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MONTEREY, CALIFORNIA

THESIS

**IMPROVING THE GENDER COMPOSITION OF THE
UNITED STATES MARINE CORPS THROUGH MILITARY
OCCUPATIONAL SPECIALTY CROSSWALK EXAMINATION**

by

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June 2018

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MARINE CORPS THROUGH MILITARY OCCUPATIONAL SPECIALTY
CROSSWALK EXAMINATION**

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ABSTRACT

To aid USMC efforts in gender representation across its organization, I first develop a crosswalk of Marine Military Occupational Specialties (MOS) to civilian Standard Occupational Codes (SOC). I then employ hedonic regression methods to determine the effects of skills and abilities required to perform Marine occupations on the proportion of females in that job. The hedonic analysis proposes an empirically justified potential upper bound of female representation for USMC gender integration goals. The civilian labor market is essentially a free market where individuals can choose their occupation with arguably lower barriers to entry than the military. Yet, civilian female representation remains low in the occupations that map to previously gender-restricted MOSs, with female representation hovering at or below 5 percent. In addition, the marginal effects of skills and abilities required for job performance tend to further restrict the female representation level expectations. While there may be a desire to increase female representation across the USMC as a whole, the aggregate adjusted female representation level of the occupational fields is only 8.82 percent. This data can provide realistic expectations for gender integration goals, as I predict that female representation will remain lower than the related civilian occupation.

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LIST OF ACRONYMS AND ABBREVIATIONS

BLS	Bureau of Labor Statistics
CBRN	Chemical biological radiation and nuclear
CNA	Center for Naval Analysis
DMDC	Defense Manpower Data Center
DoD	Department of Defense MOS Military Occupational Specialty
DOL	Department of Labor
Dstl	Defense Science and Technology Laboratory
HQMC	Headquarters Marine Corps
IDF	Israeli Defense Force
IPUMS	Integrated Public Use Microdata Series
KSA	Knowledge skills and abilities
MAGTF	Marine Air-Ground Task Force
MCRC	Marine Corps Recruiting Command
MMOA/EA	Manpower Management Officer Accessions/Enlisted Accessions
MNMV	My next move for veterans
MOD	Ministry of Defense
NATO	North Atlantic Treaty Organization
O*NET	Occupational Information Network
OIF	Operation Iraqi Freedom
PMOS	Primary military occupational specialty
RAND	Research and development corporation
SHARP	Sexual Harassment and Assault Response and Prevention
SME	Subject Matter Expert
SOC	Standard occupational classification
TFDW	Total Force Data Warehouse
UK	United Kingdom
USMC	United States Marine Corps

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I. INTRODUCTION

The Department of Defense (DoD) policies on combat exclusion had prevented women from serving in units that had a direct combat role below the Marine Expeditionary Brigade level. The exclusion included military occupational specialties (MOSs) such as special operations, infantry, combat engineers, and artillery. The exclusion policy was rescinded in a 2013 joint memo signed by the Secretary of Defense and Chairman of the Joint Chiefs of Staff with an implementation deadline of January 1, 2016. This memo recognized that removing gender barriers in favor of a merit-based qualification system will enhance military readiness and increase national security (DoD, 2013). Concerns about unit readiness still exist for the implementation, recruitment, and management of the integration of women. The new policy has made 54,000 billets—approximately 1/3 of the entire organization—available to qualified women. These newly available billets include 32 previously closed primary military occupational specialties and 16 skill designators.

These changes have prompted the assessment of the current role of women in the Marine Corps and the potential of women in this new environment to shape the future of the force. Currently, female Marines make up only about 7 to 8 percent of the active duty force, roughly half of the female representation in other services. This thesis seeks to determine what a feasible level of integration could look like for the Marine Corps by creating an empirically justified upper bound of female representation across Marine Corps occupations. To estimate this, data from the Department of Labor’s web-based civilian workforce application Occupational Information Network (O*NET) and U.S. census data from the web-based application Integrated Public Use Microdata Series (IPUMS) are used to match and compare gender representation among civilian occupations with military occupations. This information is used to estimate a potential upper bound in each occupational field.

