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Wrenches, Wages, and the Call to Continue: An Empirical Examination of Aviation Maintenance Manpower Retention in the U.S. Marine Corps

March 2026

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

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ABSTRACT

The Marine Corps 2025 Aviation Plan prioritizes operational readiness, modernization, and interoperability, all of which depends on retaining experienced talent. The demand for capable pilots and aviation maintainers has only increased in the post–coronavirus disease 2019 (COVID-19) civilian market. This suggests that civilian labor market conditions may affect the retention decision of Marine aviation maintainers. To evaluate this hypothesis, this research uses data on retention rates among Marine aviation maintainers and civilian-military wage gaps in the aviation maintenance occupation between 2014 and 2024. The multivariate regressions indicate that a $1,000 increase in civilian-military wage gaps is associated with 9.7% higher odds of separating at the five-year mark. When controlling for demographics, rank, and home of record, a $1,000 increase in civilian-military wage gap is associated with 5.3% higher odds of separating. The key findings of this research could inform decisions regarding how to retain talented aviation maintenance personnel.

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To start I would like to express my gratitude to my wife Jessica for her support throughout both my studies and my career. You kept me grounded throughout this journey, enabling me to finish with something I can be proud of. Next, I would like to thank both my advisors, Dr. Hartmann and Dr. Seagren, for their guidance and support. Dr. Hartmann, words cannot express my gratitude in your involvement and expertise in the development of this thesis. Your help with not only clarifying my topic but keeping me focused on what mattered the most is something I cannot thank you enough for. Dr. Seagren, your expert understanding of my topic and support was invaluable in the construction of my finished paper. While I didn't get the chance to cover everything we talked about, I appreciate your insight and wisdom throughout. Lastly, I would like to thank Ms. Scharmota, my writing coach; I could not have articulated my findings without her expertise. While writing is definitely not a strength of mine, you went above and beyond not only with writing development, but in helping me develop a better product.

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LIST OF ACRONYMS AND ABBREVIATIONS

A&P	airframe and powerplant
AMEX	aviation maintenance experience
AMO	Aircraft Maintenance Officer
AMSRR	Aviation Maintenance Supply Readiness Report
ATEC	Aviation Technical Council
AvB	aviation bonus
AvIP	aviation incentive pay
BLS	U.S. Bureau of Labor Statistics
CDI	Collateral Duty Inspector
CDQAR	Collateral Duty Quality Assurance Representative
CPI	consumer price index
CSRB	critical skill retention bonus
DAF	Department of Air Force
DFAS	Defense Finance and Accounting Service
DMDC	Defense Manpower Data Center
FAA	Federal Aviation Administration
FMC	full mission capable
FRED	Federal Reserve Bank of St. Louis
GAO	Government Accountability Office
MAG	Marine Aviation Group
MAGTF	Marine Air Ground Task Force
MALS	Marine Aviation Logistics Squadron
MCM	maintenance capacity model
MOS	military occupational specialty
NMC	non-mission capable
NMCM	non-mission capable maintenance
OES	occupational employment survey
PMC	partial mission capable
QAR	Quality Assurance Representative
QRMC	Quadrennial Review of Military Compensation

RMC	regular military compensation
SRB	selective retention bonus
TIG	time in grade
TIS	time in service

I. INTRODUCTION

Training and education are a fundamental part of honing military skillsets, and these skillsets are central to readiness. This is particularly evident in more technical military communities where occupational expertise is gained through years of training, education, and operational experience. The Marine Corps prioritizes retaining skill in all occupations, but the aviation community is particularly dependent on technical skillsets to meet readiness requirements, continue training, and execute the mission. Concerns for retention have been on the rise for the last few years in multiple occupations, the aviation community is no different. There is a substantial amount of documentation from professional military organizations and civilian aviation labor analysis that review or indicate current concerns regarding manpower shortfalls. Examples of this are in the Marine Corps' MARADMIN 295/22 (U.S. Marine Corps, 2022) that offers bonuses and early reenlistment opportunities for aviation Marines. Also, the Marine Corps Aviation Plan states that "each squadron will undergo a manpower re-alignment that seeks to fill gaps in certain military occupational specialties (MOS) within the maintenance department" (Gering 2025, p. 10). Civilian documentation echoes these ideas, such as in an article from the Marine Corps Times where Lt. General Jon Davis was quoted (Schogol, 2017) "We let some people go that probably – if we had better insight into who we had out there and the qualifications of those Marines inside the maintenance departments of our flying units – you'd say: 'These people can't go,'" (p .1).

The Marine Corps does in fact mention the need for retention in almost every talent management plan or planning document over the years, suggesting that it might be fragile without stating retention shortfalls. The need for incentivizing retention is commented on by General Berger (2021) in the 2030 Talent Management: "Once we invest in these individuals, we need to incentivize the retention of the right numbers of the most capable among them so they can continue to add value to our organization in ways that are necessary to achieve the requirements of the future force" (p. 18). The Marine Corps Aviation Plan states the ongoing effort for retention by working with other Marine Corps departments through bonuses and other incentives while acknowledging the need for talent.

Gering (2025) states, “We need to ensure the right Marine with the proper training and qualifications arrives to the right unit on time” (p. 5). The Marine Corps understands that talented Marines are needed for the success of Marine aviation while also admitting that there are challenges that will be faced in both procurement and placement of talent. Continuing from Gering (2025), “Fleet transitions have made inventory management and staffing a difficult task, but we will continue to execute in a manner that best supports the fleet and Marine Aviation as a whole” (p. 5). Even as platforms change and evolve, the Marine Corps still needs people to fulfill maintenance requirements.

There is, however, research that suggests that the Marine Corps aviation community is dealing with personnel constraints. According to Rose (2024)

> Manpower constraints limit the maintenance department’s ability to perform tasks simultaneously, causing delays. The MCM [Maintenance Capacity Model] assumes high NMCM [non-mission capable maintenance] rates are caused by insufficient direct-maintenance man-hour production rather than an undersized workforce. (p. 1)

Rose (2024) goes on to mention how the MCM is used and why it does not actually capture the issue: “Maintenance leaders use the MCM to calculate the hours their workforces should document in ideal conditions instead of what is actually recorded each week” (p. 1). The potential issue here is “readiness” which is directly affected by manpower constraints because of retention. The Government Accountability Office (GAO) (2025) reports that the Maine Corps aviation community has failed to meet readiness goals between 2015 and 2024 for all evaluated platforms besides one.

Aviation readiness depends on the combined availability of personnel, material, and maintenance infrastructure and is often summarized in practice as “parts, people, and tools.” While readiness outcomes are the result of all three inputs the “people” input is one of the major topics in all communities and the focal point of all retention campaigns. If readiness depends in part on people, then retention is a variable worth exploring. Although pilot retention has been a hot topic in research recently, pilots are not the only skilled labor in high demand.

There is a growing demand for aviation maintenance personnel in the civilian labor market which could greatly impact the retention of current military members. The GAO (2023) found that after the coronavirus disease 2019 (COVID-19) pandemic the rebound of commercial airline travel increased the need for both pilots and Mechanics. The Aviation Technical Education Council (ATEC) (2025) pipeline report also notes the decline in maintenance personnel supply despite enrollment increases. There is clear documentation that the need for aviation maintenance personnel is steadily increasing as the demand for airline travel increases. Marine aviation readiness largely depends on the major three inputs being parts, people, and tools with people growing in demand and being called to the civilian labor market.

If there is better pay and more opportunity in the civilian market, to what extent could personnel declines affect the Marine Corps aviation community?

My thesis addresses this question by investigating whether civilian-military wage gaps among USMC aviation maintenance personnel affect separations at key points, namely five, six, and seven years.

Currently, the fix for shortfalls in the aviation community tends to be the Selective Retention Bonus (SRB). While there is incentive pay to retain and attract aviators, there is no similar incentive pay to retain the specialized skills that maintain the aircraft. As analyzed by Fuzy (2019) the SRB has little to no effect on aviation maintainers, even adding a skill or qualification specific wage increase does not solve the problem, suggesting that there may be a better alternative in the civilian labor market.

A. SIGNIFICANCE

With the time and money, it takes to cultivate skilled, inspector designated aircraft maintainers, losing talent at earlier points in their career impacts readiness through increased time needed for repairs. This also affects the remaining talent that does not choose to leave for the civilian labor market. This effect produces less time for training and education for the newer generations to compete with readiness needs. With the constant change in aviation and overall Marine Corps mission objectives, allowing the loss of talent without action will reduce capability with lower readiness numbers. While I am not

studying the cost it takes to train and educate a worker in any aviation field, a member leaving for the civilian labor market means losing at a minimum three years of investment. Those are three years of knowledge that could grow further and help train the incoming generation and fill the gaps in manpower to handle readiness needs.

B. RESEARCH DESIGN

To answer my thesis question I collected data on enlisted Marines that have an MOS code in the 6000 series to capture the bulk of the aviation maintenance population. I cleaned the data to focus on the maintenance personnel that perform repairs on aviation assets including both aircraft and equipment. I also collected data from the U.S. Bureau of Labor Statistics (BLS) spanning the years of 2014–2024 with the applicable occupation codes as described in the USMC MOS Manual. The MOS Manual outlines and states the code for the civilian counterpart occupation for each MOS. All codes in the manual and from the BLS are a match and used to construct civilian wages for the same military job. The BLS codes specifically are from the Occupational Employment Survey (OES). I also reviewed job hirings in the acquired occupation codes. The states with the most overlap were used for regressions to evaluate if home of record, meaning the Marines home state plays any impact on the decision to separate. The next dataset that I collected was from the Defense Finance and Accounting Service (DFAS) containing military pay tables for basic pay spanning 2014–2024. I chose to examine the 2014–2024 date range because I wanted to study Marines during their first two contracts before qualifying as a careerist. I do not examine any data past 2024 because that is the most recent year of data available from the BLS.

To assess the role of wage gaps, I created a civilian-military wage differential controlling for the year of separation (or last observed year of the Marine namely 2024 if not separated) and their home of record in that year. I determined the average military pay for the three separate MOS aviation maintenance groups. Next, I evaluated the survival rate for the sample and then by assigned MOS groups. Finally, I constructed three models to run multivariate regressions at three different horizons to determine and assess the relationship between the civilian-military wage gap and the odds of separation.

C. RESULTS

Most separations occur in the junior ranks at the five-year mark; Avionics Technicians represent the occupational specialty with the highest rate of separation. The wage gap between civilians and military has been consistently around $30k give or take, but in 2024 it starts to pull away again at about $64k for civilian labor and $29k for military labor (base pay). To evaluate the validity of the QRMC and to see what the gap currently sits at I incorporated benefits for 2024 alone. Factoring in main benefits, I find that on average the civilian market pays approximately $25k more than the military for service members without dependents. The regressions report that a $1,000 increase in the civilian-military wage gap increases the odds of separation by 9.7% at the five-year mark. Lastly, I found that the higher the wage gap, the lower the probability of survival for the sample evaluated.

D. ORGANIZATION

The organization of this thesis is separated into six chapters. Chapter II includes the background aviation maintenance structure, occupations, and inspector designations as designed in the COMNAVAIRFORINST 4790.2E. Chapter II also includes the impact personnel have on aircraft readiness through roles and responsibilities. Chapter III covers the literature review for this thesis and the various findings that raise the need for investigation along with current programs and benchmarks for military pay. Chapter IV includes the data and methodology used in my analysis providing applicable graphs and models to formulate a conclusion. Chapter V is the results of the investigation, and Chapter VI provides recommendations and follow-on research that aligns with this study to further expand on the relationship between pay and separation.

