr.
Second Reader: Dan C. Boger

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE June 2022	3. REPORT TYPE AND DATES COVERED Master's thesis

4. TITLE AND SUBTITLE A COMPARATIVE ANALYSIS FOR THE USMC: LEASING VERSUS PURCHASING FOR A NOVEL AUTONOMOUS LOGISTICS SYSTEM	5. FUNDING NUMBERS
6. AUTHOR(S) Andre E. Esquibel	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	10. SPONSORING / MONITORING AGENCY REPORT NUMBER

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

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

13. ABSTRACT (maximum 200 words)

With a shift in the strategic direction of the Marine Corps due to the 38th Commandant's Planning Guidance, should the Marine Corps shift the way it procures the systems necessary to execute Expeditionary Advanced Base Operations and Littoral Operations in a Contested Environment, namely in the procurement of a novel autonomous logistics system (ALS) that provides middle-mile logistics in a military environment? This thesis attempts to answer the following questions: Should the Marine Corps seek to procure commercial ALS via outright purchase, lease, or a hybrid of the two models? What is unique about commercial ALS that would bias a lease-versus-purchase decision one way or the other, and which aspects of such systems in the analysis could translate to similar analyses of other potential Department of Defense (DOD) systems? What are the likely challenges to a lease-based business model, and what drawbacks will need to be addressed or alleviated by the DOD and by private industry? The research includes literature and legal review, case study analysis, and comparative analysis of procurement methods. A fictional operational vignette is used to ground and explain the comparison. The recommended procurement course of action is a hybrid model, starting with a trial lease period in partnership with a manufacturer, that allows the Marine Corps to test, utilize, and analyze all aspects of a commercial ALS before deciding on a long-term business model to implement across the force.

14. SUBJECT TERMS autonomous logistics system, ALS, lease, purchase, buy, business model, comparative analysis, procurement, acquisitions, civil reserve air fleet, CRAF	15. NUMBER OF PAGES 83
	16. PRICE CODE

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

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release. Distribution is unlimited.

A COMPARATIVE ANALYSIS FOR THE USMC: LEASING VERSUS PURCHASING FOR A NOVEL AUTONOMOUS LOGISTICS SYSTEM

Andre E. Esquibel
Captain, United States Marine Corps
BS, United States Naval Academy, 2017

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION WARFARE SYSTEMS ENGINEERING

from the

NAVAL POSTGRADUATE SCHOOL
June 2022

Approved by: Raymond R. Buettner Jr.
Advisor

Dan C. Boger
Second Reader

Alex Bordetsky
Chair, Department of Information Sciences

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

With a shift in the strategic direction of the Marine Corps due to the 38th Commandant's Planning Guidance, should the Marine Corps shift the way it procures the systems necessary to execute Expeditionary Advanced Base Operations and Littoral Operations in a Contested Environment, namely in the procurement of a novel autonomous logistics system (ALS) that provides middle-mile logistics in a military environment? This thesis attempts to answer the following questions: Should the Marine Corps seek to procure commercial ALS via outright purchase, lease, or a hybrid of the two models? What is unique about commercial ALS that would bias a lease-versus-purchase decision one way or the other, and which aspects of such systems in the analysis could translate to similar analyses of other potential Department of Defense (DOD) systems? What are the likely challenges to a lease-based business model, and what drawbacks will need to be addressed or alleviated by the DOD and by private industry? The research includes literature and legal review, case study analysis, and comparative analysis of procurement methods. A fictional operational vignette is used to ground and explain the comparison. The recommended procurement course of action is a hybrid model, starting with a trial lease period in partnership with a manufacturer, that allows the Marine Corps to test, utilize, and analyze all aspects of a commercial ALS before deciding on a long-term business model to implement across the force.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ALS	autonomous logistics system
BES	Budget Estimate Submission
COCO	contractor owned, contractor operated
COTS	commercial-off-the-shelf
CPG	Commandant's Planning Guidance
CRAF	Civil Reserve Air Fleet
DFAR	Defense Federal Acquisition Regulation
DOD	Department of Defense
DOT	Department of Transportation
DPG	Defense Planning Guidance
EABO	expeditionary advanced base operations
FAR	Federal Acquisition Regulation
FYDP	Future Years Defense Program
GAO	Government Accountability Office
GOCO	government owned, contractor operated
GOGO	government owned, government operated
LOCE	littoral operations in a contested environment
LUH	light utility helicopter
MCDP	Marine Corps Doctrinal Publication
MOS	military occupational specialty
NDAA	National Defense Authorization Act
NDTA	National Defense Transportation Association
OUSD A&S	Office of the Undersecretary of Defense for Acquisition and Sustainment
POM	Program Objective Memorandum
PPBE	planning, programming, budgeting, and execution
PPP	public-private partnership
USMC	United States Marine Corps
USTRANSCOM	United States Transportation Command
WEZ	weapons engagement zone

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

I would like to first thank my friends and family for supporting me throughout my entire time at NPS and always listening to my gripes and complaints along the way. This thesis research and writing process has been confusing, stressful, and time-consuming, but it would have been much more of those things without the ability to unwind and vent to loved ones along the way. Most especially, thank you to my new family that I gained in just two short years in Monterey—I love you.

Thank you to Dr. Ray Buettner for the thesis topic idea and for making yourself available as an advisor. Our cohort had a tough time building relationships with faculty and getting exposure to research topics due to imposed distance-learning requirements throughout our time at NPS, and if Ray were not around, I would still be trying to figure out a thesis topic! Ray made the writing process less stressful than it could have been, and I could not have asked for a better advisor.

Thank you to my second reader, Dr. Boger, for taking me on at the last minute. I would not have completed the thesis process without him, and I am grateful he was willing to help.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. BACKGROUND

The future of warfighting in the Marine Corps continues to shift away from the multiple-decades-long counterterrorism operations and conflicts in the Middle East. In accordance with General Berger's Commandants Planning Guidance (CPG), the Marine Corps is adjusting the force to better prepare for future conflicts. This includes a return to amphibious roots and a preparation for Expeditionary Advanced Base Operations (EABO) and Littoral Operations in a Contested Environment (LOCE),[1] particularly in the island chains across the Pacific. This shift in focus requires a new approach across the spectrum of Marine Corps warfighting functions: command and control, fires, force protection, information, intelligence, logistics, and maneuver. An updated approach in maneuver and logistics requires new platforms to best accomplish the mission and provide Marine Corps units with the supplies and capabilities necessary to accomplish the mission in an EABO and LOCE environment.

One emerging commercial system that would enhance capability is an autonomous logistics system (ALS). General Berger named "Expeditionary logistics systems to sustain Stand-in-Forces in a contested environment" as one of his 15 prioritized investments in his *Force Design 2030 Annual Update*.[2] The Marine Corps and private industry are both exploring novel systems to solve the "middle mile" logistics issue associated with distributed, small unit operations across the Pacific. This "middle mile" logistics concept is the movement of supplies from a supply point that is not the point of origin to a distribution point where those supplies can be directly distributed to warfighters. For example, if the "first mile" gets supplies from the factory onto a ship and the "last mile" gets those supplies from the final distribution point to Marines on the ground, then the

[1] David H. Berger, *Commandant's Planning Guidance* (Washington, DC: United States Marine Corps, 2019), https://www.marines.mil/News/Publications/MCPEL/Electronic-Library-Display/Article/1907265/38th-commandants-planning-guidance-cpg/.

[2] David H. Berger, *Force Design 2030 Annual Update* (Washington, DC: United States Marine Corps, 2021), 11.

"middle mile" is the intermediate link that gets supplies from the ship to the island where the final distribution point is established. It is also time to rethink how such a system should be procured, maintained, serviced, and phased out and replaced with better systems. Instead of spending many years in the acquisitions or procurement process to obtain a system that accomplishes a specific requirement and may only be of value for a limited period, there may be value in procuring such systems via a lease. This may allow for some risk to be assumed by industry partners—versus just the Department of Defense (DOD). Shorter procurement timelines, higher maintenance and readiness levels, greater marketplace competition, lower cost, surge capabilities in times of emergency, and more efficient turnover to updated systems are some potential advantages to this approach. As the Marine Corps attempts to become a lighter, amphibious, and more flexible force, building flexibility into its business model in the procurement of necessary unmanned Autonomous Logistics Systems utilizing a leasing versus purchasing model could result in more lethal warfighting capability now and in the future.

B. RESEARCH QUESTIONS

1. Given existing planning guidance and shifted priorities to EABO and LOCE in the Pacific, should the Marine Corps seek to procure unmanned commercial ALS via outright purchase, lease, or a hybrid of the two models?
2. What is unique about an unmanned commercial ALS that would bias a lease/purchase decision one way or the other, and which aspects of such systems in the lease/purchase analysis could translate to similar analyses of other DOD-interested systems?
3. What are the likely challenges to a lease-based business model, and what drawbacks will need to be addressed or alleviated, both by the DOD and by private industry?

C. SCOPE

This thesis provides a recommendation as to which method (leasing, purchasing, or hybrid) will be most beneficial to the needs of the Marine Corps, with a bias toward operational capability over time, in accordance with the stated goals, vision, and objectives of military leadership.

Studies of past systems are limited to only those systems that currently exist or were at some point in development. The battlespace is constantly shifting, so there will be no universal case study or example that applies to all future unmanned Marine Corps ALS. Also, there is no single, specific system that has been identified for this analysis (i.e., an identifiable commercial company with whom this lease versus purchase determination will be made imminently). The Marine Corps is exploring options for such systems, and while this research will focus on an exemplar unmanned ALS system, its findings may be generalizable. The exemplar system consists of a medium-range unmanned aircraft that can be launched from the ground or from a ship, can land in a contested environment on the ground or on a ship, carries a cargo pod that can be loaded with necessary supplies and equipment, and can drop off the cargo pod in a contested environment and then depart the supply drop-off point.

D. OPERATIONAL BENEFITS

The DOD has a historical and well-known problem when attempting to acquire or procure new air, surface, or ground platforms for operational and wartime use. The procurement of these platforms often gets delayed in the production stage, slow rolled in the bureaucratic processes, or results in systems that do not meet the necessary requirements and capabilities needed for current implementation in the operating forces. Additionally, maintaining and operating such purpose-built systems over the course of their life cycles comes with its own set of challenges, including additional costs, manpower, expertise, resources, etc. While there are laws and regulations that must be followed throughout these processes and all funding is appropriated by Congress for these requirements, the timeline and capability issues provide an opportunity for significant improvement in the business model. For the procurement of a novel ALS, there may be

value in the Marine Corps leasing some or all systems versus attempting to purchase them outright. As the Marine Corps and DOD attempt to remain more flexible in training and anticipating future conflicts, current purchasing practices are not conducive to immediate fielding of useful systems in an evolving operational environment.

The "lease versus purchase" analysis is important in all cases of procurement of systems, ranging in size and scope from small, handheld communications systems to large aircraft and ships. There are advantages and disadvantages to each of these processes, but there is no one-size-fits-all approach to all systems the Marine Corps might seek to procure. However, the range of issues to consider should shift to meet capabilities requirements of future operations, particularly Marine Corps EABO. The purpose of this thesis is to compare procurement options for an unmanned, novel ALS and provide a framework for evaluation of different platforms in the future. Not only are there financial considerations, but there are operational and timeline-related consequences of each approach that are just as important. There are also maintenance considerations throughout the lifetime of the systems that are key factors as well. The maintenance factor alone has its own set of financial, manpower, installation, and doctrine implications that are rarely considered up front but have lasting effects throughout the system's lifetime. The goal of procuring such systems is to fulfill a requirement in the Marine Corps operating forces in a timely manner, with all required support, maintenance, and phase-out implications taken into consideration. Based on the desired system or platform, these considerations necessarily change. This thesis will incorporate relevant factors for an unmanned, novel ALS and provide a recommendation for how the Marine Corps should procure such systems, whether leasing, purchasing outright, some combination of leasing and purchasing, as well as implementation into a civilian reserve fleet.

This thesis provides a detailed comparative analysis of leasing and purchasing implications for incorporating the emerging capability represented by unmanned ALS for implementation in the Marine Corps operating forces. Although the focus of this research is on unmanned ALS, the implications may be consequential to a variety of similar systems across the DOD.

E. METHODOLOGY

This thesis includes extensive literature and legal review, case study analysis, and comparative analysis of two distinct procurement methods, incorporating case study analysis of prior leasing and purchasing models throughout the DOD, analysis of after-action reports, costs, and operational analyses of previous system implementation. A fictional operational vignette will be used to ground and explain the comparison. Final recommendations will be based on both quantitative and qualitative analyses.

F. CHAPTER ORGANIZATION

This thesis is organized into the following chapters. Short descriptions of each chapter and section are provided.

Chapter I, "Introduction," provides background and contextual information as to why this thesis is operationally relevant in the Marine Corps and across the DOD. Three research questions, thesis scope, and research methodology have been provided to frame this thesis as useful research that can inform real-world, operationally minded procurement decision-making in the near future.

Chapter II, "Literature Review," provides an in-depth review of relevant literature that informs the remainder of the thesis. Such literature includes existing research by academic and government institutions, including the Naval Postgraduate School and others as well as applicable laws and regulations that govern the DOD purchase and lease topics. This literature review is referenced throughout the remainder of the thesis, where necessary.