Developing this mapping of civilian standard occupational codes (SOCs) to MOSs reveals a very heavily male-dominated civilian sector for equivalent Marine occupations; specifically, the previously male-only Marine occupations primarily sit at or below 5 percent female representation in the civilian sector. This highlights the occupational

segregation across civilian labor markets indicating a low supply of female workers choosing such jobs.

In addition, there is substantial variation in results of the occupational comparisons; for example, the 31 distribution management occupations have similar gender representation (26.1 percent with its civilian equivalent logisticians). In contrast, the 01 manpower and administration occupational field (third highest in female representation at 24.6 percent) maps to the 43–4161 human resources assistant civilian occupational field (the highest civilian female representation at 80.2 percent).

Finally, I predict that substantial efforts may have to be expended for female representation in the U.S. Marine Corps to reach 10 percent as an aggregate. I find that conditional on simplifying assumptions made for this thesis, the aggregate upper bound is only 8.82 percent. Naturally this number should be subject to further analysis.

The rest of this thesis is organized as follows. First, in the literature review chapter I present historical context in three parts: the civilian labor market, military gender integration, and military to civilian occupational crosswalks. Second, I explain the source of my data and the methodologies I use for its employment in the development of a MOS to SOC crosswalk and the hedonic analysis of skills and abilities. Third, I describe the results found in both the crosswalk and the skills and abilities adjustments. Finally, I discuss my conclusions, limitations, and recommendations.

II. LITERATURE REVIEW

This chapter provides a comparative study of gender integration in the U.S. civilian labor market and examples of gender integration in foreign militaries. The literature review is divided into three parts. The first part is made up of relevant studies based on civilian labor market gender integration, the second is based on foreign and domestic military gender integration and the third is previous civilian to military occupation crosswalk data analysis. These studies help define the successes and failures of gender integration and pave a way for further analysis.

A. PART 1. CIVILIAN LABOR MARKET

The American military is a microcosm of American society; therefore, it follows that the treatment of women in the American Military would be similar to the treatment of women in America generally

— Wooten, 2015, p. 17

Resources reviewed in support of this thesis bring up numerous relevant concerns regarding the integration of women into male-dominated occupations. Topics include psychological attitudes, discrimination, occupational sorting, promotion, and traditional male/female family/societal roles.

1. Traditional (Biological) Gender Roles

Traditional gender roles refers to the idea that in a marriage a woman maintains the household while the man goes to work. Motherhood is a biological need in the cycle of life, which includes pregnancy and infant care. The main reason more women are in the military is the invention of birth control (Skaine, 2011) and the all-volunteer force (Moore, 2017). Still to this day, women are coping with man-made work environments that do not support the structures for women to survive to the highest levels of employment. Women who have made it to the top echelons have had to conform to an environment that favors men; whether that be by forgoing/delaying having a family or other concessions such as

hiring out motherhood roles to a nanny: “The military’s challenge is to help soldiers understand that they do not have to choose between family and career” (Skaine, 2011).

In her book titled *Women in Combat*, Rosemarie Skaine lists examples of improvements that can assist working parents, specifically mothers. The Army Medical Center in Germany authorizes breastfeeding mothers to defer deployment for up to one year. The Army as a whole has extended deferment of deployment from four to now six months, opened previously unaccompanied tours to families, built more day-care centers, allowed families to stay in one place longer, deployed couples at the same time, and approved a ten-day paternity leave for new fathers (Skaine, 2011). The U.S. Navy has authorized some sailors to work from home or take up to a three-year sabbatical (Skaine, 2011). However, there is still work to be done; Skaine (2011) suggests childcare centers need to provide 24/7 access and work needs to be done to reduce the rate of divorce among active-duty women, who experience divorce at almost three times the rate of their male counter parts. As stated in Blau’s (2017), The Gender Wage Gap study, there are possibly huge implications from societal traditional gender roles on the wage gap. This study notes that marriages tend to suffer when the woman outearns her husband (Blau, 2017). It is anticipated that the influence of traditional gender roles can negatively impact recruitment and retention of women in the Marine Corps.