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II. BACKGROUND

This background describes the importance of Marine aviation at the maintenance department level and the composition of its people. I will explain the basic process of how the maintenance department impacts readiness and the individuals that hold inspector designations who are responsible for its upkeep. Currently the civilian labor market shows a decline in Airframe and Powerplant (A&P) education through a lack of filled seats, which could impact the Marine Corps aviation maintenance manpower numbers. Manpower is required to perform maintenance; reduced numbers decrease distribution of labor to maintain required readiness numbers.

The Marine Air Ground Task Force (MAGTF) needs Marine Corps aviation for training and mission execution. As stated in Marine Corps War Publication (MCWP) 3–20 (USMC, 2018), "Marine aviation provides the MAGTF with the operational flexibility it needs to accomplish its mission across the range of military operations" (p. 8). Marine aviation enables MAGTF to execute long-range missions, shape fires, and transport troops, greatly expanding MAGTF versatility as a ready crisis response force. Therefore, aircraft and associated aviation assets must be ready for training and missions, which demands time in planning and maintenance upkeep.

A. PROCESS

Not just in Marine aviation, but in every occupation in the Marine Corps the term readiness is used to measure the unit's capability to train, fight, or be ready to deploy. Writing for the Congressional Research Service, Herrera (2022) gives the DoD's definition of readiness as "the ability of military forces to fight and meet the demands of assigned missions" (p. 1). In aviation, readiness requires a certain number of usable assets for training and mission execution. Assets include both aircraft and the equipment used to maintain aircraft; both must be sufficient in number and functionality to sustain operational requirements. There are two main types of squadrons on operational Marine Corps Air Station: the flying squadron with flyable aircraft, pilots, and maintenance personnel; and the Marine Aviation Logistics Squadron (MALS), which supports the flying squadrons.

The flying squadron is known as the organizational level and the MALS is known as the intermediate level when regarding maintenance. The MALS supplies the material, equipment, and more specialized labor to support the flying squadron's mission. Both the flying squadron and the MALS work together to accomplish the mission and are susceptible to readiness requirement metrics under the same command, such as a Marine Aviation Group (MAG).[1]

As normal operations degrade equipment and aircraft, personnel must evaluate this degradation and assign readiness statuses, but readiness cannot improve without designated inspectors. There are three main statuses (as defined by COMNAVAIRFORINST 47903.2E) that are tracked and reported on the Aviation Maintenance Supply Readiness Report (AMSRR): Full Mission Capable (FMC), Partial Mission Capable (PMC), and Non-Mission Capable (NMC) (Office of the Chief of Naval Operations, 2024). FMC means the aircraft can do any mission that it was designed for, while PMC means the aircraft can do almost all missions it was designed for with some restrictions. A restriction could be a degraded illumination system used in night flights, preventing the aircraft from being used during night operations until repaired. NMC is the most watched status because the aircraft is limited in all capacities until the degraded flight-critical system is repaired. The NMC status critically limits a squadron's readiness, which makes repairing NMC aircraft a high priority. The AMSRR is completed every day before the morning shift to both document the squadron's readiness status and the material not on hand that is required to repair degraded assets for continued use. Both the squadrons and the MALS report their status on the AMSRR, the squadron reports aircraft status and the MALS reports material and equipment repair status. To complete a workorder to change the aircraft's NMC status to a flyable one, maintenance must be completed by a worker(s) and then inspected by a designated maintenance inspector. Both workers and inspectors are specified by skill type such as aircraft Mechanics, Airframers, or Avionics Technicians (Office of the Chief of Naval Operations, 2024). While these are not the only skill types, these are what people would call "the big three." Using Airframers as an example, if the exterior of the aircraft is

[1] For MALS and squadron organizational structures, other maintenance statuses, and roles and responsibilities refer to COMNAVAIRFORINST 4790.2E

degraded, a worker would assess and repair the airframe. Then an inspector would inspect the work to ensure that the maintenance was performed properly and safely before completing the workorder.

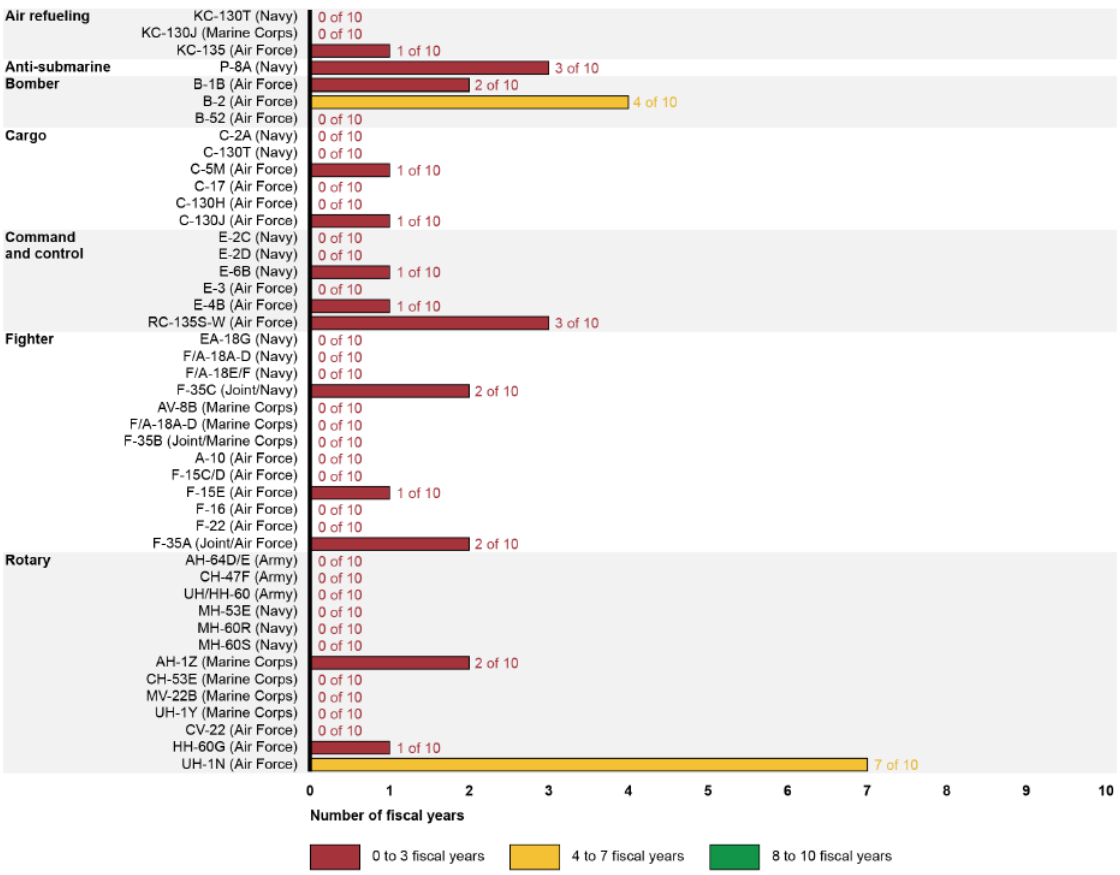
B. INSPECTORS AND THEIR ROLE

The COMNAVAIRFORINST 4790.2E also describes the general distribution of personnel (Office of the Chief of Naval Operations, 2024). Workers themselves are junior members of the maintenance department; they are trained and educated by the Marine Corps in a formal school setting. Then they are further trained and educated by inspectors through on-the-job training and practical application. Inspectors themselves were workers that completed the required level of training over time (around 2–3 years) and then passed mandatory examinations. They are then approved by the senior officer of the maintenance department, known as the Aircraft Maintenance Officer (AMO). This is important to understand; inspectors cannot be hired from the civilian labor market but rather must be trained and educated in-house from within the USMC. There are three main types of inspector designations broken up by their specialty. The most junior is the Collateral Duty Inspector (CDI), who can inspect all work that is not determined to be flight critical. The other two inspectors are, in most cases, generally equal in knowledge but separate in terms of authority. The Collateral Duty Quality Assurance Representative (CDQAR) can inspect all maintenance performed, whereas the Quality Assurance Representative (QAR) has the same permission, but has the final say regarding maintenance practices. CDQARs are in one of the maintenance work centers and QARs are in their own independent work center overseeing that all inspection practices and maintenance conducted are following governing documents (Office of the Chief of Naval Operations, 2024).

C. READINESS AS IT STANDS

Currently, the Marine Corps can meet mission requirements but still falls short in overall readiness metrics. Even having available talent to fill inspector designations it is still not enough to simply fill these roles. General labor is still required to perform the maintenance to be inspected. While inspectors themselves are authorized to perform maintenance, they cannot inspect their own work, requiring another inspector to certify the

work. This is a protective measure to guarantee safety and legality for the individual completing the work, the pilot, and aircrew if applicable. Not having enough manpower to distribute labor slows maintenance completion rates by limiting the number of jobs that can be taken on at one time. Also, not having enough experienced manpower, such as senior workers and inspectors, reduces overall efficiency in completing workorders. As it stands, the Marine Corps has failed to meet readiness goals in almost every community over the last 10 years. The GAO (2025) shows in Figure 1 aviation communities by branch that met their annual readiness goals. Focusing on the Marine Corps, it is shown that several communities did not meet their mark. Only the AH-1Z (Super Cobra) for the Marine Corps met their readiness goals, and then only twice in ten years. All other Marine Corps aviation communities failed to meet their goal; they are delivering the needed aircraft to carry out missions without a healthy rotation. At first look this poses several questions about logistics, training, manpower, etc. The Air Force and the Navy met their goals the most out of the reviewed branches with the Army completely missing the mark GAO (2025).

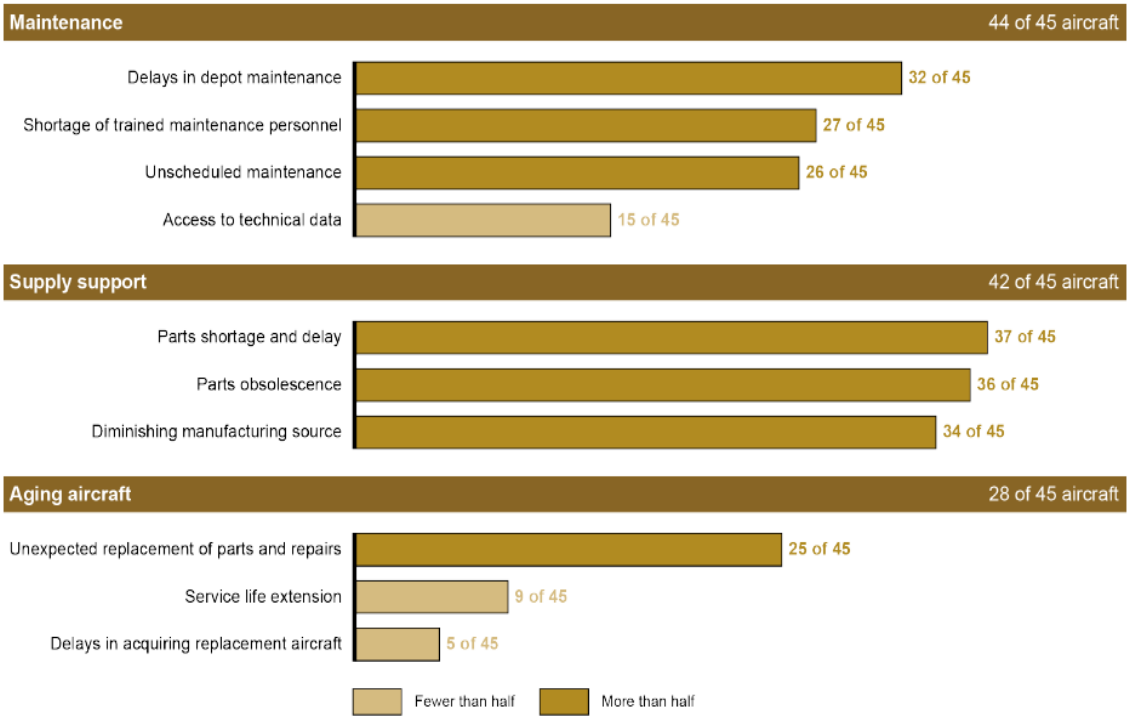


Source: Government Accountability Office (2025, p. 18).