Chapter III, "Leasing Versus Purchasing," describes what both leasing and purchasing are in DOD procurement and how they are each conducted. Applicable laws are referenced for both procurement methods, the leasing and purchasing processes are discussed, and a historical example is provided for each method. Advantages and disadvantages of leasing equipment and platforms are explored as well as advantages and disadvantages of purchasing equipment and platforms. Background and analysis of leasing and purchasing are provided to discuss leasing and purchasing in the context of Marine Corps ALS. Further, budgetary implications are discussed for each method. The Planning,

Programming, Budgeting, and Execution (PPBE) process is examined in the context of where both leasing and purchasing fit in the process. Analysis of Marine Corps ALS within the PPBE process as part of a lease model is compared to a similar analysis with a purchase model. Since a specific system is not the focus of this thesis, a quantitative cost comparative analysis of the various business models is not conducted in this chapter; rather, the effects on the PPBE process in general and cost implications of each model are explored.

Chapter IV, "Civil Reserve Air Fleet," introduces the concept of incorporating commercial Marine Corps and/or United States military ALS into the Civil Reserve Air Fleet (CRAF). This potential course of action falls under the category of a hybrid model. CRAF law is explained, and historical examples are provided. The operational impact of such an addition to the CRAF is analyzed and discussed, as well as actions and steps required to codify such a recommendation and include an unmanned autonomous system in the CRAF.

Chapter V, "Pacific 2035: A Vignette," is a fictional vignette of a future conflict in the Pacific. In the context of the described vignette, the purchase model, lease model, hybrid model, and CRAF model are each explored. The models are compared and analyzed to present an operational picture of how the conflict unfolds based on the model utilized for Marine Corps ALS. The vignette is organized into branches, which are only focused on employment of an ALS operationally with respect to carrying out its assigned role and does not focus on tactics, strategy, infantry operations, or any other aspect of EABO that is not directly related to ALS-provided logistics.

Chapter VI, "Lease/Purchase Recommendations for a Novel Autonomous Logistics System," provides the author's recommendation for procuring novel, commercial ALS for use in the Marine Corps operating forces. The recommendation is based on the comparative analysis done throughout the thesis and the fictional vignette. The recommendation is also based on qualitative and quantitative analysis of options, utilizing an exemplar commercial ALS system, with the ability for the recommendations to be generalizable across various systems and platforms as well as private entities. Recommendations are meant for United States military decision makers, not for commercial companies and/or potential government contractors.

Chapter VII, “Conclusions,” provides direct answers to the three research questions. The thesis is summarized, ideas for further research are provided, and recommended actions are put in operational and strategic context.

THIS PAGE INTENTIONALLY LEFT BLANK

II. LITERATURE REVIEW

A. INTRODUCTION

The problem of leasing or purchasing commercial systems has been explored and studied for decades, both at the Naval Postgraduate School (NPS) and other organizations and academic institutions. The lease versus purchase decision is one that is unique to the specific system, equipment, vehicle, or platform in question—there is no one-size-fits-all approach to making the determination. While some of the analysis framework of other research is applicable to a novel Marine Corps ALS, unique analysis is necessary to make a well-informed recommendation. Additionally, the operational needs of the Marine Corps change over time, particularly now that conflict in Afghanistan is over and we are preparing the force for modern conflict and deterrence. The Marine Corps vision necessarily affects the lease versus purchase decision of incoming platforms for integration into the operating forces.

Current literature on the topic includes academic studies, government reports, and standing laws and regulations regarding procurement standards and recommendations. While current regulations and practices are important and will be considered, this thesis will explore procurement possibilities that may be outside of the currently allowable or practiced standards; this will be stated, as necessary.

B. PRIOR RESEARCH

Perhaps the most relevant existing research on the lease versus purchase analysis when acquiring systems in the DOD is a 2008 NPS Master's thesis titled, "Lease vs. purchase in defense acquisition," by Carlton Hensley and Archie Tinjum.[3] The focus of Hensley and Tinjum's research is with respect to financial and managerial policies affecting leasing, benefits of leasing, financial benefits to the DOD, and legislative action required to enact long-term capital lease options.[4] The conclusion of the thesis indicates

[3] Carlton L. Hensley and Archie L. Tinjum, "Lease vs. Purchase in Defense Acquisition" (master's thesis, Naval Postgraduate School, 2008), https://calhoun.nps.edu/handle/10945/3824.

[4] Ibid, v.

that the authors did not reach definite recommendations; rather, they showed that leasing—when done properly—is a viable option.[5] The scope of Hensley and Tinjum's research is similar in scope to the research and reporting in this thesis, but this thesis will focus specifically on a novel ALS, with consideration toward financial and budget implications of leasing versus buying, but not as the primary consideration.

Other useful existing research directly related to the topic of the lease versus purchase analysis in DOD acquisitions and procurement is a 2014 report by the University of Maryland's Center for Public Policy and Private Enterprise, School of Public Policy, titled *Rethinking the Buy vs. Lease Decision*, and partially sponsored by a grant from NPS.[6] The report, prepared by Jacques Gransler et al., provides a fair analysis of leasing in the context of financial interests, capital versus operating leases, specific examples, needs of military organizations, the current impact of standing regulations with respect to leasing, and provides recommendations for Congress and the Office of Management and Budget to modify existing leasing regulations, the DOD pursuing innovative leasing agreements, and a focus on performance and value. The report suggests "that leasing is most effective when used in conjunction with carefully-structured PPPs that properly align government and private-sector incentives."[7] It defines a public-private partnership (PPP) as "a contractual agreement between a public agency (federal, state or local) and a private sector entity."[8] The authors argue the following with respect to the DOD leveraging leasing as efficiently as possible:

> We posit that in order to fully leverage the benefits that leasing can offer, the DOD should consider increasing its reliance on lease-based public-private partnerships, which capture private sector efficiencies in financing, construction, and operation, and which can translate to lower program costs (relative to traditional procurement), allowing the DOD to partially offset the higher cost of typical lease agreements (relative to outright purchase)

---

[5] Ibid, 67–71.

[6] Jacques S. Gransler et al., *Rethinking the Lease vs. Buy Decision*, UMD-AM-14-179 (College Park, MD: University of Maryland Center for Public Policy and Private Enterprise, 2014), https://calhoun.nps.edu/handle/10945/45072.

[7] Ibid, vii.

[8] Ibid.

while gaining the benefit of faster delivery at reduced risk, with less up-front dollars.[9]

Recommendations of the study include modifying existing regulations, pursuing innovative lease agreements, and focusing on performance and value.[10] This report is useful for follow-up research, most specifically in the context of a novel ALS.

Another relevant source of existing research to the lease versus purchase decision in the DOD is a 2005 NPS Acquisition Research Sponsored Report Series report titled, "Navy Acquisition via Leasing: Policy, Politics, and Polemics with the Maritime Prepositioned Ships," by Professor Joseph San Miguel et al.[11] One of the prominent leasing examples in United States military history is the Navy leasing program of Maritime Prepositioning ships in the 1980s. This source looks past the controversy and political intrigue that occurred at the time and analyzes the cargo ship (TAKX) leasing program, concluding that it was cost effective and successful.[12] Due to the program, laws/policies had since been altered to make leasing a less-viable option. This source recommends the alteration of laws and regulations to allow for more-viable leasing options of similar resources, that "with a different legislative context and regulatory climate, leasing could be made potentially viable again."[13] While the focus of this thesis is on producing a lease versus purchase analysis and recommendation for a commercial ALS to be procured by the Marine Corps, part of the necessary analysis requires consideration for applicable legislation and regulations that require alternation, although the alteration itself is outside the scope of this thesis.

The lease versus purchase analysis in defense acquisition and procurement dates back well beyond the current millennium. Another Master's thesis published by NPS in 1997, authored by Alan J. Arceneaux and titled "Cost/benefit analysis of Leasing Versus

---

[9] Ibid, viii-ix.

[10] Ibid, 38–39.

[11] Joseph G. San Miguel et al., *Navy Acquisition via Leasing: Policy, Politics, and Polemics with the Maritime Prepositioned Ships*, NPS-AM-05-006 (Monterey, CA: Naval Postgraduate School, 2005), https://calhoun.nps.edu/handle/10945/354.

[12] Ibid, i.

[13] Ibid, 25.

Purchasing Computers" provides a cost/benefit analysis of leasing and purchasing computers in order to "provide a decision making model for the acquisition of computer assets."[14] While this research is focused on a decision-making model for acquiring computers and was conducted over two decades ago, it provides an example of a potential suitable framework for conducting a lease/purchase analysis. However, the results of the research are constrained within a purely financial framework. Arceneaux concludes that purchasing was more cost effective than leasing in the case of Navy shore commands acquiring computer assets and that the government should "not enter into leasing arrangements on computer equipment," as it "would be more beneficial for the government to purchase the gear outright."[15] This research is relevant but limited in scope. Financial impacts are one consideration of the larger lease/purchase analysis. However, Arceneaux provides a significant caveat to his recommendation regarding acquiring computer equipment: "If computers realize an extended life and technology developments are prolonged, then a leasing arrangement might be feasible" and that "another area that should be researched is the possibility of having a civilian firm administer the entire informational processing requirements (of) the school."[16] This recommendation presents the option of leasing informational processing from a civilian contractor, effectively utilizing computers as a service, which is a course of action that is explored in this thesis—utilizing commercial ALS as a service within the lease model.

An even older example of research regarding a lease versus purchase analysis in defense procurement is a 1977 NPS Master's thesis by Michael Kanne titled, "Analysis of lease versus buy options for procurement of radio assets for the Marine Corps Air Station at Yuma, Arizona."[17] The research focuses largely on economic and financial cost-benefit impacts of leasing or purchasing radio assets and their maintenance. While there are some

[14] Alan J. Arceneaux, "Cost/benefit analysis of Leasing Versus Purchasing Computers" (master's thesis, Naval Postgraduate School, 1997), i, https://calhoun.nps.edu/handle/10945/8160.

[15] Ibid, 66.

[16] Ibid.

[17] Michael Raymond Kanne, "Analysis of Lease Versus Buy Options for Procurement of Radio Assets for the Marine Corps Air Station at Yuma, Arizona" (master's thesis, Naval Postgraduate School, 1977), https://calhoun.nps.edu/handle/10945/18009.

non-quantitative factors that are analyzed, they are not used as a significant factor in the determination. The determination of Kanne's research is to purchase the radios and perform maintenance at government maintenance facilities.[18] For its time and scope, Kanne's research provides a comprehensive analysis of the lease and purchase options and gives a determination as to which option was better for the service at the time. With respect to a commercial Marine Corps ALS, this thesis will provide a similar determination but will be scoped in the present day, with an operational understanding of future Marine Corps goals and requirements for logistics systems. Instead of focusing exclusively on economic and financial cost-benefit impacts, a more holistic and operationally focused approach will be utilized.

There are relevant examples of the government analyzing its own leased programs. One such example is a Government Accountability Office (GAO) report delivered in the form of a Congressional testimony delivered by Neal Curtin (Director Defense Capabilities and Management) to the House Armed Services Committee in July 2003.[19] The topic of the report is with respect to the United States Air Force's proposal to lease aerial refueling aircraft (KC-767A). The report describes the current condition of Air Force refueling aircraft at the time, provides a summary of the Air Force's proposed lease, presents preliminary GAO observations on the lease report, and identifies issues for further scrutiny.[20] The report answers important questions that were important to Congress at the time and remain relevant to present-day lease versus purchase analyses, but the most important point that Curtin makes is with respect to the benefit of considering leasing as a viable alternative to purchasing in the first place. As Curtin reports, "The main advantage of the lease, as pointed out by the Air Force, is that it would provide aircraft earlier than purchasing the aircraft and without disrupting other budget priorities."[21] This GAO report

---

[18] Ibid, 38–39.

[19] Neal P. Curtin, *Military Aircraft: Considerations in Reviewing the Air Force Proposal to Lease Aerial Refueling Aircraft*, GAO-03-1048T (Washington, DC: Government Accountability Office, 2003), https://www.govinfo.gov/content/pkg/GAOREPORTS-GAO-03-1048T/html/GAOREPORTS-GAO-03-1048T.htm.

[20] Ibid.

[21] Ibid, 11.

is not comprehensive but provides a partial framework for scrutinizing potential lease decisions of military aircraft and provides critical insight into what lawmakers and the GAO consider when deciding whether to move forward with alternative acquisition methods.

The lease versus purchase analysis in defense acquisitions and procurement is not only relevant to the United States military—it is relevant to other militaries around the world. As an example, in his 2002 Air Force Institute of Technology Master's thesis titled "Comparative Analysis of Leasing versus Buying General Purpose Vehicles (Sedan) in the Korean Air Force," Jung Jin Kim analyzed options for procuring vehicles for use by the Korean Air Force.[22] It is important to note that this research was conducted by an airman in the Korean Air Force while a student studying at the Air Force Institute of Technology in the United States. Although not directly translatable to the United States military, considerations are similar, though based on Korean practices and operational needs. Through a cost-benefit analysis, the author concludes that purchasing provides more benefits at significant cost savings, asserting that "significant benefits seem to be available in the areas of Availabilities, Flexibility, and Organization for the ownership" and "On the contrary these benefits turned out to be weakness in the leasing alternative, but in the areas of Reliability, Safety, Economy, and Service, the lease is more beneficial than the ownership."[23] The scope of Kim's research is limited almost exclusively to a financial impact analysis and not as much of an operational impact analysis, which is the primary focus of this thesis with respect to commercial ALS in the Marine Corps.

C. APPLICABLE LAWS, REGULATIONS, AND GOVERNMENT RESOURCES

One of the most current laws with relevance to DOD spending and acquisitions is the 2022 National Defense Authorization Act (NDAA). This is the law which provides funding authorization for the DOD for fiscal year 2022 (the fiscal year in which this thesis

[22] Kim, Jung Jin, "Comparative Analysis of Leasing versus Buying General Purpose Vehicles (Sedan) in the Korean Air Force" (master's thesis, Air Force Institute of Technology, 2002), https://apps.dtic.mil/sti/citations/ADA401799.