2. Psychological Attitudes and Gender Discrimination

Decomposing the gender wage gap shows that explanatory factors (education, skills, and location) predict women would outearn men.

— Bacolod, 2016

Bacolod shows in her research that even as women attain the same education and skills as men they earn less. This research is important for providing empirical evidence of gender discrimination.

Author and economist Claudia Goldin provides historical data and trends of occupational segregation. She notes that male-dominated occupations tend to have an “aura of gender” (Goldin, 1990). What she means by this is that occupations are male dominated because of the influence of bias created by the traditional roles women have fulfilled in

society throughout history. Gender discrimination refer to actions or statements that marginalize a woman's contribution due to her gender only. A typical discriminating idea might include "women should not fight or shoot things because it is not lady like or they are not strong enough." She found men in male-only/male-dominated occupations fear the introduction of women into the labor market because they believe it will deskill and degrade the status or prestige of the occupation (Goldin, 1990).

This notion is particularly relevant to the Marine Corps' previously all-male MOSs. A survey conducted by Research and Development Corporation (RAND) of active duty military members serving in special operation occupational specialties have proved these mindsets to be true still to this day. The survey was conducted in 2016 on the attitudes of special operation qualified active-duty military members and the results provide an indication of the type of environment women who earn a combat arms MOS will be facing. Around 85 percent of respondents do not want women to serve in their specialty and 71 percent feel that there is no place for women in special operation units (Szayna et al., 2016). Furthermore, only 40 percent agree that attaching women from other specialties to support communication with the local communities might be helpful (Szayna et al., 2016). Reasons for opposing integration include doubts that women can meet the physical requirements and fears that standards will be lowered and cohesion/trust within the unit will degrade (Szayna et al., 2016).

Experimental work performed on psychological attitudes as highlighted in Blau's (2017) research shows that attitudes are often influenced by their environment. An example he provides is "anticipated treatment of women in the labor market; may affect their aspirations" (Blau, 2017). What this means is that women are often deterred from attempting to work in certain occupations based on perceptions about what the work environment might be like. Also, Western societal gender biases tend to view that women should be protected and women as a people should not kill (Skaine, 2011). However, a 2013 Gallup Poll indicates that societal inclinations are shifting toward supporting women in the military, with nearly three-quarters of respondents supporting women serving in combat roles (Brown, 2013). Women's sentiments toward certain occupations are influenced by societal inclinations and media reporting on events such as sexual

harassment. This trend can influence the ability to recruit women into the Marine Corps and even more so into combat arms MOSs. Incidences such as the recent Marines United Facebook page where women have had indecent photos posted without their permission and the male users comment that they would like to sexually assault those women can create even more barriers toward recruiting women (Wolf, 2017).

3. Occupational Sorting

Also noted in Blau's (2017) research, women tend to be more risk averse and therefore sort into occupations that are less risky. Women must consider several risks when choosing to serve in the military. The risk in this case can have many aspects: fear of death in combat, fear of failure to qualify or uphold the physical standards (fear of failure), and fear of being treated differently/badly. The Marine Corps has higher standards and a tough reputation, which can pose a risk to a woman's durability, causing her to choose an easier and therefore less risky occupation. As women tend to segregate out of risky occupations, this could pose a serious issue for the Marine Corps as it desires to increase female representation across the Marine Corps from 7 percent to 10 percent and specifically for the riskier combat arms MOSs.

4. Attrition

Delus (2017) observed in her master's thesis that in general females are more likely to attrite than males. She found "that gender representation and MOS are both key determinants of attrition" (Delus, 2017). Delus (2017) notes that the presence of critical mass (the minimum number of females needed for behavior change) does tend to have an effect on attrition and retention.

Specifically, in the first six months of an enlistment contract the odds that a woman will attrite is twice that of a man's (Delus, 2017). In months 13–24, the odds that a woman attrites drops slightly to approximately 1.5 times more likely to attrite than a man (Delus, 2017). The highest rates of attrition are due to misconduct followed by disability. These two categories of attrition make up 95 percent of attrition reasons. The most significant gender difference in attrition is in the disability category. Women attrite due to disability

42.2 percent of the time, whereas men attrite in this category 31.8 percent of the time (Delus, 2017).