Figure 1. Number of Years Selected Aircraft Met Their Annual Mission Capable Rate Goal, Fiscal Years 2015–2024.

The GAO (2025) also includes contributing factors to aircraft downtime percentages showing sustainment issues ranging from depot to technical data related issues. Three of the four top sustainment issues from the sample measured by the GAO depend on people, as shown in Figure 2. Delays in depot maintenance account for 71 percent of the evaluated sustainment issues, whereas 60 percent of sustainment issues are linked to shortage of trained personnel. Unscheduled maintenance can be normal wear and tear on the aircraft because aircraft degrade overtime. The fourth sustainment issue is a higher-level acquisition problem that will require a purchase to be made. Supply and support, which accounts for 82% of sustainment issues, can be both a personnel issue and an acquisition issue. Depending on the parts and if technical documentation is available MALS can repair several parts with their trained personnel. From what the GAO found this

is an ongoing issue, and the aviation program has been operating in the red as far as goals are concerned but delivering on mission completion. While the job is getting done, there can be ramifications to delivering the bare minimum flight hours and just barely meeting readiness goals when it matters.



As of November 2022. Source: Government Accountability Office (2025, p. 19).

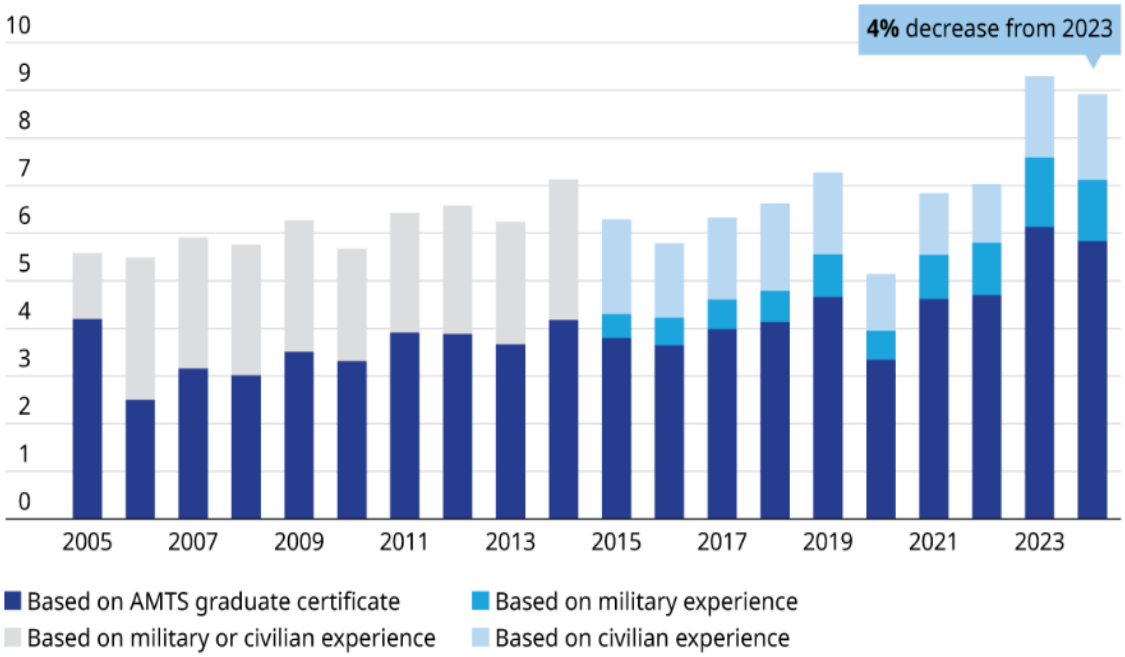
Figure 2. Sustainment Challenges Affecting Selected Aircraft

D. CIVILIAN LABOR MARKET

While parts and tools are important, people are the most valuable resource in the maintenance department. As mentioned, workers must be trained and mentored to create specialized talented Marines who can complete work orders to maintain readiness. The civilian labor market uses the same type of talent to maintain their own aviation assets. When pilots have been in high demand, the civilian labor market has enticed them to leave the military through higher pay and fewer requirements. As stated by Bernthal (2022),

"pilots make more money working for the airlines, work much less, have no collateral duties, and do not deploy" (p. 7).

The same rewards of more money, fewer hours, and no collateral duties can be offered to aviation maintainers. Due to the rebound in airline travel after Covid-19, there has been a spike in the demand for skilled labor in the civilian market. According to the GAO (2023), "aviation industry stakeholders have taken steps to address workforce supply concerns. Airlines and repair stations are increasing pay for pilots and Mechanics" (p. 1). Not only has pay increased for skilled maintenance talent, but the schools that train personnel to obtain an Airframe and Powerplant (A&P) license have seats that are unfilled. As shown in Figure 3, ATEC is showing 4% decrease in seats being filled with an expected 10% decrease in seats being filled over the next 10 years causing a decline in the overall maintenance labor in the civilian labor market.



Source: United Aviation Technician Education Council (2025, p. 1).

Figure 3. Federal Aviation Administration New Mechanic Certificates Issued 2005–2023

If inspectors and senior workers could be poached by the civilian labor market, then the capacity to increase readiness declines. So, if we can safely assume that inspectors can be or will be poached, then we can assume that readiness is at risk as it currently stands. We can also assume that less capable and less experienced talent will fill those roles, taking more time to complete the same maintenance.

Readiness is the primary goal of Marine aviation to provide the MAGTF and other Marine Corps forces with increased capabilities. Readiness itself is continuously changing and captured through reported statuses on the AMSRR to leadership for planning purposes. Statuses project a unit's current capability to support the needs of the Marine Corps, changing those statuses through maintenance to increase readiness numbers requires talent. Talented inspectors are the individuals that are required to increase readiness numbers safely and efficiently. Inspectors are grown in-house due to the structure of the military deployment requirements, not only do they certify maintenance, but they also teach and foster the new generation of maintenance Marines. Due to this, aviation readiness will always be placed on the shoulders of the capable men and women that fill the roles of various inspector types. These inspectors are exceptionally valuable to the civilian labor market due to their experience and talent. With the growing demand in the civilian labor market and the lower education seats being filled the demand will continue to grow and the civilian labor market will look to make up the difference in manpower. If civilian wages greatly exceed military wages, I hypothesize that the talent that resides in Marine aviation will leave. The next chapter reviews literature on monetary related retention issues in other MOS, different pay and incentive packages and their effect on retention issues.

III. LITERATURE REVIEW

This literature review examines various forms of compensation that might compel a service member to leave for the civilian labor market or stay in the service. Every decision is different, but there are two items that are prominent in literature. One is that there is a relationship between the service members' occupation before leaving the service and civilian earnings in that occupation. The other item is that there is a relationship between service member potential earnings and their occupational experience and expertise. Potential earnings in the civilian labor market could be higher or lower depending on occupation, experience, and expertise.

The literature suggests that wages are an important variable to consider when examining retention. The 13th Quadrennial Review of Military Compensation (QRMC) (2020) report evaluated the current Regular Military Compensation (RMC) (which includes base pay and other benefits such as housing and childcare). At the time RMC was set to the 70th percentile average for military pay in relation to the comparable civilian occupation. The report found the benchmark to be more than competitive with the civilian labor market, recommending Congress maintain current compensation levels. The 13th QRMC also investigated a proposed pay structure change from Time in Service (TIS) to Time in Grade (TIG). The analysis from the QRMC suggested that adopting the pay structure would create stronger incentives for higher performance through promotion. Asch (2019) researched various incentive programs between 2014 to 2018 including both RMC and retirement benefits. She specifically stated that specialty incentive pay should be reevaluated because they are unlinked by the Department of the Air Force (DAF) readiness goals and talent management objectives. She reviewed the debate for and against TIS vs. TIG adoption before the 13th QRMC release; one side of the debate balked at the cost of TIG as it would require paying more for promotions, while the other side of the debate criticized the fairness of TIG, noting that promotion is not equally available to all MOSs. She concluded that the 70th percentile benchmark was correctly set, however, compensation incentives should be reviewed within the pay tables.

As TIG was not adopted, later research recognized that there may be a need to increase the 70th percentile benchmark to remain competitive with the civilian labor market. The 14th QRMC (2025) analyzed whether the current RMC benchmark needed to be increased from its current 70th percentile floor to maintain competitiveness and continue the ongoing recruitment mission. The 14th QRMC found the current RMC to be highly competitive with the current average civilian labor market wage but nevertheless recommended an increase from the 70th percentile to the 75th percentile. Additional research finds evidence that a recommendation for an increase could be skewed from overstated wages, because the 14th QRMC is an average compensation generalizing pay across specialties. A study by Goldman et al. (2021) looked at a three-year evaluation period for a service member after separation to see their earnings in the civilian labor market between 2002 to 2010. Goldman et al. found that military occupational specialty and experience are among the highest determinants to post-service earnings in the civilian labor market. Goldman et al.'s findings suggest that the decision to leave could be from potential earnings once they've gained enough military training and education in the service member's field to make more in the civilian labor market.

Other research supports the claim that civilian compensation and experience are potential factors for separation. For example, Looker (2022) studied the effect of a wage increase in the civilian nursing labor market on Navy nurse retention between 2000 to 2020. Looker measured the military-civilian wage differential and found that wages differed by specialty in the civilian labor market. Nurses in 2018 that had the medical-surgical specialty had the lowest wages whereas critical care specialties had the highest wages. Looker also found that there were declines in the civilian nursing labor markets due to many nurses reaching retirement age; talent is also taking longer to fill these roles created by retirement from increased education requirements. Looker's survival analysis of the civilian labor markets determined that the current turnover rate for critical care is 18.7 percent. These findings suggest pay/wage differentials may matter more when the labor supply is low and the demand signal is higher. As reported by the GAO (2023), another community that is projecting declines is aircraft Mechanics, demands for which have increased after Covid-19. The report states the increase in airline travel is increasing and

the current population of available Mechanics is not enough to keep up with the demand. This is reinforced by the AETC (2025), which reports that although enrollment into civilian aircraft maintenance schools has increased, it will not be enough to meet the increasing demand for Mechanics. This presents a similar situation as Looker (2022) discovered in the civilian labor market for nurses that could end up in a larger pay/wage differential between the military and civilian compensation rates.

Other research evaluates the effect of incentive pay, such as bonuses, on retention. For example, Fuzy (2019) reviewed the impacts and updates of the selective retention bonus (SRB) between 2008 to 2018 for targeted populations, specifically focusing on aviation maintenance Marines. Fuzy found that changes to SRB amounts were not significantly correlated with a Marine's decision for re-enlistment in the aviation maintenance field. Other research contradicts these findings for the effects of SRB, suggesting that bonuses affect different communities differently. Asch et al. (2019) investigated the Special and Incentive (S&I) pay effects on the U.S. Special Operations Forces (SOF) commissioned officer community. They looked at Defense Manpower Data Center (DMDC) data, reviewing cohorts from 1990 to 2000 and followed them through 2012. They found offering the Critical Skills Retention Bonus (CSRB) had large steady-state effects on retention. So, although Fuzy found that bonuses had little effect on one community, Asch et al. found that they increased retention in another. This finding confirms that service-wide assessments like the QRMC or even MOS-specific assessments from other communities may offer little predictive power for explaining retention trends in a particular military community. Determining whether wages influence retention in the aviation maintenance MOS requires an assessment unique to that community.