[23] Ibid, 64.

is published) as well as the rules and regulations surrounding the operation of the United States Armed Forces. One of the relevant sections to this thesis is 10 USC 2401a (Lease of vehicles, equipment, vessels, and aircraft), which states, "The Secretary of Defense may use leasing in the acquisition of commercial vehicles and equipment whenever the Secretary determines that such leasing is practicable and efficient."[24] There are further amendments and provisions that legislate when and how such arrangements shall occur. This law is applicable throughout this thesis but will not be viewed as having boundaries or policies that cannot be changed, as a new NDAA is passed by Congress and signed into law by the President of the United States for each new fiscal year.

Another one of the most relevant government regulations with respect to defense acquisitions is the Defense Federal Acquisition Regulation Supplement (DFARS). This is a DOD source that provides the text of the DFAR, with the most recent effective change occurring on March 18, 2022. The most relevant subpart is Subpart 207.4 (Equipment Acquisition), which is provided in its entirety as follows:

> 207.401 Acquisition considerations.
>
> If the equipment will be leased for more than 60 days, the requiring activity must prepare and provide the contracting officer with the justification supporting the decision to lease or purchase.
>
> 207.470 Statutory requirements.
>
> (a) Requirement for authorization of certain contracts relating to vessels, aircraft, and combat vehicles. The contracting officer shall not enter into any contract for the lease or charter of any vessel, aircraft, or combat vehicle, or any contract for services that would require the use of the contractor's vessel, aircraft, or combat vehicle, unless the Secretary of the military department concerned has satisfied the requirements of 10 U.S.C. 2401, when—
>
> (1) The contract will be a long-term lease or charter as defined in 10 U.S.C. 2401(d)(1); or

[24] National Defense Authorization Act of 2022, *U.S. Code* 10 (2022) §§ 2401a et seq. https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section2401a&num=0&edition=prelim.

(2) The terms of the contract provide for a substantial termination liability as defined in 10 U.S.C. 2401(d)(2). Also see PGI 207.470.

(b) Limitation on contracts with terms of 18 months or more. As required by 10 U.S.C. 2401a, the contracting officer shall not enter into any contract for any vessel, aircraft, or vehicle, through a lease, charter, or similar agreement with a term of 18 months or more, or extend or renew any such contract for a term of 18 months or more, unless the head of the contracting activity has—

(1) Considered all costs of such a contract (including estimated termination liability); and

(2) Determined in writing that the contract is in the best interest of the Government.

(c) Leasing of commercial vehicles and associated equipment. Except as provided in paragraphs (a) and (b) of this section, the contracting officer may use leasing in the acquisition of commercial vehicles and associated equipment whenever the contracting officer determines that leasing of such vehicles is practicable and efficient (10 U.S.C. 2401a).

207.471 Funding requirements.

(a) Fund leases in accordance with DOD Financial Management Regulation (FMR) 7000.14-R, Volume 2A, Chapter 1.

(b) DOD leases are either capital leases or operating leases. See FMR 7000.14-R, Volume 4, Chapter 6, Section 060206.

(c) Use procurement funds for capital leases, as these are essentially installment purchases of property.[25]

While this is not a study or research with respect to the lease/purchase decision, it provides regulatory, statutory, and funding requirements and considerations that are necessary to consider as part of a comprehensive lease versus purchase analysis.

In addition to the DFARS, the Federal Acquisition Regulation (FAR) is a United States government source which provides acquisitions policy for the entire government.

[25] Department of Defense, *Defense Federal Acquisition Regulation Supplement, Part 207*: Acquisition Planning, Subpart 207.4 – Equipment Acquisition, https://www.acquisition.gov/dfars/part-207-acquisition-planning#DFARS-207.401.

The most recent effective change occurred on January 30, 2022. The most relevant subpart is Subpart 7.4 (Equipment Acquisition), provided in part as follows:

> 7.401 Acquisition considerations.
>
> (a) (1) Agencies shall acquire equipment using the method of acquisition most advantageous to the Government based on a case-by-case analysis of comparative costs and other factors in accordance with this subpart and agency procedures.
>
> (2) The methods of acquisition to be compared in the analysis shall include, at a minimum—
>
> (i) Purchase;
>
> (ii) Short-term rental or lease;
>
> (iii) Long-term rental or lease;
>
> (iv) Interagency acquisition (see 2.101); and
>
> (v) Agency acquisition agreements, if applicable, with a State or local government.
>
> (b) (1) The factors to be compared in the analysis shall include, at a minimum:
>
> (i) Estimated length of the period the equipment is to be used and the extent of use within that period;
>
> (ii) Financial and operating advantages of alternative types and makes of equipment;
>
> (iii) Cumulative rent, lease, or other periodic payments, however described, for the estimated period of use;
>
> (iv) Net purchase price;
>
> (v) Transportation, installation, and storage costs;
>
> (vi) Maintenance, repair, and other service costs; and
>
> (vii) Potential obsolescence of the equipment because of imminent technological improvements.

(2) The following additional factors should be considered, as appropriate, depending on the type, cost, complexity, and estimated period of use of the equipment:

(i) Availability of purchase options.

(ii) Cancellation, extension, and early return conditions and fees.

(iii) Ability to swap out or exchange equipment.

(iv) Available warranties.

(v) Insurance, environmental, or licensing requirements.

(vi) Potential for use of the equipment by other agencies after its use by the acquiring agency is ended.

(vii) Trade-in or salvage value.

(viii) Imputed interest.

(ix) Availability of a servicing capability, especially for highly complex equipment; e.g., can the equipment be serviced by the Government or other sources if it is purchased?

(c) The analysis in paragraph (a) is not required—

(1) When the President has issued an emergency declaration or a major disaster declaration pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5121 et seq.);

(2) In other emergency situations if the agency head makes a determination that obtaining such equipment is necessary in order to protect human life or property; or

(3) When otherwise authorized by law.

7.402 Acquisition methods.

(a) Purchase method. (1) Generally, the purchase method is appropriate if the equipment will be used beyond the point in time when cumulative rental or leasing costs exceed the purchase costs.

(2) Agencies should not rule out the purchase method of equipment acquisition in favor of renting or leasing merely because of the possibility

that future technological advances might make the selected equipment less desirable.[26]

Many of these considerations are utilized in this thesis. As stated in the NDAA, DFARS, and FAR, the best interest of the government through the most practical and efficient method available shall be the primary consideration. In this thesis, the best interest of the government not only includes the considerations outlined in these laws and regulations but also includes the model most beneficial to Marine Corps operations and accomplishment of the mission.

D. SUMMARY

There are many laws and regulations governing the acquisition and procurement of military systems, and there has been a significant amount of research that has been done on the lease versus purchase of military systems analysis topic. This thesis incorporates existing research as well as currently applicable laws and regulations and applies a lease versus purchase comparative analysis to a novel, commercial ALS for the Marine Corps. Such a system, like all novel systems, is unique in function, design, maintainability, survivability, availability, interoperability, and operational capability. In other words, an ALS has specifications that affect how it can and should be implemented in the operating forces. Prior research and existing laws, regulations, and doctrine all contribute to the business model analysis of an ALS. The following chapters utilize the information and policy contained in these references and literature as applicable to provide a unique analysis and recommendation for a novel ALS.

[26] United States, *Federal Acquisition Regulation, Part 7: Acquisition Planning*, Subpart 7.4 – Equipment Acquisition, https://www.acquisition.gov/far/subpart-7.4.

THIS PAGE INTENTIONALLY LEFT BLANK

III. LEASING VERSUS PURCHASING

A. INTRODUCTION

The lease versus purchase analysis for any item—whether it be a personal vehicle or a multi-billion-dollar DOD acquisition—requires both qualitative and quantitative analysis to determine which option is best for the customer. The same holds true for procurement of a commercial ALS for use in the Marine Corps operating forces. This thesis uses both qualitative and quantitative reasoning but does not focus on specific cost comparisons as those costs are not yet available. This chapter describes what both leasing and purchasing are in DOD procurement and how they are each conducted. Applicable laws are referenced for both procurement methods, the leasing and purchasing processes are discussed, and a historical example is provided for each method. Advantages and disadvantages of leasing and purchasing are explored. Background and analysis of leasing and purchasing are provided to discuss leasing and purchasing in the context of Marine Corps ALS. Budgetary implications are also discussed for each method, in the context of the PPBE process. Since this thesis explores lease, purchase, and hybrid models, a hybrid model is discussed with respect to what procurement as a hybrid model would entail, including maintenance and ownership responsibilities. Since a specific system is not the focus of this thesis, a quantitative cost comparative analysis of the various business models is not conducted in this chapter; rather, the effects on the PPBE process in general and cost implications of each model are explored.

B. WHAT IS LEASING?

This section explains what leasing is in the context of DOD procurement, how leasing is executed, what the budgetary implications are of leasing, advantages, disadvantages, and provides a historical example of a DOD-leased product for context and precedent. For the purposes of continuity throughout this section, the term "lease" refers to an operating lease, in which the government utilizes the ALS throughout the execution of the lease terms but there is never a transfer of ownership from the private company to the DOD.

1. Laws and Regulations

Chapter II of this thesis provides direct quotations of relevant portions of the most recent NDAA, FAR, and DFAR, which all assert that leasing can be considered as a reasonable option if leasing is beneficial to the government. According to the FAR, leasing may be used "in the acquisition of commercial vehicles and associated equipment whenever the contracting officer determines that leasing of such vehicles is practicable and efficient" and contracting officers shall use "procurement funds for capital leases, as these are essentially installment purchases of property."[27] Of note, although a capital lease for procuring commercial ALS is a potential course of action, this thesis focuses on leasing as an operating lease, which opens the door for utilizing the Operations and Maintenance appropriation to fund the lease.

Further, the DFAR states that a comparative analysis should be conducted prior to making a lease versus purchase decision, taking into consideration all life cycle costs and contract terms of a program.[28] Section 7.402 of the DFAR also clarifies that the decision to lease a system should not be made solely based on potentially new technologies making a purchase obsolete in the future.[29] Although the comparative analysis conducted in this thesis does not include cost comparisons of purchase and lease models of an exemplar ALS, other operationally relevant factors are more heavily considered, which is still in line with the NDAA, FAR, and DFAR, although more focused on what is operationally advantageous to the government versus strictly financially advantageous to the government.

The business processes are in place to procure commercial ALS on a leased basis, as the laws and regulations allow it, and there is precedent for such a business practice to be utilized. Contracting officers follow applicable laws and regulations when constructing lease agreements, and they are the points of contact for ensuring the government completes

---

[27] Department of Defense, *Defense Federal Acquisition Regulation Supplement, Part 207*: Acquisition Planning, Subpart 207.4 – Equipment Acquisition.

[28] Ibid.

[29] Ibid.

the process ethically and in its best interest. The specific acquisitions and contracting processes required to enter into a lease agreement with a commercial partner are outside the scope of this research.

2. Historical Example

One recent example of the Marine Corps procuring a system as a lease is the utilization of the MQ-9A Reaper aircraft, produced by General Atomics. According to an official Marine Corps press release, prior to August 2021, "Since 2018, flight operations of the MQ-9A have fallen under a COCO (contractor owned, contractor operated) construct."[30] With respect to the system itself, the Marine Corps press release went on to describe the MQ-9A system capabilities and why the system is important to Marine Corps operations: "The remotely piloted aircraft capability revolutionizes military operations by allowing the system operator to operate from ship and shore, and employ both collection and lethal payloads while integrating with command and control centers, allowing the synchronization of remotely piloted aircraft with ground and air assets."[31] According to Audrey Decker at Inside Defense, "Reapers (had) been in operation for the Marine Corps as part of a leasing agreement since 2018 and (had) accrued over 12,000 flight hours supporting operations in the Middle East."[32] Prior to August 2021, when the Marine Corps purchased its own MQ-9A systems, the COCO construct was a pure lease; the Marine Corps paid the private company for the service of flying the aircraft with its contracted pilots.[33]

Justin Katz of Breaking Defense provides his analysis of the pros and cons of this type of construct by writing, "The advantage to this approach is the service doesn't have to spend time or money training Marines on how to use the aircraft. The disadvantage,

---

[30] Levi Voss, "3rd MAW Procures Marine Corps' First MQ-9A 'Reaper,'" Marines: The Official website of the United States Marine Corps, September 7, 2021, https://www.marines.mil/News/News-Display/Article/2766284/3rd-maw-procures-marine-corps-first-mq-9a-reaper/.

[31] Ibid.

[32] Audrey Decker, "Marine Corps Acquires Two MQ-9 Reapers," Inside Defense, October 20, 2021, https://insidedefense.com/insider/marine-corps-acquires-two-mq-9-reapers.

[33] Justin Katz, "Marine Corps' First MQ-9A Takes Flight in Arizona," Breaking Defense, September 9, 2021, https://breakingdefense.com/2021/09/marine-corps-first-mq-9a-takes-flight-in-arizona/.

however, is that the service is limited by law to what kinds of missions civilian contractors are allowed to conduct."[34] Further, the shift to government owned, contractor operated (GOCO) gives the Marine Corps "the ability to start modifying the aircraft to better fit the Marine Corps' purposes."[35] This analysis can be directly applicable to the considerations involved in determining how to best procure and utilize commercial ALS. With respect to the MQ-9A, the Marine Corps began with a COCO construct, shifted to a GOCO construct with some aircraft, and has a goal to eventually shift to a government owned, government operated (GOGO) construct, in line with the Commandant's Planning Guidance and Force Design 2030.[36]

While utilizing unmanned aircraft as a contractor-provided service requires less training on the part of the Marine Corps, missions are limited, and modifications cannot be made by the Marine Corps in accordance with the needs of service. This model is convenient, but the MQ-9A Reaper case study shows that when given the option to transition and unmanned system from COCO to GOCO to GOGO, the Marine Corps has chosen to do so. The pure lease—unmanned aircraft as a service—served a vital role in mission accomplishment, but for the sake of more operational flexibility, the Marine Corps is transitioning to government owned and operated systems, regardless of the training and financial burdens that come with it.