As shown in Table 1, Delus conducts occupational field analysis by sorting MOSs into four categories: combat arms, combat service support, service support, and aviation support. The proportion of women in service support is not provided in Delus' (2017) study. Interesting gender differences observed by Delus (2017) includes the following:

Though enlisted females make up 7 percent of the total force, 20 percent are in combat service support and 8 percent in aviation support. Attrition in the first two years is higher for females in combat service support and lower in aviation support when compared to men. Model 6 [a female only linear probability regression using demographic, MOS, and female critical mass controls] displays that females are less likely to not separate than males. There are various factors as to why this is this the case however; it does appear that the proportion of females has some impact on attrition, sometimes positive and sometimes negative, with the results changing between the full versus female only sample. (p. 24)

Table 1. Description of MOS Codes by Primary MOS Occupational Fields.
Source: Delus (2017)

	Primary MOSs	Comments
Combat Arms	03, 08, 18	
Combat Service Support	01, 04, 30, 34	
Service Support	02, 05, 06, 11, 13, 15, 21, 23, 26, 28, 31, 33, 35, 41, 43, 44, 46, 48, 55, 57, 58, 59, 68	
Aviation Support	60, 61, 62, 63, 64, 65, 66, 70, 72	
Dropped as Erroneous	00, 09, 25, 40, 48, 73, 75, 80, 81, 84, 85, 89, 97, 98, 99	Missing, Secondary, Miscellaneous, Senior Enlisted or Officer MOSs

5. Promotion and Retention

In shortened form, Carl Von Clausewitz said “War is the continuation of politics by other means.”

An important question to consider is: why do we not have more women in politics and higher ranks of our organizations to influence how we fight? We bound our potential by limiting the diversity at the top of our organizations.

Table 2, “Table of Active Duty Females by Rank/Grade and Service,” is published on the DoD Defense Manpower Data Center (DMDC) website and is accurate as of November 2017. This table shows that currently women make up 5.4 percent of the highest rank in the military (DoD, 2017). Compared to historical numbers as presented in Figure

1, “Women Officers as a Percent of Total Officers,” some progress has been made since 2008, where at that time, women had no representation in the top military grade of O-10 (Skaine, 2011). Table 3, “Percent of Women in Male Dominated Occupations,” as published by Careerbuilder on 13 July 2017 shows that women hold 23 percent of chief executive officer (CEO) positions available in civilian organizations (Grasz, 2017). Additionally, gains have been made in the highest enlisted ranks; representation in the top three grades has grown by almost 2 percent since 2008, as seen by comparing the data in Figure 2 and Table 2.

Table 2. Active Duty Females by Rank/Grade and Service. Source:
Department of Defense (2017).

Data as of: November 2017							
Data Source: Active Duty Master Personnel File, Military Academies							
Females						DoD Total	Pct Females
Rank/Grade	Army	Navy	Marine Corps	Air Force	TOTAL		
O10	0	0	0	2	2	37	5.4%
O09	3	3	0	5	11	144	7.6%
O08	6	5	1	6	18	298	6.0%
O07	8	10	0	8	26	419	6.2%
O06	470	368	16	465	1,319	11,104	11.9%
O05	1,257	815	88	1,514	3,674	26,922	13.6%
O04	2,845	1,769	237	2,685	7,536	42,478	17.7%
O03	5,766	3,902	458	4,818	14,944	74,681	20.0%
O02	2,524	1,441	365	1,658	5,988	28,969	20.7%
O01	1,510	1,581	326	1,726	5,143	24,879	20.7%
W05	42	5	6	0	53	720	7.4%
W04	180	16	12	0	208	2,689	7.7%
W03	419	48	35	0	502	5,249	9.6%
W02	522	54	57	0	633	6,977	9.1%
W01	235	0	10	0	245	2,534	9.7%
Officer Total	15,787	10,017	1,611	12,887	40,302	228,100	17.67%
E09	281	173	56	402	912	10,147	9.0%
E08	1,286	609	204	1,036	3,135	26,200	12.0%
E07	4,223	2,667	488	5,129	12,507	89,185	14.0%
E06	6,232	6,394	1,117	7,325	21,068	154,670	13.6%
E05	9,712	11,981	2,492	11,233	35,418	217,150	16.3%
E04	16,790	11,547	3,107	9,743	41,187	249,318	16.5%
E03	7,561	12,228	3,601	11,355	34,745	189,555	18.3%
E02	4,410	3,047	2,000	1,858	11,315	69,024	16.4%
E01	3,583	3,055	878	2,185	9,701	58,756	16.5%
Enlisted Total	54,078	51,701	13,943	50,266	169,988	1,064,005	15.98%
Total DoD Officer & Enlisted (Excl Cadets/Midshipmen)	69,865	61,718	15,554	63,153	210,290	1,292,105	16.27%
Military Academy Cadets & Midshipmen	1,008	1,201	N/A	1,101	3,310	13,201	25.07%
Grand Total (Officers, Enlisted and Cadets/Midshipmen)	70,873	62,919	15,554	64,254	213,600	1,305,306	16.36%