As stated, wages may have a bigger influence on a service member's decision to stay or leave based on potential civilian earnings. Research also shows that Military Occupational Specialty (MOS) is a contributing factor in earnings after separation. Within that MOS, personnel have the potential for even higher earnings in technical fields that maintain inspector designations for expertise and experience. Calkins et al. (2023) looked at Aviation Incentive Pay (AvIP) and Aviation Bonus (AvB) for aviators in the Army from 1998 to 2020, and they found a positive relationship between military pay and retention.

One of their research's key findings was that not all aviators will strive to meet occupational milestones, instead stagnating in their current position, but that AvIP supports aviator retention by incentivizing aviators to pursue and attain occupational milestones. Asch et al. (2023) analyzed the Department of the Air Force (DAF) special and incentive (S&I) compensations and found that decision makers rarely understood the expertise or requirements of fields other than their own, which resulted in misaligned compensation policies that prioritize remedying shortfalls instead of retaining specialized skillsets.

Retention and readiness are closely related, and research has found that increasing readiness through other means when retention suffers is difficult. D'antonio and Bartolf (2019) investigated the ability to increase readiness through training and education to offset manpower declines in aviation maintenance. They looked at Aviation Maintenance Experience (AMEX) and Navy Enlisted Classification code data from 2017 to 2019. Using AMEX, they measured the expertise of personnel in multiple squadrons to determine the capabilities of different communities. They found that training and education alone were not enough to ease the readiness requirements growing from manpower decline in any community. Additional research investigates taking expertise into a new structure to increase readiness through rate creation. Hatzung and Welborn (2020) utilized forecasting models to evaluate whether a specialist rate being created within the F/A-18 community's current structure would improve overall readiness numbers. They analyzed the F/A-18 community with AMEX and Aviation Maintenance Supply Readiness Reporting (AMSRR) data covering 2018 to 2020. On conclusion they found a positive relationship between experience and readiness suggesting that a deeper dive may yield more information.

The other potential issue is that readiness simply is not being measured correctly. Rose (2024) states that leadership uses the Maintenance Capacity Model, which measures maintenance manhours on Non-Mission Capable Maintenance jobs (NMCM). He found that this leads leadership to conclude that there is a lack of maintenance manhours instead of an undersized or underexperienced workforce. The GAO (2025) reports that from 2015 to 2024 only one squadron, (AH-1Z) Super Cobra, met readiness goals. If leadership only

focuses on the number of manhours logged instead of assessing the size and expertise of the personnel pool, readiness may continue to suffer.

The literature shows that money can be an effective retention tool depending on how that money is used to incentivize skilled talent. The Marine Corps' main goal is to maintain and improve readiness in all fields, which cannot be achieved through training and education alone; retaining experienced personnel is also crucial. Certain incentive methods, such as bonuses, do not equally affect retention across different communities; for example, literature has shown that bonuses do not affect the aviation maintenance community. My research expands on the retention literature and builds on Looker's (2022) research, similarly, assessing how monetary compensation in the civilian labor market compares with military compensation. The military must grow its own expertise in the aviation community; not maintaining the pool of experienced labor ultimately limits the community's growth potential. If the civilian labor market offers better pay and opportunities to experienced aviation maintenance workers, then increasing retention and readiness in this military community would require monetary solutions.

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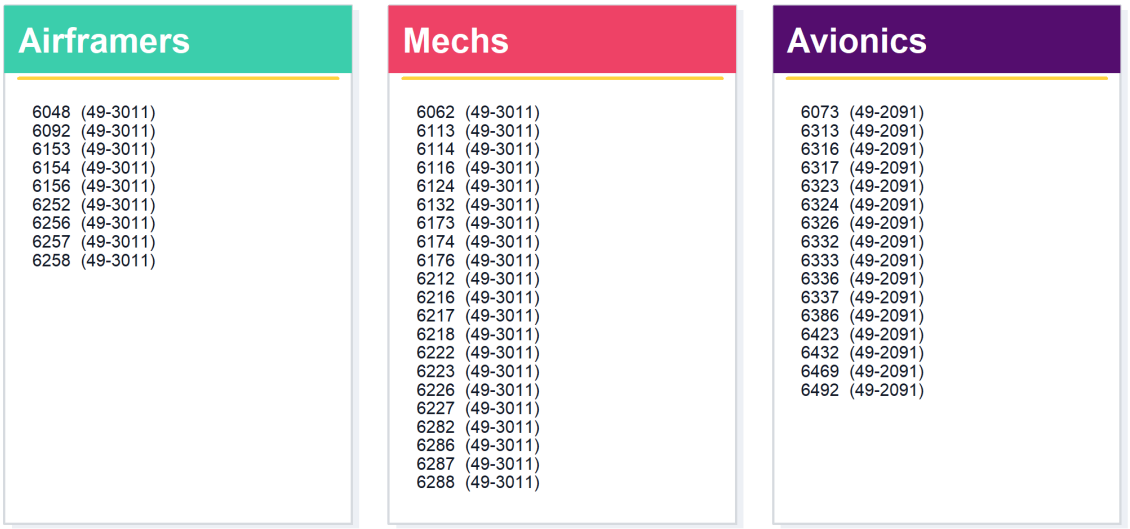
IV. DATA AND METHODOLOGY

In this Chapter I describe the data used for the analysis including the USMC personnel data, military wage data, civilian wage data, and the consumer price index data. I also discuss how I refined the personnel data, evaluated Marine separations, constructed the wage gap, and conducted the multivariate regressions.

A. MILITARY DATA

I obtained the USMC personnel demographic data from the Defense Manpower Data Center (DMDC) through the Advanced Analytics (ADVANA) platform. I focused on Marines belonging to aviation military occupational specialties within the 6000 series from 2014 to 2024. I restricted the data further to Marines that obtained the ranks of E-3 through E-6 to approximate the population that would be at the end of their first or second term. Since each term is roughly five years, I omitted any individual Marine observation that exceeded 10 years of service. Since the dataset included multiple observations for each Marine, I used only the most recent observation for each Marine (as indicated by their Electronic Data Interchange Personal Identifier [EDIPI]); for example, if one EDIPI appears in 2014, 2020, and 2023, then I omitted the first two observations and use only the 2023 observation). I then used the USMC MOS Manual to match each Marine's MOS to its corresponding civilian occupation code as shown in Figure 4. Then I grouped each MOS into one of three bins: Mechanics, Airframers, or Avionics Technicians. I excluded any Marine observation with a MOS that did not have a civilian counterpart. After restricting the data and removing duplicates, there were 50,123 Marine observations.

Figure 4 shows each MOS, binned in either Airframers, Mechanics, or Avionics Technicians, and its corresponding civilian standard occupational code (SOC). The civilian SOC 49–3011 corresponds to all Airframer and Mechanics MOSs, whereas SOC 49–2091 corresponds to all Avionics Technicians MOSs.



Based on civilian data, Airframers and Mechanics are recognized by the civilian labor market as being able to perform the same job. Other jobs such as Crew Chiefs being both aircrew and Mechanics in the Marine Corps were placed in the Mechanic group because they are Mechanics when they are not on the flight schedule.

Figure 4. Maintenance Bins

Using the military dataset, I constructed three separation outcomes: an indicator if the Marine had separated by five, six and seven years between 2014 and 2024. To do this I first calculated the individual Marine's years of service by taking the accumulative years from the time since Pay Entry Base Date (PEBD) to their EAS rounding down to the next whole year. The indicator for each horizon was 1 if the years of service was equal to those specific years of service in five, six, and seven years; the indicator was 0 if the value was either less than or greater than the exact. For example, if a Marine separated with 5.3 years of service, the Marine would be rounded down to five years of service and would be coded as 1 under the separated by five years indicator and a 0 in the six- and seven-years indicators.

I gathered the military finance data from Defense Finance and Accounting Service (DFAS). I used military base pay information from 2014 through 2024. I did not include basic allowance for housing (BAH) and basic allowance for subsistence (BAS) in the analysis apart from a generalized average for 2024 to analyze the complete wage gap for that year as an example. Key variables in the military dataset were constructed for each part of the analysis, the variables of age, sex, rank, dependents, home of record, and MOS

were given and used as is. I constructed years of service for each observation using PEBD to determine when the Marine entered the service and the Marine's Expiration of Active Service (EAS) to determine when they separated. If the EAS occurs within the ten-year timeframe, then that means the Marine has separated; if there is no EAS within the timeframe, then the Marine has not separated. A Marine with years of service that are less than 10 years and beyond the censored date were set to 2024 in the wage analysis because of the civilian data limitation. For education I constructed three indicator variables: no college (any Marine with a high school diploma or GED but no years of college), some college (for Marines who had one or more years of college but no degree), and college degree (for Marines who had received a college degree, including bachelors, masters, or PhD). To bin each MOS, I created two indicator variables for the two most applicable SOC codes: 49–3011 for Mechanics and Airframers, and 49–2091 for Avionics. The pay comparison for Mechanics and Airframers is the same regarding the civilian labor market. For race I created five indicator variables for white, black, Asian, other, and Hispanic based on ethnic codes and race codes. I also created an indicator variable for Marines that have an EAS date that falls within the analysis window for 2014 to 2024 to indicate separations. Finally, there were several descriptors for marital status such as divorced, separated, widowed, not married, etc. I created 2 variables to collapse the marital status codes into either married or not married. I merged the military pay data from the DFAS to the DMDC dataset, accounting for years of service and rank for each Marine. If any Marines are still active, their EAS date is beyond the censored date their pay is set to current years of service as of December 31st, 2024.

B. CIVILIAN DATA

To construct the civilian-military wage gap, I pulled state-level wage data from the U.S. Bureau of Labor Statistics Occupational Employment Survey (OES) spanning the years from 2014 to 2024. I pulled one data set for each year from 2014 through 2024; after combining all states' data and dropping territories, the SOC observations total reached 398,463. The OES civilian dataset contains all wage data as reported by employers for each state by year containing wages for each Standard Occupational Code (SOC). Each SOC has an associated mean and median hourly and annual wage. By creating a cross-walk

between the MOS and civilian SOC category, I can construct the civilian-military wage gap. Next, I merged the OES dataset with the DMDC dataset: I connected military EAS dates to the corresponding year of OES wage data for the proper SOC code using the home of record at the time of EAS. As an example, if the Marine's home of record is Missouri and they are a mechanic that separated in 2016, then the civilian wage for that Marine is the average wage for Mechanics in Missouri in the year 2016. This is applied to each Marine individually throughout the sample with exception of those with an EAS outside of the censored date in which case I use their home of record in 2024 to assign their civilian wage. I decided to use home of record because both the command data and reporting unit information was mostly missing.

I further cleaned the data and only retained Marines with complete information on age, race, marital status, home of records, etc. The final sample for the analysis came to a total of 40,855 Marines. Next, I pulled the 2017 Consumer Price Index from the Federal Reserve Bank of St. Louis (FRED) to construct real wages. I constructed two variables for CPI deflation, one for military pay and one for civilian pay. The civilian pay was based on home of record for each individual Marine during its construction. I used the 2017 CPI to deflate the wages of both the military and the civilian wages to account for inflation and to properly assess the wage gap impact on the odds of separation.

C. SUMMARY STATISTICS

Table 1 shows the summary statistics for the analytical sample of aviation maintenance Marines. The Table is categorized by sample number (N), separation horizons, demographics, marital status, education, years of service, dependents, and rank. The Table presents both the number and percentages for the sample overall and for each of the three binned aviation groups. I used five, six, and seven years as the separate horizons because the average first contract is for either five or six years, while some might extend to seven years due to education requirements to complete training for the Marine's designated MOS.