3. Budgetary and PPBE Implications

According to a 2021 primer by the Congressional Research Service, PPBE is the DOD "process for allocating resources among the armed services, defense agencies, and other components."[37] Further, the report goes on to describe how the PPBE process fits into the bigger picture of government resourcing:

---

[34] Ibid.

[35] Justin Katz, "From Lease to Own: Marines Get Two MQ-9 Reapers of Their Own," Breaking Defense, October 22, 2021, https://breakingdefense.com/2021/10/from-lease-to-own-marines-get-two-mq-9-reapers-of-their-own/.

[36] Voss, "3rd MAW Procures Marine Corps' First MQ-9A 'Reaper.'"

[37] Brendan W. McGarry, *Defense Primer: Planning, Programming, Budgeting, and Execution (PPBE) Process*, CRS Report No. IF10429 (Washington, DC: Congressional Research Service, 2021), 1, https://sgp.fas.org/crs/natsec/IF10429.pdf.

> The process is designed to produce DOD's portion of the President's annual budget request to Congress, as well as updates to the department's five-year spending plan known as the Future Years Defense Program (FYDP). PPBE is one of DOD's three main acquisition-related decision support systems, along with the Joint Capabilities Integration and Development System (JCIDS) for developing requirements to address capability gaps and the Defense Acquisition System (DAS) for managing acquisition programs.[38]

PPBE is the part of the DOD acquisitions process that aligns funding to defense priorities and initiatives. It is an ongoing process that results in the allocation of funds to the DOD based on planning that has occurred for five or more years leading up to the fiscal year of execution. Each phase of the process produces documents for use in follow-on phases of the process, described as follows:

> The planning phase produces the Defense Planning Guidance (DPG), which details force development priorities. The programming phase generates a Program Objective Memorandum (POM), a funding plan for each DOD component covering a five-year period that adjusts programs in the FYDP. The budgeting phase results in a Budget Estimate Submission (BES), which covers the first year of the POM and converts programs into budget terms for submission to Congress.[39]

When executing the programming and budgeting phases of PPBE and building the POM and BES for each fiscal year, a lease model is unique in that the overall cost of leasing the system is more distributed across the FYDP. In a lease model, there is an upfront cost to obtain use of the system and there are continuous costs throughout the lease to continue the services provided by the contractor. With respect to just the lease of the system and not personnel, training, or other costs not directly paid through the lease, the POM would have to include lease payments throughout the life of the lease, extending into multiple fiscal years. However, since the Marine Corps would not procure the system for ownership, there would not be a requirement within the Procurement appropriation at any point in the POM for commercial ALS; rather, Operations and Maintenance funds would be required across the FYDP to lease and operate the system, based on the terms of the lease. The Marine Corps would need to identify this each year on the POM and again on the BES for each

[38] Ibid.

[39] Ibid.

fiscal year in which it would utilize commercial ALS. The appropriations utilized and funding levels required each year differ based on whether the DOD uses a lease or purchase model to obtain the system. The "What is Purchasing?" section of this chapter includes a subsection that explores how the PPBE process is different with an outright purchase model.

4. Advantages

The main advantage of a pure lease model is that the DOD does not lock itself into ownership of a system that could become obsolete during the life cycle of the system. Private companies are continuing to develop innovative technologies in many different fields—unmanned aircraft is no different. By leasing a system or systems that it wants to incorporate in operations, the Marine Corps does not own any of the systems and does not provide the full cost of ownership up front. This gives the Marine Corps and DOD more flexibility to move on from one technology and upgrade to another. This type of upgrade could be written into a lease agreement if the Marine Corps has an indication that the lessor may develop or upgrade its ALS technology in the future. For instance, a new model comes out two years after the initial lease agreement is made, and the Marine Corps trades in the current model to receive the updated model under the same contract. Another way this transpires is if a new ALS technology is developed by a different company than the current ALS provider; in this case, the Marine Corps could sever the current lease agreement, pay some form of penalty for doing so, and move on to a better technology with a different manufacturer.

Another advantage of this model is that maintenance responsibilities and the risk that comes with operations and maintenance costs remain with the manufacturer and not with the Marine Corps. This saves the Marine Corps time, money, personnel, and effort; the Marine Corps would not have to train Marines on how to maintain or fix the systems—personnel would only have to be trained on how to operate the system to fulfill required logistics needs. If ALS is being leased as a service, the risk of system malfunction and failure remains with the manufacturer. While these costs would be factored into the overall cost of the lease, the likelihood of unforeseen ballooning costs and system deadlines that

fall on the Marine Corps to fix and overcome is reduced to near zero. If a system malfunctions, the Marine Corps can return the system to the manufacturer, who either fixes the system itself or provides a replacement.

Further, leasing ALS keeps the responsibility of system disposal on the manufacturer. When the system becomes obsolete or individual systems run their course, the Marine Corps does not have to dispose of the physical systems—that duty is carried out by the manufacturer because the manufacturer still owns the systems entirely. This is one more responsibility of the project life cycle that the Marine Corps can avoid by going with a pure lease model.

From a financial perspective, leasing requires less up-front cost than purchasing. This lower up-front cost is less of a hit to the Marine Corps and DOD budgets, allowing for the government to spread the cost of procuring the system across multiple fiscal years. The benefit to this is more than just an accounting function that hides the actual cost of procuring the system; rather, this gives the Marine Corps flexibility to spend money on other priorities both now and over the life of the lease.

5. Disadvantages

The main disadvantage of a pure lease model is that the Marine Corps could lock itself into disadvantageous terms that eliminate or reduce potential advantages. Any of the advantages discussed in the previous subsection are contingent upon contract terms that are advantageous to the government. Anything can be written into a contract; as such, it is important for the Marine Corps to negotiate lease terms that avoid as much risk as possible, benefit the Marine Corps financially, and allow the flexibility to upgrade to more advanced and operationally beneficial models as those technologies become available. However, this is not always possible, depending on the state of the private company providing the service and the level of competition in the marketplace. If there is one company with an ALS that the Marine Corps wants to lease, the company maintains the negotiating leverage, but if there are multiple companies competing for the Marine Corps' business, the Marine Corps can take some of that leverage back to negotiate lease terms that are most beneficial to the government both operationally and financially.

From a financial perspective, although leasing requires less up-front cost than purchasing, costs over the life of the system would be higher. The difference in overall cost can be reduced through negotiating advantageous lease terms, but any lease agreement is going to require more money to procure the system or service over the life of the system. This is an important disadvantage that must be considered as part of the comparative analysis, but this thesis focuses more on other differences between leasing and purchasing that do not necessarily involve direct costs of procuring the system. For instance, a lease could be more beneficial to the government financially if the systems are less reliable than expected and require significant maintenance and repair costs by the owner throughout the life of the system that supersede the cost savings gained by purchasing the system outright up front.

C. WHAT IS PURCHASING?

This section explains what purchasing is in the context of DOD procurement, how purchasing is executed, what the budgetary implications are of purchasing, advantages, disadvantages, and provides a historical example of a DOD-purchased product for context and precedent.

1. Laws and Regulations

Like leasing, applicable regulations and standards with respect to purchasing can be found in the most recent NDAA, FAR, and DFAR. The details of the acquisitions process are not discussed in detail in this research. These laws and regulations all assert that purchasing should be considered a primary option if purchasing is most beneficial to the government. A comparative analysis should be conducted prior to making a lease versus purchase decision, taking into consideration all life cycle costs and contract terms of a program. Per Section 7.402 of the DFAR, purchasing should still be considered a viable option even if new technologies may eventually make a purchase obsolete.[40] Although the analysis conducted in this thesis does not include cost comparisons of business models,

[40] Department of Defense, *Defense Federal Acquisition Regulation Supplement, Part 207*: Acquisition Planning, Subpart 207.4 – Equipment Acquisition

other operationally relevant factors are considered, which is still in line with the guidance from applicable laws and regulations, although more focused on what is operationally advantageous to the Marine Corps versus financially advantageous to the government.

The business processes are in place to procure commercial ALS as a purchase, and contracting officers have done so for many commercial systems. Contracting officers follow applicable laws and regulations when constructing purchase contracts, and they are the points of contact for ensuring the government completes the process ethically and in its own best interest. The specific acquisitions and contracting processes required to enter into a purchase agreement with a commercial partner are outside the scope of this research, as the laws and regulations are considered for the purpose of scoping the comparative analysis in accordance with federal guidance and ensuring that recommendations are realistic without a system overhaul.

2. Historical Example

Many of the major systems and aircraft the Marine Corps and DOD purchase for fielding in the operating forces are procured through the DOD's acquisition process and not as commercial-off-the-shelf (COTS) items. Examples of aircraft and platforms that are not COTS include the F-35 Lightning, MV-22 Osprey, RQ-21 Blackjack, and many others. For this comparative analysis, it is important to utilize a COTS system as a case study because that is the method by which commercial ALS would be purchased for use by the Marine Corps. One such aircraft that was purchased as COTS by the DOD is the UH-72 Lakota light utility helicopter (LUH), purchased for use by the Army and eventually utilized by the Navy and National Guard.

According to Jan Tegler, writing for Defense Media Network, "Launched in 2004…the LUH is a key element in the Army's Aviation Modernization Program…the idea behind LUH was to quickly identify, acquire and field a platform capable of performing a range of utility missions by purchasing an extant Commercial-Off-the-Shelf

design."[41] The Army began its search for a COTS solution to its LUH requirement. Then, in 2006, "the Army selected EADS North America's (now Airbus Group, Inc) UH-145 variant of its civilian EC-145 as the winner of the LUH competition," and in December 2006, Airbus delivered the UH-74A Lakota.[42] This was a true COTS fulfillment of the Army's LUH initiative, which has resulted in 463 deliveries of the UH-74A Lakota, as of October 2021.[43] According to Airbus, UH-72 Lakotas have amassed over one million flight-hours since delivery, including Army, Navy, and National Guard operations.[44] Missions of these LUH systems have included "training, general utility, search and rescue, disaster response, homeland security, drug interdiction, command and control, and VIP transport…responding to wildfires, hurricanes, floods and other disasters across the country and abroad."[45]

To fulfill the Army's need, Airbus took an existing aircraft, equipped it to function in a military role (hence the designation switch from EC-145 to UH-74) and provided the aircraft for purchase by the DOD. In fact, the contractor trained maintainers and pilots to operate the aircraft, and the aircraft can be configured for several types of mission sets.[46] This is near identical to the process that would occur for procurement of commercial ALS by the Marine Corps. Private companies are already seeking to solve the middle-mile logistics problem within the civilian sector. If the Marine Corps can find a company that can adapt an existing model to fit a military role with minimal modifications, it can mimic the process utilized in the procurement of the UH-72A by the Army. The Army aircraft has been operational for two decades and has proven operationally useful in executing multiple types of missions. The Army searched for models to fill the LUH need and procured

---

41 Jan Tegler, "UH-72A Lakota Introduction," Defense Media Network, December 31, 2009, https://www.defensemedianetwork.com/stories/light-utility-helicopter-uh-72a-lakota-introduction-progresses-rapidly/.

42 Ibid.

43 Airbus, "Airbus Helicopters UH-72 Lakota Fleet Surpasses One Million Flight Hours, with U.S. Army, Navy and National Guard Units," October 11, 2021, https://www.airbus.com/en/newsroom/press-releases/2021-10-airbus-helicopters-uh-72-lakota-fleet-surpasses-one-million-flight

44 Ibid.

45 Ibid.

46 Tegler, "UH-72A Lakota Introduction."

multiple UH-72A aircraft as an outright purchase, with training and design assistance from the contractor. This business model is one that has precedent and should be considered for adoption or adaptation when the Marine Corps makes its procurement decision with respect to commercial ALS, a similar COTS technology.

3. Budgetary and PPBE Implications

When executing the programming and budgeting phases of PPBE and building the POM and BES for each fiscal year, an outright purchase model requires a large upfront cost in the fiscal year in which the DOD procures the system. If the DOD purchases all required commercial ALS as a single, bulk purchase, Procurement funds are only required during the first fiscal year; alternatively, if the DOD purchases systems in batches across multiple fiscal years, the need for Procurement funds is spread across the years in which procurement occurs. In addition to the Procurement appropriation for purchase of the systems, Operations and Maintenance funds are required to operate and maintain the systems throughout their life cycles, up to and including disposal. Depending on how the Marine Corps chooses to train and educate system operators, Military Personnel funds may also need to be incorporated in the programming and budgeting involved with commercial ALS, due to the potential need to train Marines in a schoolhouse and on-the-job setting that could require an increase in manpower levels, though that is part of a larger force structure discussion and decision.

In a purchase model, upfront procurement costs are higher and occur any fiscal year in which the service purchases new systems—this must be programmed and budgeted within the POM and BES. Further, operations and maintenance as well as personnel requirements inherent to operating the systems must be built into programming and budgeting documents for every fiscal year in which the Marine Corps owns and operates the systems. This would need to be identified each year on the POM and again on the BES for each fiscal year in which commercial ALS is utilized by the Marine Corps. The appropriation categories differ based on whether the Marine Corps owns or leases the system, as do the planned expenditures across the FYDP for the life of the system.