Figure 1. Women Officers as Percent Total Officers. Source: Skaine (2011).

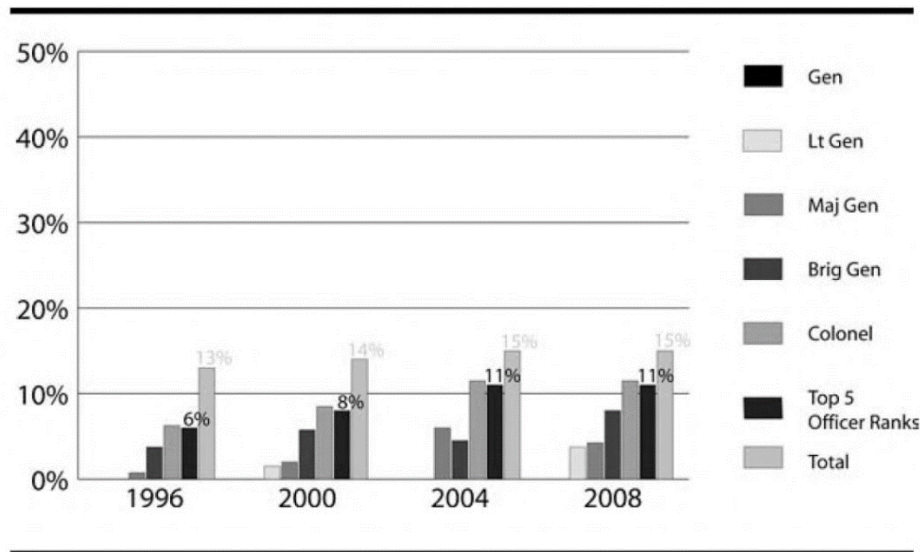


Figure 2. Women Enlisted as Percent of Total Enlisted. Source: Skaine (2011).