Table 1. Summary Statistics

Variable	Overall	Airframers	Mechs	Avionics
N	40,855	12,104	14,650	14,101
% Separated by 5 years	61.3	60.9	60.1	62.9
% Separated by 6 years	71.6	71.6	70.6	72.7
% Separated by 7 years	75.2	75.2	74.2	76.2
Demographics				
Age (Mean)	25.26	25.29	25.35	25.14
Age (Median)	26	26	26	25
% Male	93.7	95.1	95.1	90.9
% Hispanic	21.8	19.1	18.3	27.8
% White	86.2	87.5	88.7	82.4
% Black	7.1	6.5	5	9.7
% Asian	3.3	3	2.8	4
% Other	3.5	3	3.5	4
Marital Status				
% Married	43.3	44.1	43.8	42.3
Education				
% No college	93.9	94.4	93.1	94.2
% Some college	4.6	4.1	5.1	4.4
% College degree	1.5	1.4	1.8	1.4
Years of Service				
YOS (Mean)	5.85	5.85	5.89	5.81
Dependents				
% with >=1 dependent	40.5	41.5	41.3	38.7
Dependents (Mean)	0.65	0.67	0.66	0.61
Rank.				
% E3	27.1	28.4	26	27.1
% E4	30.4	31	29.4	30.8
% E5	39	37.1	39.9	39.6
% E6	3.6	3.5	4.7	2.5

Adapted from Advanced Analytics (n.d.). USMC [dataset].

In Table 1 of the summary statistics, we can see that the largest group in the sample is composed of Mechanics and has the lowest separation rate when compared to the other MOS across each horizon. The population of each group in the sample is similar in size, with Airframers having the smallest population at 12,104 Marines. The overall percentage of separations at five years 61.3%, with Avionics Technicians having the largest separation

rate at 62.9% out of the three groups. Airframers have the second largest separation rate at 60.9% and Mechanics close behind at 60.1%. Following separation horizons at six years and seven years, Avionics Technicians continue to hold the highest separation rate with a 72.7% at the 6-year horizon and 76.2% at the 7-year horizon. Airframers remain at the second largest separation rate with 71.6% on the 6-year horizon and 75.2% at the 7-year horizon. The overall sample separation rate average is 75.2% at the 7-year horizon, tied with Airframers. The average age is around 25, with much of the population also being white males; the Avionics MOS holds the larger percentage of racial and ethnic diversity. Hispanics, an ethnicity code separate from race, account for 27.8% of Avionics. In terms of race, Avionics are 82.4% white, 9.7% black, 4% Asian, and 4% other. Airframers, having the second highest separation rate, also have the highest percentage of Marines that are married at 44.1%. Almost 94% of Marines in the dataset have no higher education, but Mechanics have the highest percentages with 5.1% having some college and 1.8% having a college degree. Around 40% of Marines in the sample have dependents and the largest population of the sample is composed of E-5 (Sergeant).

D. CIVILIAN-MILITARY WAGE ANALYSIS

To construct the civilian military wage gap, I took the difference between the real civilian wage for the SOC code associated with Marine *i*'s MOS in their last observed year, *t* (their separation year if they separated before 2024, or 2024 if they are not separated) and their home state of record, *s,* in that year, *t,* and their real military wage as shown in Equation 1; civilian wages are greater than military wages in almost all cases. So, if the wage gap is positive then the civilian wage is higher and if negative then the military wage is higher. This construction enables me to determine whether increasing the civilian SOC pay by $1000 compared to the military pay increases the odds of separation. I created 1 plot to visualize both the average wage gap between civilian and military pay as shown in Figure 8 (Chapter V), to further expand on this I pulled data from the Defense Travel Management Office to analyze benefits in 2024 as shown in Table 4 (Chapter V). I did only for the most recent year to see what the average wage gap was with benefits calculated as shown in Table 4 (Chapter V). Next, I created a plot for the average military base pay received for each maintenance bin as shown in Figure 9 (Chapter V).

$$(Civilian - Military)_i = \frac{CivilianWage_{ist} - MilitaryWage_{ist}}{1000}. \quad (1)$$

E. SURVIVAL ANALYSIS

The Kaplan-Meier survival analysis I conducted to measure the separation probability for the sample of Marines. The analysis was constructed with PEBD and EAS for each individual Marine over a time frame of 10 years. I created two plots to visualize the output; the first plot I decided to measure the entire sample to see what the separation trend was for all maintenance Marines as shown in Figure 10 (Chapter V). The second plot isolated the output to the three maintenance Marines bins to see if there were certain MOS that were more susceptible to separation at different times as shown in Figure 11 (Chapter V).

F. LOGISTIC REGRESSION MODELS

For the regression analysis, I ran logit regression models for three different separation horizons at the five-, six-, and seven-year markers. I chose to use logit regression models because the separation indicator I created is a binary variable being 1 or 0. For the logit models I used three different specifications for each separation outcome. For the first model I included only the wage gap itself to see what the effect is on the Marine. The models are expressed in odds ratios, so Sep_{ih} is the odds of separation for the individual Marine for that respective horizon. In the first case this is the five-year mark (h).

$$Sep_{ih} = \beta_0 + \beta_1 \times (Civilian - Military)_i + \varepsilon_i. \quad (2)$$

The second model in each horizon takes it a step further and adds controls for demographics to account for the effect that individual demographics play on a Marine's odds of separation. This is based on their individual occupation, sex, ethnicity, race, and marital status. The omitted variables in the construction for this model are Mechanics, females, not Hispanic, white, and not married.

$$\begin{aligned} Sep_{ih} &= \beta_0 + \beta_1 \times (Civilian - Military)_i + \beta_2 \times OccGroup_i + \beta_3 \times Male_i \\ &+ \beta_4 \times Hispanic_i + \beta_5 \times Race_i + \beta_6 \times Married_i + \varepsilon_i \end{aligned} \quad (3)$$

The third model accounts for pay differences such as rank, home of record, and year. $OccGroup_i$ was constructed from the three MOS categories. I created a new variable for each Marine by adding their applicable SOC code in their individual observation under OccGroup. The omitted variable for rank is E-3, whereas for $Home\ of\ Record_i$ I used a different method for analysis. Since I had state-level data and each Marine's home of record, I wanted to evaluate the effect of location based on states with the highest percentage of hiring. Based on the BLS site the most overlap were the states of California, Texas, Florida, and Georgia; I added North Carolina for analysis based on its large Marine aviation footprint. The last control is the fixed effects for year from 2014 to 2024.

$$\begin{aligned} Sep_{ih} &= \beta_0 + \beta_1 \times (Civilian - Military)_i + \beta_2 \times OccGroup_i + \beta_3 \times Male_i \\ &+ \beta_4 \times Hispanic_i + \beta_5 \times Race_i + \beta_6 \times Married_i + \beta_7 \times Rank_i \\ &+ \beta_8 \times Home\ of\ Record_i + \gamma_t + \varepsilon_i \end{aligned} \quad (4)$$

G. WAGE GAP SURVIVAL ANALYSIS

I concluded the analysis by evaluating wage gap survival based on a $1,000 increase to the gap itself capturing what effect the wage gap has. To do this I created one plot to see the effect of civilian-military wage gaps on survival probability based on three different gap levels: small, medium, and large. This was constructed from the wage differential average values over the 10-year analysis period as shown in Figure 12.

V. RESULTS

This chapter presents the results of the separation analysis, wage gap analysis, sample survival analysis, multivariate regressions, and wage gap survival analysis. The conclusion of this chapter will report on my key findings and my data limitations that could be expanded on for further research.

A. SEPARATION ANALYSIS

To analyze separation, I used three different approaches to visualize the number of separations as depicted in the summary statistics. For the first approach I captured separations for the whole sample spanning the years 2014 through 2024 to see differences in separation rates over time. I constructed the number of separations for the sample as shown in Figure 5, I also completed a comparison of Figure 5's results to the trend of the Marine Corps total force population as shown in Table 2. The comparison of the sample to the Marine Corps was to see if the sample's separation number followed the same trend as Marine Corps' total force population numbers. Next, I analyzed the percentage of separations from the sample covering the same time frame as shown in Figure 6. I followed this with an evaluation of the most recent year (2024) to see the composition of separations by rank as shown in Table 3. This was to see which rank had the largest contribution to separation percentages. Finally, I analyzed the number of separations by maintenance bins to show the composition of each year by bin by taking the results from the first approach (Figure 5) and applying each observation's assigned group as shown in Figure 7.

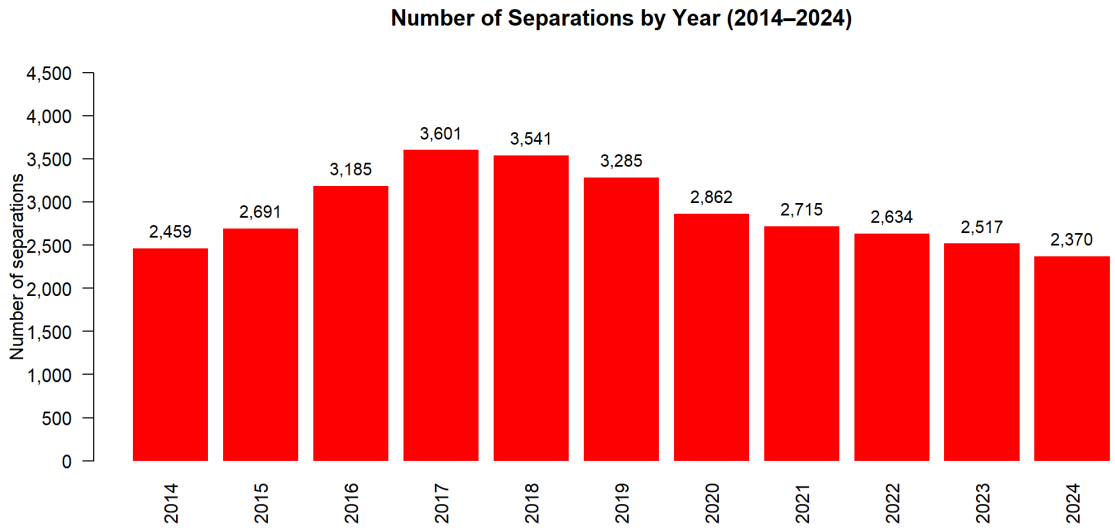


Figure 5. Number of Separations

Separation rates climbed until 2017 and then slowly declined to a more stable plane. It is important to note that several things happened during this time frame, including U.S. wars ending and policy changes, that may have influenced the separation rate. For example, the Temporary Early Retirement Authority (TERA) authorized early retirement under the Fiscal Year 2012 National Defense Authorization Act (NDAA) Public Law 112-81. Authority to enact or submit for TERA ended in fiscal year 2018. TERA allowed Marines that had completed 15 years of service to retire from the Marine Corps, leaving billets empty, which may have led to accelerated promotions to fill those billets. While increasing pay through promotion will incentivize retention, the experience and maturity of the newly promoted Marine is variable. Policies and changes enacted by inexperienced leadership could potentially cause stress on the lower levels, potentially leading to more separations. The spike in separations in years 2017 and 2018 also correspond to years when the BLS reported unemployment rates below 4%, meaning that the civilian labor market was strong during the years with the highest rates of aviation maintenance separations. Also, during this period, the Blended Retirement System under fiscal year 2016 NDAA Public Law 114-92 amended the retirement system. All Marines that had a date of initial entry into military service (DIEMS) from 2006 to 2018 had the option to elect to the new retirement system, while all Marines that joined starting in 2018 were automatically enrolled into the

new retirement system. The new system allowed Marines to take whatever retirement money they had accumulated by the time of separation, thereby disincentivizing the 20-year obligation. Although this policy change doesn't solely explain my sample's separation trends, it is probably one compounding factor.

Another policy that may have affected separation trends was the Covid-19 vaccine requirement that started in 2021; the GAO (2022) investigated the effects of the requirement after it had been rescinded and found that approximately 8,700 service members across the branches separated during this time. To further analyze the separation trend, I compared the number of separations per year to the overall Marine Corps force population per year. The intent was to determine whether my sample's separation trends aligned with or deviated from the trends of the overall force's composition from year to year. To do this, I gathered Marine Corps population data from the fourth quarter of each year (to capture population at the end of the year) from DMDC. Table 2 shows that Marine Corps population trends are aligned with my sample's separation rates; in other words, as the overall force population draws down, it makes sense that separations (even those in just one Marine Corps community) would also slow or reduce.