4. Advantages

The main advantage of an outright purchase model is the flexibility to make business and operational decisions with respect to the system without consultation of a private company or staying compliant with the terms of a lease agreement. Once the Marine Corps owns the system, it is free to make decisions about system utilization, operations, maintenance, disposal, upgrades, etc., without consultation of the system provider. The caveat to this is that the Marine Corps would be incentivized to not do anything with respect to the system that could void a manufacturer warranty, if that is a warranty that the Marine Corps wants to keep in place.

From a financial perspective, purchasing is cheaper over the life of the system. Although purchasing requires greater up-front cost than leasing, procurement costs are not spread out over additional fiscal years after the initial purchase. The Marine Corps would still have to budget for all other costs of ownership—maintenance, repairs, fuel, operations, personnel, training, disposal—throughout the life of the system but not procurement costs. The Marine Corps would then be free to utilize Procurement dollars for other requirements as ALS costs would then shift to Operations and Maintenance dollars for the remainder of the system life cycle. Once the life of the system has ran its course and the system is no longer in use by the Marine Corps, overall procurement costs associated with the system will have been lower than a pure lease model.

5. Disadvantages

The main disadvantage of an outright purchase model is that the DOD assumes the risk of locking itself into ownership of a system that could become obsolete during the life cycle of the system. While the DOD is legally free to scrap the system at any point and move on, doing so is practically and optically difficult. Private companies are continuing to develop innovative technologies in many different fields, including unmanned, middle-mile aircraft. By purchasing a system that it wants to incorporate in operations, the Marine Corps fully owns the system and provides the full cost of ownership up front. This gives the Marine Corps and DOD little to no flexibility to move on from one technology and upgrade to another without taking a major hit financially and having to answer questions

to Congress and the American people about why the purchase decision was made in the first place and why the Marine Corps deserves to be given more money to procure another ALS. For instance, a new model comes out two years after the initial purchase of an ALS is made, and the Marine Corps cannot simply trade in or move on from the current model to receive the updated model because it has already fully committed to the current model it owns. An outright purchase limits the Marine Corps' flexibility and relies on the hope that the purchased ALS is reliable and meets all requirements in the long term.

Another disadvantage of this model is that maintenance responsibilities and the risk that comes with operations and maintenance costs remain with the Marine Corps and are not transferred to a private company. The Marine Corps would have to train its own personnel to conduct preventive and corrective maintenance on the ALS and would be on the hook financially to pay for all parts and equipment necessary to maintain the systems. While projected costs may be reasonable at the time of purchase, there is never a guarantee that once systems are fielded, they do not prove to be unreliable, money sinks. In the purchase model, there is no way to be certain that this will not happen. Even if the risk of unreasonable, unanticipated maintenance responsibilities and costs appears to be low, the risk is still transferred to the Marine Corps at the time of purchase. The only caveat to this is if the Marine Corps can negotiate warranty terms with the manufacturer, but warranty terms would not cover all potential issues with the system, whether foreseen or unforeseen.

Further, purchasing ALS gives the responsibility of system disposal to the Marine Corps. All requirements and responsibilities inherent in the life cycle of an aircraft fall on the Marine Corps. When the system becomes obsolete or individual systems run their course, the Marine Corps must dispose of the physical systems—that duty is not carried out by the manufacturer unless a disposal agreement is written into the purchase agreement. This is one more responsibility of the project life cycle that the Marine Corps assumes by going with an outright purchase model.

From a financial perspective, purchasing requires higher up-front costs than leasing. The total cost of procuring the systems must be provided before the systems are in the hands of Marines. Securing the funding required to get the system in the hands of operators is much more difficult in this model. In the current budgeting process in the

United States, lawmakers focus most of their attention on one budget at a time. If there is a high price tag for a system that a service wants to procure in the upcoming fiscal year, that program is going to receive Congressional scrutiny because of that glaring hit to the budget. For the fiscal year in which the systems will be procured, the Marine Corps would have less flexibility to procure other systems—it would have to be confident that ALS is a requirement that should take priority over other systems. Financial flexibility in the upcoming fiscal year would be limited.

D. HYBRID MODEL

A hybrid model could take on many different forms based on an agreement made between the government and the private business. Any model that is not a pure lease or outright purchase is considered a hybrid model in this context. With respect to the procurement of commercial ALS, if the DOD or Marine Corps does not own and fully operate and maintain every part of the system, including aircraft and cargo pods, then the business model is not an outright purchase. However, warranty terms and depot-level maintenance could be included in an agreement with the commercial provider, with the system still falling under the outright purchase model. Conversely, if the DOD or Marine Corps does not fully lease every part of the system—to include aircraft and pods—effectively utilizing ALS as a service, then the business model is not a pure lease. A business model that falls along the spectrum between lease and purchase is considered a hybrid model.

The major advantage to a hybrid model is that the Marine Corps or DOD can negotiate terms with the commercial provider, determining which aspects of both the lease and purchase model are most advantageous to the government. If negotiated to the best interest of the government, advantages of leasing and purchasing could all be incorporated into the deal while simultaneously avoiding disadvantages of each. With respect to commercial ALS, there are parts of the overall system, services/capabilities that the system provides, and maintenance requirements that can each be considered separately for lease and purchase consideration. The following parts and services can each be evaluated separately for consideration of a lease agreement or outright purchase (this list is not

exhaustive): the unmanned aircraft (not including cargo pods), cargo pods, aircraft operation, cargo pods storage and/or disposal, preventive maintenance, intermediate-level corrective maintenance, and depot-level corrective maintenance.

One example configuration of a hybrid model is the Marine Corps leasing the aircraft on a multi-year lease with an upfront cost and payments in line with the pure lease model; however, the Marine Corps would purchase cargo pods outright and would determine how to store, utilize, re-use, and dispose of all cargo pods once they are purchased. Ownership of the aircraft and the cargo pods would be separate. Further, Marine Corps personnel would be trained to operate the aircraft as well as conduct preventive maintenance on the aircraft (fluid checks and changes, landing gear tire replacement, air filter replacements, etc.), but the manufacturer would assume responsibilities for intermediate-level and depot-level corrective maintenance (blade/wing replacement, engine malfunctions, etc.). All these responsibilities would be written into the terms of the contract as the Marine Corps may determine that training Marines to conduct corrective maintenance on any level requires considerable time and financial investment in schoolhouse training, on-the-job training, and personnel in the form of a new military occupational specialty (MOS). Since there is a possibility that the Marine Corps would seek to acquire ALS from many different independent manufacturers to fill its autonomous logistics needs, it would sense for the Marine Corps to not focus on training maintainers as a primary MOS; rather, logisticians and infantrymen could learn how to operate the system, conduct preventive maintenance as a secondary function, and leave corrective maintenance responsibilities to each of the manufacturers. Lease and purchase terms would be written accordingly.

In addition to separating the system by its parts and life cycle requirements, a hybrid business model can also be used for the Marine Corps to try ALS on a small scale and determine how it wishes to proceed with force-wide implementation. Contrary to standard practice when procuring major military systems, the Marine Corps can procure a small number of systems for use by one unit utilizing a lease or hybrid model for a pre-determined trial period and then evaluate follow-on courses of action. The Marine Corps assumes less

risk by starting with a trial period of commercial ALS. This trial period concept is a hybrid business model.

E. SUMMARY

There are many variables that factor into the lease versus purchase analysis for a commercial ALS. There is precedent for each business model, and the Marine Corps would have justification for pursuing procurement of commercial ALS via any of the three models presented in this chapter. This analysis of the models, their processes, advantages, disadvantages, and budgetary implications lay the groundwork for making the procurement determination. Chapters V and VI take the results of this comparative analysis and provide an operational vignette and recommendations to determine which model would be most beneficial to achieving the operational objectives of the Marine Corps in a future contested environment.

IV. CIVIL RESERVE AIR FLEET

A. INTRODUCTION

In addition to a lease versus purchase analysis and decision for procurement of commercial ALS, another option that the Marine Corps and DOD should consider is incorporation of commercial ALS airlines into the CRAF. This consideration can and should be independent from the systems directly leased or purchased by the Marine Corps. Just as United States military services own and operate cargo aircraft even though the CRAF exists to surge capabilities in cases of extraordinary need, the Marine Corps could own/lease and operate commercial ALS even though ALS could exist as part of the capabilities provided by the CRAF. This chapter explains the CRAF as it stands today, provides a brief history of the CRAF, and explores how the government could go about incorporating ALS into the CRAF. Regardless of the lease versus purchase decision for ALS, CRAF consideration can stand on its own; consideration of this chapter can and should stand alone from the direct lease versus purchase analysis presented in other parts of this thesis.

B. CRAF LAW

According to the United States Department of Transportation,

> The Civil Reserve Air Fleet is a cooperative, voluntary program involving the DOT, DOD and the U.S. civil air carrier industry in a partnership to augment DOD aircraft capability during a national defense related crisis, Air carriers volunteer their aircraft to the CRAF program through contractual agreements with U.S. Transportation Command (USTRANSCOM), located at Scott Air Force Base, Illinois. In return, the participating carriers are given preference in carrying commercial peacetime cargo and passenger traffic for DOD.[47]

Although used rarely throughout the history of the CRAF, this gives the United States government the ability to surge capabilities that are not inherently possessed by the DOD;

47 "Civil Reserve Airfleet," U.S. Department of Transportation, November 20, 2020, https://www.transportation.gov/mission/administrations/intelligence-security-emergency-response/civil-reserve-airfleet-allocations.

the capabilities are possessed by a multitude of private-sector airlines that are more typically associated with providing day-to-day passenger and cargo air travel both domestically and internationally. Apart from benefitting the government by providing that surge capability, the CRAF is beneficial to the participating airlines as well, otherwise they would not willfully agree to the terms of the contracts that allow the government to pull from the civilian reserve when necessary. According to Ben Baldanza—former CEO of Spirit airlines and current member of the board of JetBlue Airways—writing for Forbes, one less-tangible benefit to airlines that will ask for financial support from the government when it is beneficial for them to do so is to be able to do "good for the country,"[48] effectively getting in the good graces of the government for the next time the airlines need support. Baldanza continues,

> More tangible is the fact the government spends a lot of money on commercial airlines to move people around in the normal course of their business. Being part of CRAF puts these airlines into a position where they can bid for and win some share of that business. Also, when the planes are actually called into use under CRAF, the airlines are paid for that use. While this may always not be a full recovery of the airlines' costs, the amount of planes used has not often been a challenge for the airlines participating. The airlines may also have additional Department of Defense operations audits, supplementing those done regularly by the Federal Aviation Administration. While these audits could be seen as extra time or effort by the airlines, it also helps the airlines by identifying issues that they may need to address operationally.[49]

In other words, the CRAF is beneficial to civilian airlines because it allows them an opportunity to do business with the government, provides financial incentives, and requires additional audit requirements which can be viewed as opportunities.

The DOD itself recognizes the important capabilities the CRAF provides. According to an August 2021 press release by the DOD, "CRAF is a National Emergency Preparedness Program designed to augment the Department's airlift capability and is a core

---

[48] Baldanza, Ben. "How the Civil Reserve Air Fleet Benefits the Country and Helps Airlines." Forbes. September 1, 2021. https://www.forbes.com/sites/benbaldanza/2021/09/01/how-the-civil-reserve-air-fleet-benefits-the-country-and-helps-airlines/?sh=2dc782756566

[49] Ibid.

component of USTRANSCOM's ability to meet national security interests and contingency requirements."[50] The press release goes on to state that, "Under CRAF, the commercial carriers retain their Civil Status under FAA regulations while USTRANSCOM exercises mission control via its air component, Air Mobility Command."[51] If possible and practical, incorporating the capabilities provided by commercial ALS into the CRAF would provide the DOD with significantly more unmanned logistics capabilities at its disposal. This is an option that should be considered in anticipation of large-scale conflict where organic logistics capabilities alone may not be sufficient, especially throughout the conduct of EABO and distributed operations.

C. HISTORY

The concept of the CRAF was officially approved in 1951 via a memorandum of understanding between the DOD and the Department of Commerce.[52] The two main factors that shaped the CRAF as we currently know it are the United States' military strategy as well as "the economics of the air transportation marketplace."[53] Since its inception, the CRAF has been activated on three occasions. The first activation of the CRAF occurred from August 1990 to May 1991, when it was activated in support of Operation Desert Shield and Operation Desert Storm, and the second activation occurred from February 2002 to June 2003, when it was activated in support of Operation Iraqi Freedom.[54] The most recent activation occurred in August 2021, when Secretary of Defense Lloyd Austin ordered the United States Transportation Command to activate Stage I of the CRAF, providing "the Department of Defense access to commercial air mobility resources to augment [its] support to the Department of State in the evacuation of U.S.

---

50 "Department of Defense Activates Civil Reserve Air Fleet to Assist With Afghanistan Efforts," U.S. Department of Defense, August 22, 2021, https://www.defense.gov/News/Releases/Release/Article/2741564/department-of-defense-activates-civil-reserve-air-fleet-to-assist-with-afghanis/.

51 Ibid.

52 Theodore Joseph Crackel, *A History of the Civil Reserve Air Fleet* (Washington, D.C.: Air Force History & Museums Program, 1998), ix, https://media.defense.gov/2013/Sep/16/2001329866/-1/-1/0/AFD-130916-006.pdf.