Table 2. Marine Corps Total Force by Year versus Sample Separations

Year	Population	Separations
2014	184,991	2,459
2015	183,197	2,691
2016	183,420	3,185
2017	184,758	3,601
2018	185,830	3,541
2019	185,831	3,285
2020	181,031	2,862
2021	178,530	2,715
2022	171,533	2,634
2023	167,474	2,517
2024	168,527	2,370

Adapted from Advanced Analytics (n.d.). USMC [dataset], Defense Manpower Data Center (n.d.).

Next, in my separation analysis I plotted the percentage of separations by year. This provides the separation rate in percentages for the sample Marines in the evaluation as shown in Figure 6. Separation percentages remain consistent with the drawdown of the overall Marine Corps population.

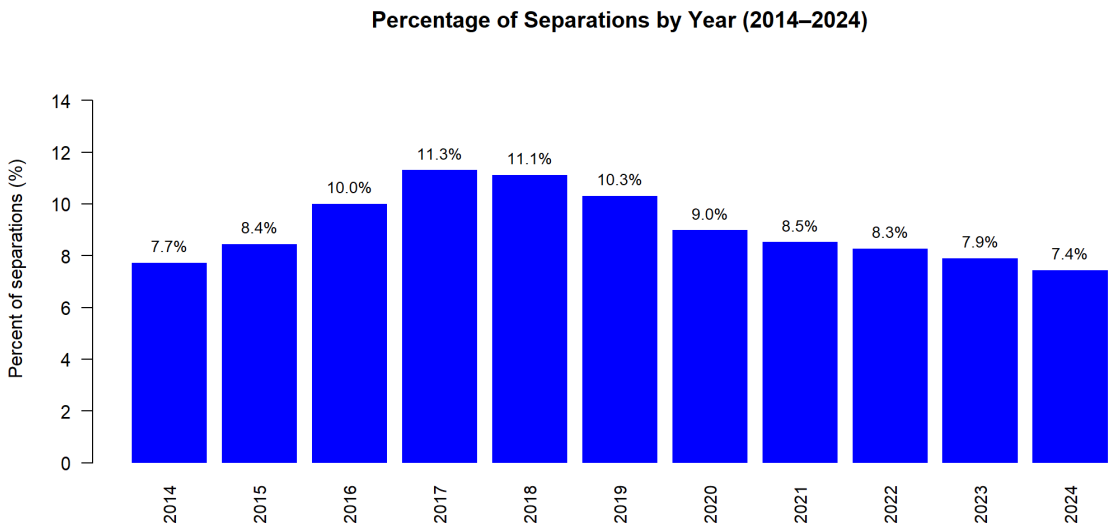


Figure 6. Percentage of Separations

I next calculated separation percentages by rank in 2024 only to see which ranks were more likely to separate, as shown in Table 3. The rank of E-3, which in 2024 was the largest population, and makes up most of the separations in 2024.

Table 3. Share of Separation Percentage

Rank	Population 2024	Separations	Share	Percentage of Separations
E-3	6273	464	48.64%	3.60%
E-4	3246	240	25.17%	1.86%
E-5	3059	226	23.72%	1.76%
E-6	318	24	2.47%	0.18%

Adapted from Advanced Analytics (n.d.). USMC [dataset].

To conclude my separation analysis, I calculated separations for each of the three bins, as shown in Figure 7. More Avionics Technicians separated compared to the other aviation groups, but the Avionics community is also the largest in the sample. Fewer Airframers are separated, but there are also a smaller population.

The separation rates shown in this discussion are crude annual separation rates and do not account for differences in the career trajectory of individual Marines. My regression analysis below uses individual Marine separation rates in aviation maintenance communities and hence are higher than the crude annual separation rates for the USMC.

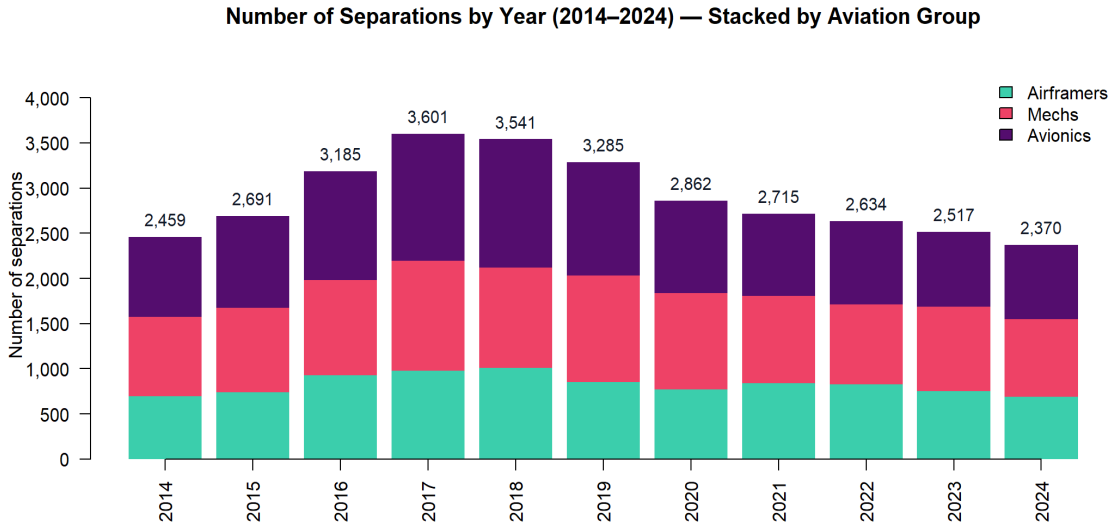


Figure 7. Separations by Aviation Groups

B. WAGE GAP ANALYSIS

For the wage gap analysis, I compared the average annual civilian wage per year to that of my sample's military pay at the time of separation in Figure 7. The wage gap has projected a consistent $30,000 difference over the years, with a large difference in 2020, and another large difference in 2024. This is concerning because of previous research covering the decline in available aviation maintenance talent in the civilian labor market.

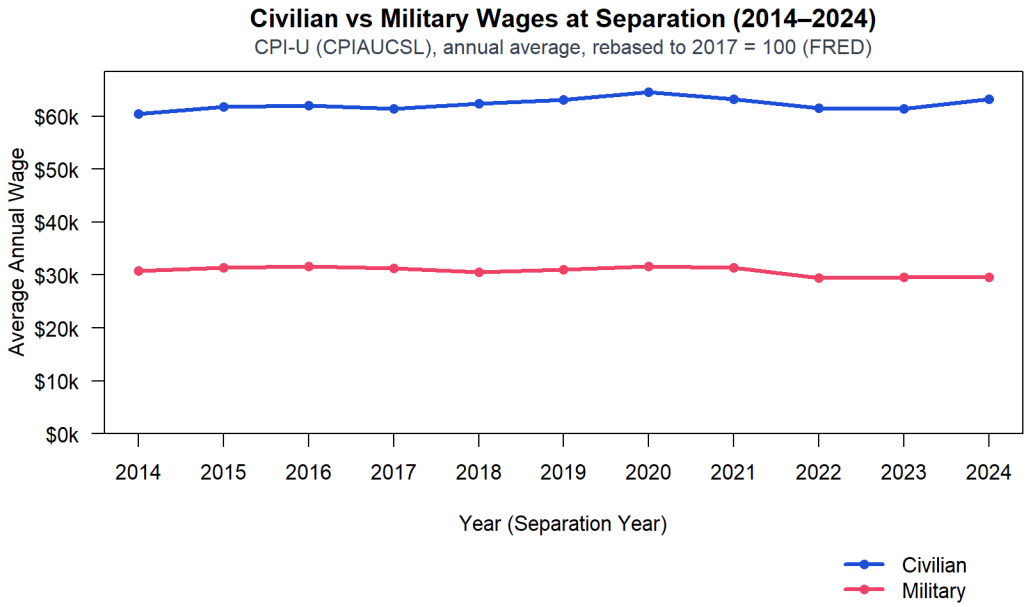


Figure 8. Civilian versus Military Wages at Separation

The latest QRMC stated the benchmark for average military pay is in the 70th percentile, which does not align with my sample's wage gap. However, the QRMC includes base pay, BAH, and BAS, while my data plot only includes base pay. In 2024, military wages were approximately $29,000 while civilian wages were approximately $64,000 (after deflation). That means that in 2024, military pay—not including BAH or BAS—was in the 45th percentile. Because the wage percentile for my sample was so much lower than the QRMC benchmark, I decided to gather the BAH and BAS rates for ranks E-3 through E-6 from the Defense Travel Management Office for 2024 and deflated their values to 2017 dollars as shown in Table 4.

Table 4. Monthly Basic Allowance for Housing and Basic Allowance for Subsistence, 2024

Rank	BAH no Dep	BAH Dep	BAS	Total no Dep	Total Dep
E3	$1,145.33	$1,471.61	$359.64	$1,504.96	$1,831.24
E4	$1,145.33	$1,471.61	$359.64	$1,504.96	$1,831.24
E5	$1,282.24	$1,590.17	$359.64	$1,641.87	$1,949.80
E6	$1,416.40	$1,825.69	$359.64	$1,776.03	$2,185.33

Adapted from the Defense Travel Management Office (n.d.).

I took the average for each total and multiplied it by 12 to get an estimate of the value of annual benefits. The average annual benefit with dependents was $23,392.84. The average annual benefit without dependents was $19,283.50. If I use the smaller of the two (no dependent), adding that amount to the base pay of $29,000, equates to an annual pay of $48,283.5. That annual pay puts the average military pay in the 75th percentile when compared to the average civilian wage for 2024. Therefore, when including benefits with the base pay, my findings from the wage gap analysis align with the QRMC and Marines are compensated as claimed. This still leaves the upper 25th percentile as leverage for the civilian labor market; while $64,000 is around the mean there are geographical locations with job opportunities that pay more.

The last step of the wage gap analysis was to evaluate the military pay for Marines at the time of separation, which is graphed in Figure 8. Marines in this plot were evaluated within their respective aviation groups to see if there were differences. Avionics Marines are the lowest earners at the time of separation, and they have the highest rate of separation. Beyond being the largest pool of Marines in the sample, this plot also suggests that most separations from the Avionics MOS field are junior in rank and years of service.

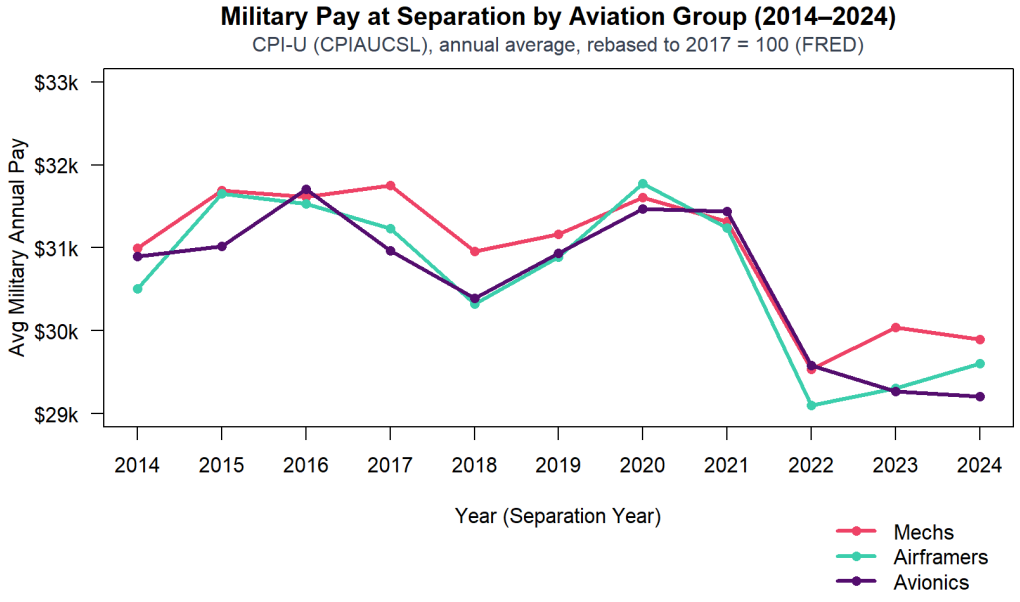


Figure 9. Military Pay at Separation by Aviation Group

C. SURVIVAL ANALYSIS

For the survival analysis, I first analyzed separations throughout the entire sample as shown in Figure 9. Figure 9 shows a normal trend in military separations: most separations occurred at the five-year mark. A five-year contract is typical for the first term and where the Marine Corps loses much of its enlisted force. At the five-year mark, survival probability drops from about 97% to 38%, with a further drop occurring at nine years. As mentioned in the previous chapter, although five years is typical for a first-term contract, I analyzed separation at six and seven years of service to account for extensions and slightly longer contract obligations (to complete education or training, for example).

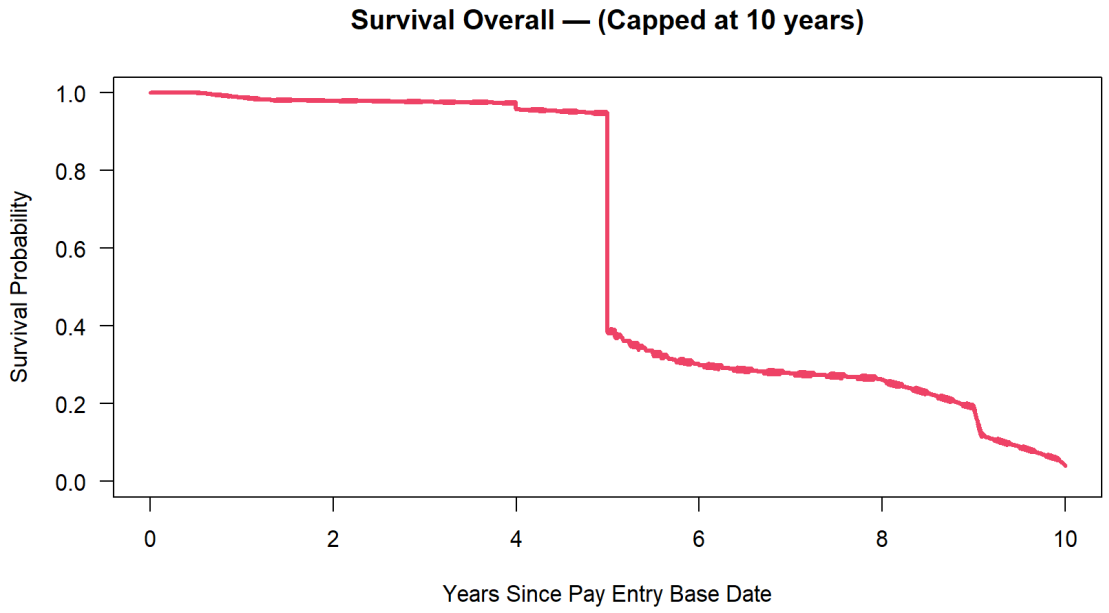


Figure 10. Sample Survival Curve

Next, I analyzed survival for the three binned aviation maintenance groups, shown in Figure 10. Figure 10 shows that the three bins follow roughly the same trends as the overall sample. The Avionics Technicians are most susceptible to separation, while Airframers and Mechanics are slightly less so, being in the low fortieth percentile for survival probability.

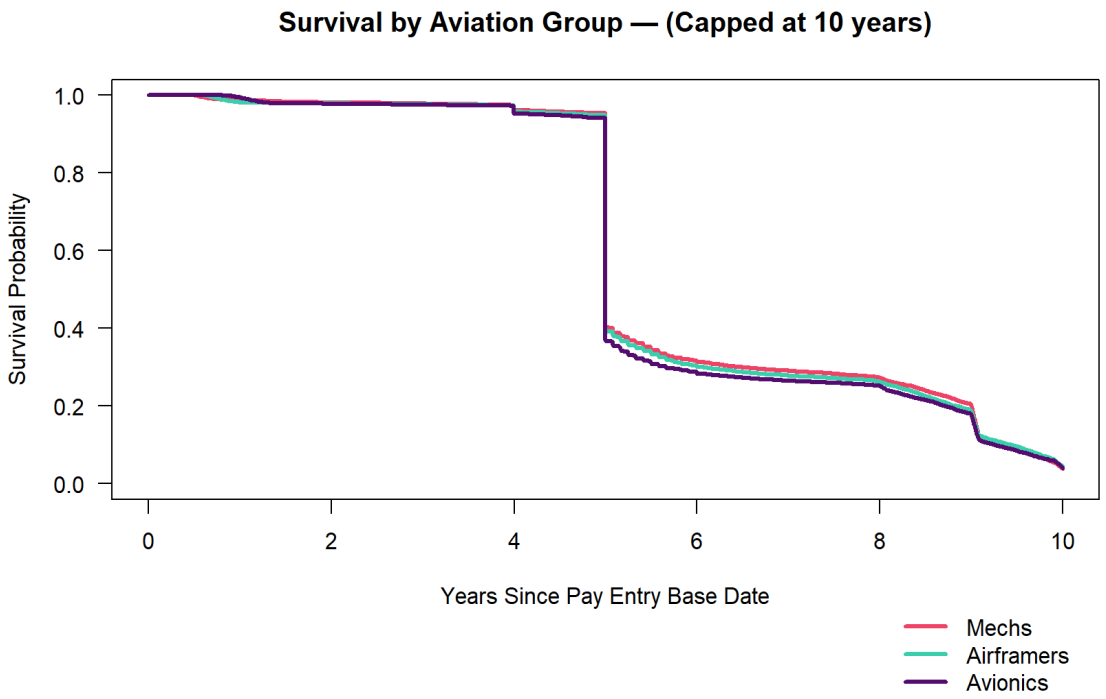


Figure 11. Aviation Group Survival Curve

D. MULTIVARIATE REGRESSIONS

I ran a total of nine regressions: three different models for each separation outcome to measure the effect that the wage gap has on the odds of separation for aviation maintenance Marines. Model 1 captures the wage gap's effect by itself by a $1000 increase in the civilian-military wage differential. Model 2 captures the wage gap with added controls for demographics and marital status, and Model 3 captures the wage gap, demographics, and marital status with added controls for rank and home of record with fixed effects for year covering 2014 to 2024.

Table 5. Separation by Five Years

Outcome: Separated by 5 years			
	(1)	(2)	(3)
Wage gap ($1k, 2017$)	1.097***	1.096***	1.053***
	(0.002)	(0.002)	(0.002)
Occupational Group			
Airframers		1.023	-0.885***
		(0.03)	(0.036)
Avionics		1.24***	1.037
		(0.03)	(0.035)
Demographics			
Male		-0.867***	-0.811***
		(0.051)	(0.059)
Hispanic		-0.746***	1.019
		(0.031)	(0.039)
Asian		-0.719***	1.068
		(0.072)	(0.084)
Black		-0.594***	-0.589***
		(0.048)	(0.058)
Other		-0.646***	-0.594***
		(0.062)	(0.072)
Marital Status			
Married		-0.48***	-0.512***
		(0.025)	(0.029)
Rank			
E-4			-0.386***
			(0.062)
E-5			-0.068***
			(0.061)
E-6			-0.001***
			(0.414)
Home of record			
California			-0.722***
			(0.048)
Florida			-0.902*
			(0.057)
Georgia			-0.574***
			(0.08)
North Carolina			1.254***
			(0.081)
Texas			-0.954
			(0.048)
N	33139	33139	33139

Table 5. Excluded Variables: group=Mechs, sex=F, race=White, married=NotMarried, rank=E-3. Reported as Odds ratio, Standard errors in parentheses, Fixed effect for year included.
p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

The first set of regressions in Table 5, focusing on column (1), shows that a $1,000 increase in the civilian-military wage gap is associated with a 9.7% increase in the odds of separation and is statistically significant. Column (2) I also find a small drop in the wage gap effect, but still an increase in the odds of separation with 9.6%. Next, I added occupational groups and found that Airframers, while positive, their MOS is not significant whereas Avionics is associated with a 24% increase in the odds of separation compared to Mechanics and is statistically significant. Being male is associated with an 86.7% decrease in the odds of separation. All race categories and Hispanic ethnicity decrease the odds of separation and are statistically significant. Being married is associated with a 48% decrease in the odds of separation.

Column (3) shows that a $1,000 dollar increase in the wage gap at the 5-year mark is associated with a 5.3% increase in the odds of separation. In occupational groups Airframers completely change and become statistically significant and are associated with an 88.5% decrease in the odds for separation whereas Avionics Technicians become insignificant. Hispanic and Asian controls become insignificant. Black Marines are associated with a 58.9% decrease in the odds for separation followed by Other at 59.4%. Being Married increases from the previous association in model (2) to report a 51.2% decrease in the odds for separation. Moving to rank, the lower the rank the higher the odds for separation such as E-4 being associated with 38.6%. Higher ranks are less susceptible to separation as shown in E-5s being associated with a 6.8% increase in separation, all ranks are reported as significant. Out of the states selected for analysis in the regression, only North Carolina was positively associated with an increase in separation at 25.4%.

Table 6. Separation by Six Years

Outcome: Separated by 6 years			
	(1)	(2)	(3)
Wage gap ($1k, 2017$)	1.132***	1.133***	1.098***
	(0.002)	(0.002)	(0.003)
Occupational Group			
Airframers		1.041	-0.881***
		(0.034)	(0.042)
Avionics		1.266***	1.002
		(0.034)	(0.041)
Demographics			
Male		-0.784***	-0.674***
		(0.059)	(0.071)
Hispanic		-0.675***	1.004
		(0.036)	(0.046)
Asian		-0.716***	1.167
		(0.087)	(0.104)
Black		-0.572***	-0.562***
		(0.054)	(0.067)
Other		-0.565***	-0.517***
		(0.067)	(0.081)
Marital Status			
Married		-0.383***	-0.386***
		(0.028)	(0.034)
Rank			
E-4			-0.412***
			(0.099)
E-5			-0.044***
			(0.095)
E-6			0***
			(0.287)
Home of record			
California			-0.498***
			(0.057)
Florida			-0.925
			(0.065)
Georgia			-0.447***
			(0.092)
North Carolina			1.494***
			(0.094)
Texas			-0.887**
			(0.056)
N	32271	32271	32271

Table 6. Excluded Variables: group=Mechs, sex=F, race=White, married=NotMarried, rank=E-3. Reported as Odds ratio, Standard errors in parentheses, Fixed effect for year included.
p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

The second set of regressions in Table 6 focusing on column (1) I find that a $1,000 increase in the civilian-military wage gap is associated with a 13.2% increase in the odds of separation and is statistically significant. Column (2) I also find an increase in the wage gap effect; the wage gap is associated with an 13.3% increase in the odds of separation. Following occupational groups, I find that Airframers are positive, but their MOS is not significant whereas Avionics is associated with a 26.6% increase in the odds of separation compared to Mechanics. Demographics being male is associated with an 78.4% decrease in the odds of separation. All race categories and Hispanic heritage all decrease the odds of separation and are currently statistically significant. Being married is associated with a 38.3% decrease in the odds of separation. In column (3) I find that a $1,000 increase in the wage gap at the six-year mark is associated with a 9.8% increase in the odds of separation. In occupational groups Airframers completely change and become statistically significant and are associated with an 88.1% decrease in the odds for separation whereas Avionics Technicians become insignificant and drop to being associated with a 0.02% increase in the odds of separation. Males are lower than in the 5-year regression Table for the decrease in odds for separation being associated with a 67.4% decrease in the odds of separation, Hispanic and Asian controls again become insignificant. Black Marines are associated with a 56.2% decrease in the odds for separation followed by Other at 51.7%. Being Married increases the previous association in model (2) reporting a 38.6% decrease in the odds for separation. Moving to rank, the lower the rank the rise in the odds for separation with E-4 being associated with 41.2%. E-4 has risen from its odds of separation reported in horizon 5. Higher ranks are less susceptible to separation as shown in E-5s being associated with a 4.4% increase in separation, E-5s unlike E-4 have dropped between horizons, all ranks are reported as significant. Out of the states selected for analysis in the regression, only North Carolina was positively associated with an increase in separation at 49.4% and is almost double its original value. Texas is now reported as significant and associated with an 88.7% decrease in the odds of separation.