53 Ibid.

54 "Department of Defense Activates Civil Reserve Air Fleet to Assist With Afghanistan Efforts."

citizens and personnel, Special Immigrant Visa applicants, and other at-risk individuals from Afghanistan."[55] The 18 activated aircraft were used "for the onward movement of passengers from temporary safe havens and interim staging bases."[56]

Although the CRAF has been around for approximately 70 years, its three activations have all occurred due to conflicts and operations in one region of the world and have happened in the last 32 years. This shows that the CRAF has been used sparingly and only for missions in which the DOD is better served to tap into civilian capabilities to transport personnel and cargo at high capacities. It is important to note that the CRAF implementation suggested in this thesis would be a unique undertaking in that the aircraft would be utilized to provide logistics capabilities directly to warfighters and would not necessarily require civilian crews to operate. History shows that the purpose of the CRAF to provide a surge of capabilities in extraordinary circumstances has been used sparingly and successfully, and if implemented properly and with deference to operational needs, it can prove valuable to warfighters in accomplishing logistics functions on the battlefield, alongside procured, organic ALS that would already be implemented in operations.

D. INCORPORATING ALS INTO THE CRAF

According to the August 2021 DOD press release explaining CRAF activation for the Afghanistan withdrawal, the "DOD's ability to project military forces is inextricably linked to commercial industry, which provides critical transportation capacity as well as global networks to meet day-to-day and contingency requirements."[57] Further, "utilizing commercial partners expands USTRANSCOM's global reach as well as access to valuable commercial intermodal transportation systems."[58] DOD leaders understand the impact that commercial industry can have on power projection and mission accomplishment; as such, the following subsections argue the importance of considering commercial ALS to play a

[55] Ibid.

[56] Ibid.

[57] Ibid.

[58] Ibid.

role in the civilian reserve as well as what is required to make that a reality for the CRAF before the systems are needed in conflict.

1. Precedent

According to an October 2007 report by the Congressional Budget Office, under the CRAF, "U.S. commercial air carriers contractually commit aircraft and air crews for use by DOD during times of crisis," and in exchange, the "DOD makes peacetime business available to carriers that participate in the program."[59] There are three segments to the CRAF, including the international segment, national segment, and aeromedical evacuation segment. The segment for which ALS would be in consideration in this context is the international segment, "which is divided into a long-range section (for aircraft that have a minimum range of 3,500 nautical miles) and a short-range section."[60] Through consultation with the DOD, USTRANSCOM is authorized to activate the CRAF, which is activated in the following three stages:

> Stage I covers minor operations or operations in which adequate time is available so that a small augmentation of the military's fleet is sufficient to move the required people or cargo. A Stage I CRAF activation of long-range international cargo and passenger aircraft occurred from August 1990 to January 1991 in support of Operation Desert Shield, and a Stage I activation of long-range international passenger aircraft occurred from February to June 2003 in support of Operation Iraqi Freedom.
>
> Stage II is tailored for a major theater war that requires rapid deployment of forces. In January 1991, the long-range international segment was activated to Stage II for both passenger and cargo aircraft in support of Operation Desert Shield/Desert Storm.
>
> Stage III would be required if the military had to fight more than one major theater war at the same time or operate in a larger crisis. A Stage III CRAF activation has never occurred. It was seriously considered after the Desert

---

59 David Arthur, *Issues Regarding the Current and Future Use of the Civil Reserve Air Fleet* (Washington, DC: Congressional Budget Office, 2007), 2, https://www.cbo.gov/sites/default/files/110th-congress-2007-2008/reports/10-09-craf.pdf.

60 Ibid.

> Storm air war began, in late January 1991, but was rendered unnecessary by the short duration of the conflict.[61]

The framework is in place for ALS to be implemented in the CRAF. Activation of ALS in the context of this thesis could occur in any of these three stages. Stage III activation would be in the realm of possibility if a major theater conflict were to occur in the Pacific. Plans and contingencies would be built into the agreements between the United States government and civilian airlines, the same way they are in the current composition of the CRAF.

2. Operational Impact

The operational impact of incorporating ALS into the existing CRAF could range from negligible to decisive. In future conflict in the Pacific, the Marine Corps would be conducting EABO, requiring some form of middle-mile logistics capable of distributing supplies to small, distributed units. The Marine Corps must have this capability one way or another. It is recommended that the Marine Corps procures ALS sufficient to accomplish required logistics missions in a future contested environment without having to rely on a civilian reserve to fill a gap. However, that does not mean that a civilian reserve should not exist to fill the role that reserves are meant to fill—to fill a gap and deliver a decisive result. Although this civilian reserve of ALS would not be combative in nature, the overarching concept of the use of the reserve in combat still applies. Marine Corps Doctrinal Publication 1-3 (*Tactics*) explains the importance of the use of the reserve in combat as follows:

> The reserve is an important tool for exploiting success. The reserve is a part of the commander's combat power initially withheld from action in order to influence further action. The reason to create and maintain a reserve is to provide flexibility to deal with the uncertainty, chance, and disorder of war. The reserve is thus a valuable tool for maintaining adaptability. In general, the more uncertain the situation, the larger should be the reserve.[62]

---

[61] Ibid, 2–3.

[62] U.S. Marine Corps, *Tactics*, MCDP 1-3, (Washington, DC: Department of the Navy, 1997), 106, https://www.marines.mil/Portals/1/Publications/MCDP%201-3%20Tactics.pdf.

Although this description of a reserve is based on tactics in combat, logistics are also important in accomplishing the mission and exploiting success; success in combat is not possible without sound logistics.

Incorporating ALS into the CRAF does not mean the Marine Corps or DOD would tap into that capability right away. The CRAF has never been used as a primary response, nor should it in future situations. However, the potential threat we face in the Pacific and the stakes of large-scale conflict require us to be prepared for contingencies. Having a fleet of ALS in reserve as part of the CRAF gives the DOD the ability to continue accomplishing the mission in extraordinary circumstances while simultaneously benefiting the civilian sector. The operational impact is situationally dependent—if the Marine Corps procures sufficient ALS assets to accomplish required logistics functions, the CRAF would not play a role. However, the CRAF could serve as a provider of a logistical "decisive blow" or play the role of augmenting existing capabilities where necessary. Having the resources available gives the DOD flexibility to impact the battlespace as it deems fit.

3. Actions Required

According to the Air Mobility Command, "To participate in the international segments of CRAF, carriers must maintain a minimum commitment of 40 percent of its CRAF-capable fleet. Aircraft committed must be U.S.-registered and carriers must commit and maintain a 4:1 flight-deck crew ratio for each aircraft accepted in the fleet."[63] Further, according to a February 2020 article published by the National Defense Transportation Association (NDTA), "There are two important requirements for airline participation in the CRAF…specific aircraft are identified by tail number…four crews must also be committed for each aircraft."[64] While incorporation of ALS into the CRAF would be unique compared to the civilian cargo aircraft that currently make up the CRAF, it would not be an impossible undertaking. The systems discussed in this thesis would not require four crews for each aircraft as the aircraft would be unmanned. The CRAF would have to

[63] Air Mobility Command, "Civil Reserve Air Fleet," August 2021, https://www.amc.af.mil/About-Us/Fact-Sheets/Display/Article/144025/civil-reserve-air-fleet/.

[64] Kent N. Gourdin, "Sustaining the Civil Reserve Air Fleet," NDTA, February 18, 2020, https://www.ndtahq.com/sustaining-the-civil-reserve-air-fleet/.

be modified to allow for unmanned systems to be included, given unique requirements compared to the existing requirements for manned cargo aircraft. Instead of crews and aircraft mobilizing on behalf of the government's mission, participating ALS airlines would provide their systems to the DOD for use in operational scenarios. According to Kent Gourdin, writing for the NDTA,

> The CRAF is a strategic partnership worth sustaining. Simply put, the nation needs the CRAF. Ironically, the widening gulf between military and airline aircraft needs may be the biggest problem, facing the future of the CRAF…Peacetime business provides a good incentive to attract civilian carriers to the program and keep them familiar with moving military cargo, assuming they have the aircraft and the interest to participate.[65]

The CRAF is a mutually beneficial opportunity for both the DOD and civilian airlines. Although implementation of ALS into the CRAF would require change to the current CRAF policy and new business procedures, consideration of ALS as part of the CRAF or as its own program modeled after the CRAF could result in operational and strategic benefits to the DOD and Marine Corps leading up to and during future conflicts.

This thesis does not make any explicit recommendations for implementation of ALS into the CRAF and provides context and required actions as a means of providing alternative solutions to fulfilling the logistics requirements of the Marine Corps in future operations and conflicts.

E. SUMMARY

The CRAF provides a means for the United States government to tap into the capabilities of the civilian sector to surge transport aircraft during extraordinary circumstances when the DOD's fleet of aircraft is not sufficient to accomplish strategic objectives. As Gourdin puts it, "The CRAF is like an insurance policy for the DOD and, by implication, the nation, providing coverage for a future everyone hopes will never occur."[66] This existing capability could be modified to include platforms other than transport aircraft. Although this thesis does not make the recommendation to incorporate

[65] Ibid.

[66] Ibid.

commercial ALS into the CRAF based on the current situation and commercial availability, that possibility should remain open for consideration based on additional testing and operational implementation of commercial ALS into DOD operating forces. Such a consideration can be made independent of the lease versus purchase decision of commercial ALS in the Marine Corps as commercial ALS could be implemented into the CRAF regardless of whether the systems are otherwise procured by the Marine Corps via a lease, purchase, or hybrid model. After procuring commercial ALS and determining force-wide implementation actions, the DOD and United States government can analyze effectiveness and future needs to make a CRAF determination.

THIS PAGE INTENTIONALLY LEFT BLANK

V. PACIFIC 2035: A VIGNETTE

A. INTRODUCTION

This chapter is presented as a vignette that takes place in the island chains across the Pacific in the year 2035. All scenarios and events are entirely fictional and are presented from the perspective of the author as each situation unfolds, given the anticipated advantages and disadvantages of each business model and the application of each business model in obtaining and deploying a novel ALS. Other than the United States, names of countries are omitted, and fictional names are utilized to progress the vignettes in a realistic yet non-attributional manner. These scenarios are not based on any intelligence, predicted timelines, or currently existing nations and are presented purely to explain how each model might contribute to the order of battle throughout a military conflict.

Scenario: The year is 2035. For the past four years, the nation of Comsociala has been testing the international community and the United States by driving ships through other sovereign nations' exclusive economic zones, conducting aircraft exercises and weapons tests up against and sometimes inside other sovereign nations' airspace, and harassing commercial cargo ships and fishermen in international waters. After receiving no significant response from any nation to date, Comsociala has decided to further test the international community by conducting a full-scale military invasion of the nearby island nation of Democropolis to annex the nation and claim it as part of Comsociala. The United States and allies suspected that Comsociala's actions would lead to this invasion, and now they have determined that it is time to react with a significant response to curb Comsocialian aggression in the Pacific and not allow further Comsocialian expansion in the region.

The United States has developed strategic plans to project power across the Pacific islands, from Hawaii up to and including the islands immediately surrounding Democropolis. The Marine Corps' role in this effort is to conduct EABO across the islands, supporting sea control and denial, providing command and control throughout the region,

and providing forward sustainment, consistent with the missions of EABO.[67] Logistics will play a significant role in this mission, and in order to ensure efficient and effective conduct of all logistics functions, the Marine Corps will utilize the newly-procured ALS throughout its force in order to conduct those logistics operations. Each of the following sections serve as branches of the vignette and are only focused on employment of the ALS operationally with respect to carrying out its assigned role and does not focus on tactics, strategy, infantry operations, or any other aspect of EABO that is not directly related to ALS-provided logistics.

B. PURCHASED ALS

In this outright purchase model, the Marine Corps has procured the ALS entirely and is responsible for all personnel, maintenance, operations, and disposal of the systems throughout their life cycle. The Marine Corps has sufficiently trained its personnel to operate the system, and the system is utilized as intended: to execute middle-mile logistics. This primarily consists of transportation of supplies from ship to shore as well as transportation of supplies from shore to shore (island to island). Since the Marine Corps owns the aircraft and pods of each system entirely, it is free to utilize every portion of the system as it wishes. However, Marines are responsible for maintaining the aircraft, operating the aircraft, addressing any equipment malfunctions and defects internally, storing pods, and disposing or storing used or unusable pods.

Marines decide that reusing pods during operations is an unnecessary burden and instead opt to maintain an abundance of pods on ships to fill with necessary supplies and equipment for transportation, as necessary. Once the aircraft reach their destinations ashore, they drop off the pods and immediately return to the source location. The pods are unloaded by Marines, and the supplies and equipment are distributed accordingly. Marines on the receiving end of the shipment begin to store the pods in a predetermined location somewhere on the destination location. This is doable because the Marine Corps owns the

67 "Expeditionary Advanced Base Operations (EABO)," Marines: The Official website of the United States Marine Corps, August 2, 2021, https://www.marines.mil/News/News-Display/Article/2708120/expeditionary-advanced-base-operations-eabo/.

pods. Given the circumstances of operations, the Marine Corps has decided that storing the pods at the various destination locations is the best solution. The pods are stored, and though most of them are still in good enough condition to be reused, they are stacked and stored indefinitely—the Marine Corps will decide what to do with them later as it has an abundance of pods, can procure more at a cheap price, and does not want to focus on disposal or refurbishment until the conflict is more stable.

Since the aircraft portion of the ALS are also owned by the Marine Corps, the government assumes all the risk for anything that malfunctions or otherwise goes wrong. Some systems may not work as intended or may need extensive maintenance to remain operational. Although most of the systems operate as expected and provide logistics services in accordance with their design, some are more troublesome.