Table 7. Separation by Seven Years

Outcome: Separated by 7 years			
	(1)	(2)	(3)
Wage gap ($1k, 2017$)	1.145***	1.145***	1.105***
	(0.002)	(0.002)	(0.003)
Occupational Group			
Airframers		1.037	0.874
		(0.036)	(0.044)
Avionics		1.271***	-0.962
		(0.036)	(0.043)
Demographics			
Male		-0.768***	-0.671***
		(0.063)	(0.075)
Hispanic		-0.712***	1.06
		(0.039)	(0.049)
Asian		-0.702***	1.123
		(0.096)	(0.111)
Black		-0.561***	-0.568***
		(0.057)	(0.07)
Other		-0.506***	-0.482***
		(0.07)	(0.083)
Marital Status			
Married		-0.32***	-0.32***
		(0.031)	(0.037)
Rank			
E-4			-0.405***
			(0.123)
E-5			-0.039***
			(0.117)
E-6			-0.001***
			(0.24)
Home of record			
California			-0.472***
			(0.061)
Florida			-0.918
			(0.068)
Georgia			-0.437***
			(0.097)
North Carolina			1.452***
			(0.098)
Texas			-0.897*
			(0.059)
N	31597	31597	31597

Table 7. Excluded Variables: group=Mechs, sex=F, race=White, married=NotMarried, rank=E-3. Reported as Odds ratio, Standard errors in parentheses, Fixed effect for year included.
p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

In the final set of regressions in Table 7, focusing on column (1), I find that a $1,000 increase in the civilian-military wage gap is associated with a 14.5% increase in the odds of separation and is statistically significant. Column (2) I find that the wage gap effect remains unchanged and is associated with 14.5% increase in the odds of separation. Following occupational groups, I find that Airframers are reported as positive, but not significant whereas Avionics is associated with a 27.1% increase in the odds of separation. Male is associated with an 76.8% decrease in the odds of separation. All race categories and Hispanic heritage reflect a decrease the odds of separation. Being married is associated with a 32% decrease in the odds of separation.

In column (3) I find that a $1,000 increase in the wage gap at the seven-year mark is associated with a 10.5% increase in the odds of separation. In occupational groups Airframers are still statistically insignificant and Avionics Technicians become insignificant and are now negatively associated with a 96.2% decrease in the odds of separation. Males are lower in the Table for the decrease in odds being associated with a 67.1% decrease in the odds of separation, Hispanic and Asian controls become insignificant. Black Marines are associated with a 56.8% decrease in the odds for separation followed by Other at 48.2%. Being Married remains unchanged from the previous model, associated with a 32% decrease in the odds for separation. Moving to rank, the model reports a rise in the odds for separation such as E-4 being associated with 40.5%. E-4 has now dropped in the odds of separation between horizon six and horizon seven. Higher ranks are less susceptible to separation as shown in E-5s being associated with a 4.4% increase in separation, E-5s have also dropped between horizons, all ranks are significant. North Carolina is reported positive and is associated with an increase in separation at 45.2%. Texas is now significant and being associated with an 89.7% decrease in the odds of separation.

E. WAGE GAP SURVIVAL ANALYSIS

I analyzed the wage gap's effect on survival within the selected aviation maintenance sample. As depicted in Figure 11, the higher the gap, the more a Marine's survival probability decreases.

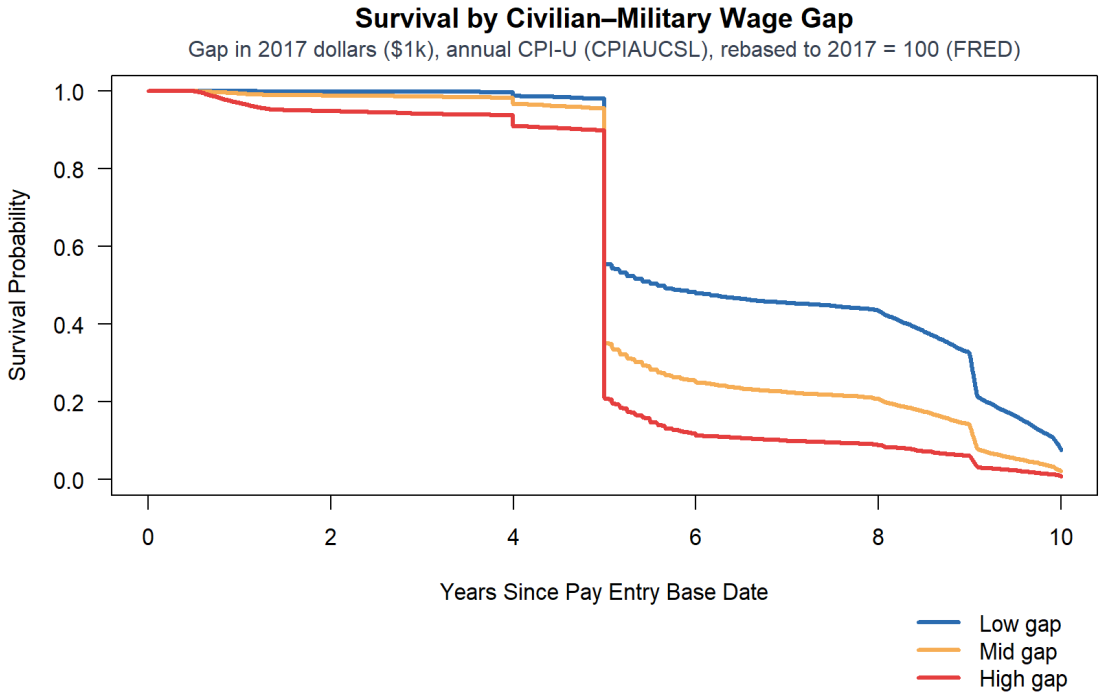


Figure 12. Wage Gap Survival Curve

Figure 11 aligns shows that the higher the wage gap, the lower the survival probability for aviation maintenance Marines. Currently the civilian labor market pays more than the military does for the same skills. As previously mentioned, there is still the upper 25th percentile to contend with, Marines may leave for $64,000 dollars depending on their rank and dependent composition, lower ranks are more likely to experience higher wage gaps. It is also important to mention that while E-3s make up most separations, E-4s and E-5s can be inspection-designated and are susceptible to enticement from the civilian labor market because they are more marketable. E-4s and E-5s with higher levels of skills could potentially see a wage gap even higher than a difference of 25k depending on civilian labor market demands.

A key takeaway is that most of the separations are happening at the early stages of the Marine Corps; this is a leak in the manpower pool that could be utilized for maintenance. Airframers reflect lower odds of separation in the regressions compared to the other occupations, but they perform the same job in the civilian labor market. Race, sex

and marriage follow consistent trends throughout each horizon with marriage being a big driver in favor of lowering the odds of separation. Higher ranks are less likely separation compared to lower ranking Marines and home of record has predominately a negative effect on the odds of separation with exception of North Carolina. As shown in the wage gap survival analysis, the higher the wage gap, the more likely Marines are to separate.

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VI. CONCLUSION

Marine aviation maintenance personnel pay aligns with the QRMC; there is however a wage gap, and it is on average a difference of $25,000 thousand dollars favoring the civilian labor market. As the gap itself increases the probability of survival drops and the odds for separation increase for maintenance Marines. Predominantly rank and marriage are two of the larger drivers for decreasing the odds in separation. Geographical locations such as California and Florida work in favor of decreasing the odds whereas North Carolina increases it. The main group of Marines that makeup the separations as of 2024 are junior Marines, this poses an issue because they never mature to their full maintenance capability. While the Marine Corps can train more personnel the pool for people that can even join the military shrinks and the process for creating an inspection-designated maintainer starts over. As stated in the introduction, the need for talented men and women to fill the positions in the civilian labor market will soon begin to rise. The civilian labor market has more flexibility than the military does regarding wages, if the civilian-military wage differential is already high then what is to say they will not leave?

Using some back of the envelope math regarding the wage gap, we can quickly calculate some potential pay issues that might entice Marines to leave. The wage for an E-3 in 2024 with five years of service is $2,680.20 per month. So, if the Marine is single and living in the barracks, they do not receive BAH and BAS, so their annual salary is approximately $32,162.40. The average civilian wage annually is $64,000. Taking the difference, we can see that an E-3 on average could increase their annual wage by $31,837.60 separating from the Marines and entering the civilian labor market. That is almost double the Marine's current salary living in the barracks. If the same E-3 Marine is married and receives BAH and BAS, their wage for the year is approximately $54,137.28; the difference between that annual pay and the average civilian annual wage is now $9,862.72. Being married closes the gap, but there is still approximately $10k more to be made in the civilian labor market on average.

I started the thesis to conduct an analysis on potential manpower attrition due to compensation. From my analysis I have found that the civilian labor market if not already will begin trying to fill their maintenance requirements. To address my question:

If there is better pay and more opportunity in the civilian market, to what extent could personnel declines affect the Marine Corps aviation community?

Based on my findings from my data analysis and the findings from the literature review, the current and soon potentially increasing rates of separation may lead to lower readiness and increased manpower shortfalls. We know the Marine Corps has to grow its own, so losing skilled or experienced labor can have a domino effect on the talent pool affecting the availability and sustainability of aircraft. There is more money to be made in the civilian labor market, but at this current stage it is difficult to prove that personnel are leaving for money or state that anything else in the analysis so far is causal; further research needs to be done. Specifically, conducting interviews and surveys could provide information on why aviation maintenance Marines are choosing to separate. There is also an opportunity to expand the research to explore how separation affects the Marine Corps aviation maintenance community and its ability to sustain readiness.

This research evaluated separation rates and the wage gap; I originally wanted to incorporate Advanced Skill Management (ASM) data to see who had a designation and what type. I think this is a good expansion because inspection-designated maintainers are more marketable to the civilian labor market because of their expertise. Another area for further research is the evaluation of separations to aviation readiness with the Aircraft Maintenance Supply Readiness Report (AMSRR). This would allow an analysis on trends such as dips in readiness from separations, if augmented with ASM data it could be scoped to see if the dip at the unit level is possibly associated with inspector designated maintainer departure. As seen in the research and analysis, most of the separations are from the junior Marines and potentially junior inspector designated maintainers. Fuzy (2019) mentioned in her thesis that bonuses do not affect the aviation community, other incentive programs such as incentive pay for being inspector designated might be worth researching as well. Programs such as the pilot incentive pay have been effective. To possibly find causality or make argument for its data needs to be collected from the Marines themselves through

either the interview process or surveys. This would provide insight into the reason that Marines made the decision to separate when they did. I firmly believe that actual interviews and survey data may also provide more to the answer that this research seeks to answer.

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