C. LEASED ALS

In this outright lease model, the Marine Corps has leased every aspect of the system, effectively utilizing ALS as a service. The manufacturer continues to own the system and is paid by the Marine Corps for the service provided by the system. The manufacturer is responsible for personnel, maintenance, operations, and disposal of the systems throughout their life cycle. The manufacturer owns the pods as well as the aircraft. The Marine Corps has paid an up-front cost to procure the systems and continues to pay a yearly fee to continue to lease the systems and utilize the services of a contracted civilian airline.

The difficulty with this model is the challenge of utilizing ALS as a service in a combat environment. Unless the manufacturer is a major government contractor that is used to having personnel forward deployed with military forces, it would be difficult to lease the systems outright and utilize the capabilities as a service. In addition, some units may be the size of companies, platoons, or even squads and smaller, operating in islands independently, conducting all Marine Corps warfighting functions among a small group of individuals. In this scenario, it may not be practical for ALS to be utilized fully as a service. Lots of supply chain delays occur, and Marine units are often left to fend for themselves or solve logistical challenges that would not occur at all if the Marine Corps owned these systems.

D. HYBRID MODEL ALS

In this hybrid model, the Marine Corps has leased the aircraft but purchased the pods outright. The manufacturer owns the aircraft, but the Marine Corps is responsible for all personnel and operations with relation to the systems throughout their life cycle. Maintenance is handled by the manufacturer, per the lease terms. Replacement terms for faulty systems and parts and depot-level maintenance of aircraft are written into the lease terms and agreed upon by both the contractor and the Marine Corps. The aircraft and pods are stored and operated by Marines. Marines can stack and maintain used pods in designated locations across their distributed locations without worry of returning them to the source during combat or contested operations. However, destruction or loss of aircraft results in payment in full of the unpaid cost of the system to the contractor. As with the purchase model, the Marine Corps has been responsible for training personnel and units to handle the system safely and effectively and determine what doctrine and policy changes are required for full implementation across the force. All these requirements have already occurred prior to the deployment of these systems in support of Pacific 2035.

The hybrid model provides the least amount of risk to the Marine Corps. The aircraft themselves are on a lease, so the full cost of the system has not been paid to the manufacturer up front. This results in a smaller hit to the budget up front, and the Marine Corps can negotiate terms of the lease and terms of renewal. While the total cost of leasing at the end of the ALS life cycle or at the end of Pacific 2035 may end up being higher than the total cost of pure ownership, the risk involved throughout the life cycle of the systems and throughout Pacific 2035 may be worth the tradeoff.

E. CIVIL RESERVE AIR FLEET

In this branch of the vignette, commercial ALS is available for use as part of the CRAF. Stage II CRAF activation has occurred. Multiple airlines have already pledged their middle-mile logistics aircraft to the government in exchange for financial compensation if the systems are needed. In the years leading up to the conflict, the United States government put these airlines on notice that the potential existed for this portion of the CRAF to be activated. In addition to the ALS that the Marine Corps already procured based

on one of the above models, the United States government can surge these necessary logistics capabilities for use in the Pacific. However, Marines are not familiar with how to operate every system. This requires certain airlines to provide autonomous logistics capabilities as a service, much like the more traditional CRAF airlines before the addition of ALS.

Another aspect of this branch of the vignette is that the government would be liable for any aircraft that are damaged or destroyed during conduct of operations. When flying in and out of contested areas, landing and taking off from ships, damage happens to aircraft and pods, and the government would be on the hook to reimburse airlines not only for the operating terms of the CRAF but also to replace or repair aircraft, as necessary. The final bill to the government would be unknown and unpredictable.

F. COMPARATIVE ANALYSIS AND SUMMARY

Within the context of the vignette, the only model that would not be effective operationally because it provides unnecessary personnel challenges is the lease model. Purchased ALS is a reasonable model because that is how Marines are used to employing many of the systems and platforms that it currently operates—purchase the system, train personnel how to operate and maintain it, and send it out to the operational forces for full employment. The hybrid model is also reasonable because it provides all of the operational benefits of the purchase model, with less financial and maintenance risk to the Marine Corps—if the systems work flawlessly, the manufacturer will end up being compensated at the same rate or higher compared to the purchase model; however, if the systems do not provide the capabilities as required or prove to be faulty, the government can terminate the lease in accordance with the terms and not be forced to continue operations with ineffective systems. The worst-case scenario in this Pacific 2035 vignette is the Marine Corps purchasing as many ALS as it deems necessary to conduct middle-mile logistics across the Pacific and the systems turn out to be ineffective in accomplishing the desired mission. That would require the Marine Corps to either press forward with the systems or eat the cost of the already-purchased systems. Either course of action at that point is not beneficial to the government or the operating forces.

The CRAF branch of the vignette contains the most complexity. In the context of EABO and LOCE in the Pacific, the idea of being able to surge capabilities as necessary utilizing a civilian fleet held in reserve would be beneficial to the mission and provide great benefit to the Marine Corps and other services. However, reaching that end state would prove difficult. Some questions to be considered include the following:

1. Does each airline provide its own contracted personnel to be responsible for maintenance, operations, and/or advisement on the use of the aircraft?

2. What training do contracted personnel require other than knowledge of their specific aircraft?

3. Are the logistics pods assumed to be a loss, or does the Marine Corps keep track of them to return to their respective manufacturers?

4. Are funds set aside to reimburse airlines for expected damage, destruction, and loss of aircraft? If so, how much?

5. What are the security concerns that exist when utilizing civilian airlines to provide unmanned aviation services, and how can they be mitigated?

Given the scenarios present in each branch of the vignette, the two options that stand out as being able to accomplish the mission effectively are the outright purchase model and hybrid model. The lease model is too complex given the operating environment and circumstances surrounding ALS as a service. Incorporation of ALS into the CRAF is a course of action that should be up for consideration. Given the history of the CRAF and the laws currently on the books, ALS would not be able to be added to the CRAF without significant changes. The Marine Corps and DOD should approach the possibility of ALS being incorporated in the CRAF as a long-term consideration, necessary if forces can first lay the groundwork for operating ALS in a contested environment. Incorporating ALS into the CRAF is much more complex than the current condition of the CRAF, so significant considerations and changes would be required for the CRAF to play a role in an operational scenario like Pacific 2035.

VI. LEASE/PURCHASE RECOMMENDATION FOR A NOVEL AUTONOMOUS LOGISTICS SYSTEM

A. INTRODUCTION

The below recommendation is based on all relevant advantages and disadvantages of each available option, with a focus on maximum operational benefit to the Marine Corps' operating forces. There is no perfect solution to DOD procurement of commercial assets, and the same holds true for procurement of a novel ALS. However, it is not realistic to make a long-term lease versus purchase determination without first determining how the Marine Corps would utilize such a novel ALS and getting operational units hands-on experience with the systems. As such, it is recommended that the Marine Corps makes the lease versus purchase determination after an initial lease trial period with an operational unit. Further, the DOD should make an additional determination as to whether ALS should be considered for implementation in the CRAF. The discussion includes considered recommendations with reasoning for each, followed by the formal recommendation for Marine Corps leadership to consider when making procurement-related decisions for novel ALS.

B. DISCUSSION

The first considered recommendation is an outright purchase model of commercially available ALS. In this model, the Marine Corps would own the systems entirely and would be responsible for all personnel, maintenance, operations, and disposal of the systems throughout their life cycle. The only prolonged partnership with the producer would be whatever warranty terms are agreed upon, including replacement for faulty systems and parts and depot-level maintenance of aircraft, as necessary. The Marine Corps would purchase the aircraft as well as the pods and would own both outright. The aircraft would be maintained, stored, and operated by Marines, and a supply of pods would also be stored and handled by Marines. The Marine Corps would be responsible for training personnel and units to handle the system safely and effectively and determine what doctrine and policy changes are required for full implementation across the force.

The second considered recommendation is an outright lease model of commercially available ALS. In this model, the Marine Corps would lease every aspect of the system, effectively utilizing ALS as a service. The producer of the system would continue to own the system and would be paid by the Marine Corps for the service provided by the system. The producer would be responsible for personnel, maintenance, operations, and disposal of the systems throughout their life cycle. Warranties of ownership would not be required in this model as any defects or system faults would be taken care of by the producer as part of the lease terms. The producer would own the pods as well as the aircraft.

The third considered recommendation is a hybrid model of commercially available ALS. In this model, the Marine Corps would lease the aircraft but would purchase pods outright. Part of the lease terms could include a pods "subscription" in which the Marine Corps purchases set numbers of pods and either disposes of them internally or sends back to the manufacturer at the end of the life cycle for disposal. In this model, the manufacturer would own the aircraft, but the Marine Corps would be responsible for all personnel and operations with relation to the systems throughout their life cycle. Maintenance would be handled by the manufacturer, per the lease terms. Warranties of ownership would not be required for the same reason as the lease model; however, replacement terms for faulty systems and parts and depot-level maintenance of aircraft would have to be written into the lease terms and agreed upon by both the contractor and the Marine Corps. The purchased pods could include necessary warranty and disposal/ refurbishment terms. The aircraft and pods would be stored and operated by Marines. Destruction or loss of aircraft in a combat or training environment would result in payment in full of the unpaid cost of the system to the contractor. As with the purchase model, the Marine Corps would be responsible for training personnel and units to handle the system safely and effectively and determine what doctrine and policy changes are required for full implementation across the force.

The fourth considered recommendation is for ALS implementation into the CRAF. Autonomous logistics may play a major role in humanitarian and combat operations in the future. Along with the pilot-operated passenger jets that currently make up the CRAF, ALS could serve as a landmark addition to the fleet, which is only utilized in extraordinary cases when available military resources are not capable of conducting the required mission alone.

Since ALS is being developed and manufactured by corporations for more than just military purposes, not all produced ALS will be procured by the DOD, let alone the Marine Corps. Airlines are developing ALS for civilian and industrial purposes, just like passenger airlines develop jets for civilian air travel and cargo movements. As the CRAF is currently utilized for emergency use of civilian aircraft for movements of people in extraordinary circumstances, with modifications, it could also be utilized for emergency use of civilian ALS for military logistics purposes in cases such as large-scale conflict as well as humanitarian assistance and disaster relief and any other purpose that autonomous middle mile movement of supplies would be beneficial. Since middle mile ALS has not been implemented on a large scale in either a civilian or military role to date, considering ALS for implementation in the CRAF is still premature. It should be a course of action and legislative change that is considered but not acted upon until more information is known as to how the government could utilize the capabilities.

The fifth considered recommendation, which is the recommendation of this thesis, is a hybrid business model in which a short trial period is conducted as a lease with one Marine Corps battalion-sized unit and the Marine Corps re-evaluates options after that initial trial. The trial would consist of full system implementation in one logistics battalion, which would incorporate ALS into its operations as if the system was adopted as a permanent system in the unit's table of equipment. However, the system would still be owned and maintained by the manufacturer. The manufacturer would be compensated appropriately for the trial, but the government would not assume further risk in the case of the system not being effective, having a high failure rate, or being otherwise underwhelming. Both the government and private sector benefit from this arrangement. The private sector can showcase its products to a military unit, and if the products are deemed to be operationally sufficient, the government will continue to spend money on a much wider scale. The government assumes minimal risk if the systems fail to meet necessary criteria but maintain the ability to evaluate performance of the system after the initial trial period and either continue the lease model or implement an outright purchase model, based on an analysis of the effectiveness of the system in the hands of Marine operators.

Testing autonomous aircraft in a lab environment or even in a field test environment are necessary parts of the systems engineering process to develop a technology into a useable system in the operating forces, but those tests do not replace the knowledge and insight gains by putting the system into the hands of an operational unit and incorporating it into real Marine Corps operations. History has proven that developing and acquiring military systems without significant input and testing from military operators is not the most effective way of incorporating an effective system or platform into real-world operations. Marines must get their hands on these systems so the Marine Corps can evaluate the procurement path forward in a low-risk, high reward process. Partnering a battalion-sized logistics unit with a private corporation to lease an ALS on a trial basis is the recommendation to reach that end state.

C. SUMMARY

A lease versus purchase decision should not be made until Marine Corps operational forces have implemented the novel ALS in a manner consistent with full implementation, using an initial, year-long lease trial period. Prototypes as well as field and lab experimentation in controlled environments are not enough. The recommendation is for a battalion-sized logistics unit to implement the system and conduct all operations as if the system is a permanent part of the unit's table of equipment. At the current stage of development of such novel ALS, future operators do not know what the systems will be capable of and how they will function when implemented in combat and other austere conditions.

The lease versus purchase decision is important for determining the best procurement model that will benefit operations the most, and while the analysis has proven advantages and disadvantages to each model, a well-informed decision cannot be made without input and analysis from future operators and stakeholders of the system. Based on all available metrics and analyses, the most essential element of the decision is the operational benefit of the chosen model. Given the changing focus of the Marine Corps, shift in operational and strategic goals, and evolving tactics necessary for future conflicts, Marines must get their hands on these systems before any decision is made with respect to

their long-term, service-wide procurement and employment. Additionally, based on analysis from end-user through service leadership, the Marine Corps can then be made the determination as to whether the system should be considered for inclusion in the CRAF. This would require significant legal and legislative action, but if inclusion in the CRAF can provide benefit to the DOD, it should be considered, and follow-on actions can be determined at that time.

THIS PAGE INTENTIONALLY LEFT BLANK

VII. CONCLUSIONS

A. RESEARCH QUESTIONS ANSWERED

1. Given existing planning guidance and shifted priorities to EABO and LOCE in the Pacific, should the Marine Corps seek to procure unmanned commercial ALS via outright purchase, lease, or a hybrid of the two models?

The Marine Corps should seek to procure these commercial systems via a hybrid model. Since the Marine Corps does not yet have doctrine and training in place to use commercial ALS, the institution must first determine how to use the systems. The goal should not be to immediately procure a new system for implementation across the service; rather, the goal should be to take on a commercial system with minimal modifications and determine how to implement the system operationally, if at all. A small number of systems in an initial lease should be used to inform a long-term decision for the Marine Corps. Following an initial trial period or pilot program of the system, the Marine Corps can decide which business model (lease or purchase) should be utilized for procurement and implementation of the system across the Marine Corps. This could also include a determination that another system should be pursued or that the ALS does not provide the return on investment necessary to pursue any such system. Further, determination could be made as to whether the DOD should begin the process to incorporate ALS into the CRAF and seek to make an even bigger investment in using commercial ALS as a centerpiece of future operations.

This recommended hybrid model includes an arrangement for a lease with a private company that produces an ALS. The Marine Corps should identify one battalion-sized infantry or logistics unit to partner with the company in a pilot program concept. During this pilot program, the operational unit will equip, test, and train with the ALS and identify problem areas, advantages, disadvantages, usefulness, difficulties, etc. After one fiscal year of utilizing the platform as a lease in a peacetime setting, the Marine Corps can evaluate how to proceed. This model ensures cost savings, market competition, faster timelines,

flexibility, better decision-making in individual lease/ buy analyses, and procurement of systems, equipment, and platforms that best accomplish operational missions in a way that is most beneficial to both the Marines on the ground and the organization.

2. What is unique about an unmanned commercial ALS that would bias a lease/purchase decision one way or the other, and which aspects of such systems in the lease/purchase analysis could translate to similar analyses of other DOD-interested systems?

Characteristics of an unmanned commercial ALS that would bias a lease/ purchase decision include a multitude of competing companies (many ways to source the systems), production capabilities, longevity of individual systems, maintenance requirements, system viability, and operational situation (peace, war, buildup, etc.). With respect to other medium-sized platforms, the Marine Corps and DOD should seek to incorporate the lease pilot program model. Instead of locking into a specified number of systems before they are even developed and produced—or purchasing a specified number of systems with minimal to no operational fielding analysis—the DOD should identify appropriately sized units to test systems and platforms for potential force-wide fielding. This limits risk on the side of the DOD by not locking the department into programs that may or may not generate a sufficient return on investment and opens opportunities for private industry that may otherwise not get the chance to partner with the DOD.

All types of systems and platforms are different. However, when it comes to commercially available technology, the DOD should find a better balance between closing itself off to industry and trusting industry with producing a product that the DOD has already locked itself into. A mutually beneficial middle-ground for small-to-medium-sized systems and platforms is a hybrid, pilot lease program which keeps all options open while not committing large sums of money, time, and personnel to programs that may or may not prove beneficial in meeting the DOD's needs. This would allow the DOD to take a chance on a wider range of companies, fully evaluate which systems will be beneficial to operations, and either purchase, lease, or no longer pursue systems accordingly. This model demands that private industry competes and produces high-quality technology and equipment that the DOD would want to procure.

3. What are the likely challenges to a lease-based business model, and what drawbacks will need to be addressed or alleviated, both by the DOD and by private industry?

Challenges to a lease-based business model include continuous costs over the life of the lease, reluctance by private companies to provide systems and services as a lease, and lack of ownership. Although the lease-based business model has the advantage of being cheaper in the sort-term, companies will only agree to providing ALS on a lease if the agreement is financially advantageous. This will mean that over the life of the lease, the overall cost of the system to the DOD will be higher.

Private companies may be biased toward a purchase-based business model so that they can transfer ownership of a system to the DOD, receive a considerable sum of money up front, and move on to other transactions, save for any warranty terms that are part of the purchase agreement. A lease-based business model becomes more complicated, requires continuous involvement by the company throughout the execution of the lease, and does not provide payment for the cost of the total lease up front. The DOD can alleviate these concerns using the hybrid model. The proposed model allows for partnership with a wider range of companies and keeps open the possibilities of extended leasing or outright purchase. By including more companies of all sizes in the process, the DOD would increase competition, demand the best products, and ensure that only the best deals are reached after the initial trial periods. Private companies receive fair compensation for the trial periods, but neither party is locked into an initial long-term commitment, allowing all sides time to determine their most beneficial course of action moving forward.

B. TOPICS FOR FURTHER RESEARCH

The recommendations and conclusions of this thesis are not decisive in determining the best procurement path forward for the Marine Corps to procure commercial ALS indefinitely. Relevant topics for further research into this decision include the following questions:

- Which operational unit should the Marine Corps use as its testbed for a year-long trial?

- Once a year-long trial has been conducted with an operational Marine Corps unit and commercial ALS manufacturer, based on actual costs, acquired data, and expertise, which procurement method should the Marine Corps pursue to equip the entire force with these ALS capabilities?

- Which aspects of the Joint Capabilities Integration and Development System (JCIDS) Process, PPBE Process, and Acquisition Process require changes to most efficiently implement ALS across the Marine Corps prior to the next large-scale conflict, and what can the DOD do today to affect those changes?

- Should a concept like the CRAF be utilized to surge civilian capabilities for a military purpose for industries other than the airline industry?

- What other innovative technologies require a lease versus purchase comparative analysis to determine the best procurement method for mission accomplishment and effective operations, not just cost savings?

C. SUMMARY

Given the changing operational and geopolitical landscape, the Marine Corps is shifting its focus and priorities to most effectively counter adversaries and threats in the future. This shift also requires adjustments in the way the force procures necessary systems to meet our objectives. In his *Force Design 2030*, General Berger insists the following: "Logistics (sustainability) is both a critical requirement and critical vulnerability. Forces that cannot sustain themselves inside the WEZ are liabilities; however, those that can sustain themselves while executing reconnaissance and counter-reconnaissance missions create a competitive advantage."[68] Procuring novel ALS in a timely, affordable, efficient, and operationally focused way that allows Marines to seamlessly execute logistics functions in the Pacific, ensuring successful execution of EABO and LOCE, in accordance with the Commandant's Planning Guidance and Force Design. To that end, the most

[68] David H. Berger, *Force Design 2030* (Washington, DC: United States Marine Corps, 2020), 5.

effective course of action for procuring commercial ALS is to partner with a private company that produces the ALS the Marine Corps requires and agree to a short-term (one year) lease. This trial period will allow one battalion-sized fleet unit to utilize the system as if it is fully implemented across the force. This model would go beyond prototypes and experimentation and stops just short of full implementation. Once the trial period is complete, all options remain on the table, and the Marine Corps can determine how to best procure ALS across the force. This recommendation opens the door for efficient implementation of future systems and keeps procurement options open based on user and command-level knowledge, experience, and input after gaining full familiarity with the system.

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

Airbus. "Airbus Helicopters UH-72 Lakota Fleet Surpasses One Million Flight Hours, with U.S. Army, Navy and National Guard Units." October 11, 2021. https://www.airbus.com/en/newsroom/press-releases/2021-10-airbus-helicopters-uh-72-lakota-fleet-surpasses-one-million-flight.

Air Mobility Command. "Civil Reserve Air Fleet." August 2021. https://www.amc.af.mil/About-Us/Fact-Sheets/Display/Article/144025/civil-reserve-air-fleet/.

Arceneaux, Alan J. "Cost/benefit analysis of Leasing Versus Purchasing Computers." Master's thesis, Naval Postgraduate School, 1997. https://calhoun.nps.edu/handle/10945/8160.

Arthur, David. *Issues Regarding the Current and Future Use of the Civil Reserve Air Fleet*. Washington, DC: Congressional Budget Office, 2007. https://www.cbo.gov/sites/default/files/110th-congress-2007-2008/reports/10-09-craf.pdf.

Baldanza, Ben. "How the Civil Reserve Air Fleet Benefits the Country and Helps Airlines." *Forbes*. September 1, 2021. https://www.forbes.com/sites/benbaldanza/2021/09/01/how-the-civil-reserve-air-fleet-benefits-the-country-and-helps-airlines/?sh=2dc782756566.

Berger, David H. *Commandant's Planning Guidance*. Washington, DC: United States Marine Corps, 2019. https://www.marines.mil/News/Publications/MCPEL/Electronic-Library-Display/Article/1907265/38th-commandants-planning-guidance-cpg/.

———. *Force Design 2030*. Washington, DC: United States Marine Corps, 2020.

———. *Force Design 2030 Annual Update*. Washington, DC: United States Marine Corps, 2021.

Crackel, Theodore Joseph. *A History of the Civil Reserve Air Fleet*. Washington, D.C.: Air Force History & Museums Program, 1998. https://media.defense.gov/2013/Sep/16/2001329866/-1/-1/0/AFD-130916-006.pdf.

Curtin, Neal P. *Military Aircraft: Considerations in Reviewing the Air Force Proposal to Lease Aerial Refueling Aircraft*. GAO-03-1048T. Washington, DC: Government Accountability Office, 2003. https://www.govinfo.gov/content/pkg/GAOREPORTS-GAO-03-1048T/html/GAOREPORTS-GAO-03-1048T.htm.

Decker, Audrey. “Marine Corps Acquires Two MQ-9 Reapers.” Inside Defense. October 20, 2021. https://insidedefense.com/insider/marine-corps-acquires-two-mq-9-reapers.

Department of Defense. *Defense Federal Acquisition Regulation Supplement, Part 207: Acquisition Planning*, Subpart 207.4 – Equipment Acquisition. https://www.acquisition.gov/dfars/part-207-acquisition-planning#DFARS-207.401.

Gansler, Jacques S., William Lucyshyn, and John Rigilano. *Rethinking the Lease vs. Buy Decision*. UMD-AM-14-179. College Park, MD: University of Maryland Center for Public Policy and Private Enterprise, 2014. https://calhoun.nps.edu/handle/10945/45072.

Gourdin, Kent N. “Sustaining the Civil Reserve Air Fleet.” NDTA. February 18, 2020. https://www.ndtahq.com/sustaining-the-civil-reserve-air-fleet/.

Hensley, Carlton L and Archie L. Tinjum. “Lease vs. Purchase in Defense Acquisition.” Master’s thesis, Naval Postgraduate School, 2008. https://calhoun.nps.edu/handle/10945/3824.

Kanne, Michael Raymond. “Analysis of Lease Versus Buy Options for Procurement of Radio Assets for the Marine Corps Air Station at Yuma, Arizona.” Master’s thesis, Naval Postgraduate School, 1977. https://calhoun.nps.edu/handle/10945/18009.

Katz, Justin. “From Lease to Own: Marines Get Two MQ-9 Reapers of Their Own.” Breaking Defense. October 22, 2021. https://breakingdefense.com/2021/10/from-lease-to-own-marines-get-two-mq-9-reapers-of-their-own/.

———. “Marine Corps’ First MQ-9A Takes Flight in Arizona.” Breaking Defense. September 9, 2021. https://breakingdefense.com/2021/09/marine-corps-first-mq-9a-takes-flight-in-arizona/.

Kim, Jung Jin. “Comparative Analysis of Leasing versus Buying General Purpose Vehicles (Sedan) in the Korean Air Force.” Master’s thesis, Air Force Institute of Technology, 2002. https://apps.dtic.mil/sti/citations/ADA401799.

Marines: The Official website of the United States Marine Corps. “Expeditionary Advanced Base Operations (EABO).” August 2, 2021. https://www.marines.mil/News/News-Display/Article/2708120/expeditionary-advanced-base-operations-eabo/.

McGarry, Brendan W. *Defense Primer: Planning, Programming, Budgeting, and Execution (PPBE) Process*. CRS Report No. IF10429. Washington, DC: Congressional Research Service, 2021. https://sgp.fas.org/crs/natsec/IF10429.pdf.

Miguel, San, Joseph G., John K. Shank, and Donald E. Summers. *Navy Acquisition via Leasing: Policy, Politics, and Polemics with the Maritime Prepositioned Ships*. NPS-AM-05-006. Monterey, CA: Naval Postgraduate School, 2005. https://calhoun.nps.edu/handle/10945/354.

National Defense Authorization Act of 2022, *U.S. Code* 10 (2022) §§ 2401a et seq. https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section2401a&num=0&edition=prelim.

Tegler, Jan. "UH-72A Lakota Introduction." Defense Media Network. December 31, 2009. https://www.defensemedianetwork.com/stories/light-utility-helicopter-uh-72a-lakota-introduction-progresses-rapidly/.

United States. *Federal Acquisition Regulation, Part 7: Acquisition Planning*, Subpart 7.4 – Equipment Acquisition. https://www.acquisition.gov/far/subpart-7.4.

U.S. Department of Defense. "Department of Defense Activates Civil Reserve Air Fleet to Assist With Afghanistan Efforts." August 22, 2021. https://www.defense.gov/News/Releases/Release/Article/2741564/department-of-defense-activates-civil-reserve-air-fleet-to-assist-with-afghanis/.

U.S. Department of Transportation. "Civil Reserve Airfleet." November 20, 2020. https://www.transportation.gov/mission/administrations/intelligence-security-emergency-response/civil-reserve-airfleet-allocations.

U.S. Marine Corps. *Tactics*. MCDP 1-3. Washington, DC: Department of the Navy, 1997. https://www.marines.mil/Portals/1/Publications/MCDP%201-3%20Tactics.pdf.

Voss, Levi. "3rd MAW Procures Marine Corps' First MQ-9A 'Reaper.'" Marines: The Official website of the United States Marine Corps. September 7, 2021. https://www.marines.mil/News/News-Display/Article/2766284/3rd-maw-procures-marine-corps-first-mq-9a-reaper/.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California