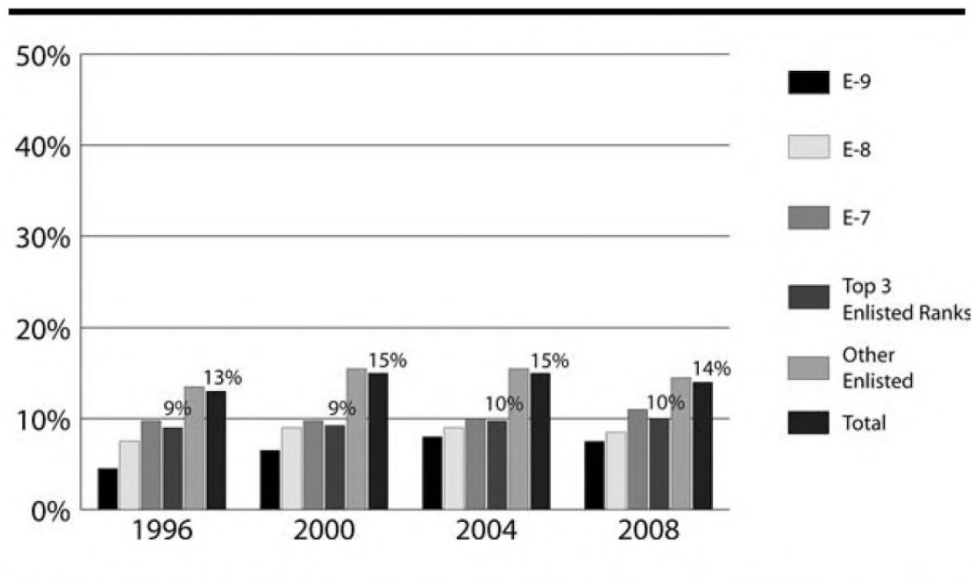


Table 3. Percent of Women in Male-Dominated Occupations. Source: Garza (2017).

Occupation	Total No. of Jobs 2017	% of Women Employed 2017	% of Men Employed 2017	Jobs Added 2009-2017	Increase in No. of Women Employed 2009 - 2017	% of Women in New Jobs Added 2009-2017
Lawyers	631,899	38%	62%	31,815	15,247	48%
Veterinarians	70,935	46%	54%	12,540	5,974	48%
Commercial and Industrial Designers	33,175	46%	54%	4,373	2,085	48%
Marketing Managers	207,610	44%	56%	30,038	14,221	47%
Optometrists	37,504	46%	54%	7,292	3,155	43%
Management Analysts	662,722	45%	55%	96,446	41,030	43%
Sales Managers	382,032	41%	59%	40,307	17,345	43%
Producers and Directors	112,907	41%	59%	18,671	7,813	42%
Chemists	87,746	39%	61%	6,132	2,583	42%
Coaches and Scouts	234,742	38%	62%	25,764	10,480	41%
Private Detectives and Investigators	32,667	42%	58%	3,896	1,603	41%
Emergency Medical Technicians and Paramedics	248,923	37%	63%	28,929	11,420	40%
Financial Analysts	286,398	37%	63%	31,789	12,644	40%
Team Assemblers	1,144,211	39%	61%	196,095	77,426	40%
Computer Systems Analysts	599,910	35%	65%	132,139	44,769	34%
General and Operations Managers	2,259,632	29%	71%	259,923	84,523	33%
Firefighters	326,951	5%	95%	3,232	1,029	32%
Surgeons	43,497	33%	67%	5,548	1,174	31%
Web Developers	143,606	32%	68%	38,606	11,824	31%
Dentists, General	105,409	29%	71%	14,865	4,642	31%
Chief Executives	255,916	24%	76%	12,385	3,518	28%

As stated by Skaine (2011),

Women assigned to noncombatant units, but who perform in combat, have promotional opportunities only as a noncombatant. These women cannot realize their leadership potential when they are not allowed to enter career track or combat positions that lead to the top ranks of command officers ...The Iraq and Afghanistan Veterans of America reported on three studies that indicated career progression remains a barrier for women. [Defense Department Advisory Committee on Women in the Services] DACOWITS reported women are underrepresented in the higher ranks of the military, and have lower promotion rates than their male counterparts...They serve at the order of commanders who must meet readiness requirements but without rank and career benefits commensurate with their performance and the great risk. (p. 36)

Even with all of the barriers listed so far in this literature review, a study conducted by CareerBuilder shows a decline in the polarization of gender dominated fields. A full list of nontraditional (male-dominated) occupations assembled by the U.S Department of Labor (DOL) is available in Appendix A. In 2017, 23 percent of male-dominated occupations are held by women, and 27 percent of female-dominated occupations are held by men (Grasz, 2017). Women are taking on more leadership roles, which is good news for the Marine Corps in terms of retaining women. This must indicate a slow shift in the traditional view of women's roles and capabilities in society.

A study conducted by the Center for Naval Analyses (CNA) discovered that women who become mothers before reaching E5 are more likely to leave the service (CNA, 2016). Birth rates have fallen by 1 percent according to statistics found on the National Center for Health Statistics website but births for women over the age of 30 have risen, which may indicate that women are forgoing children entirely or until an older age in order to participate in the labor market (Hamilton, Martin, Osterman, Driscoll, & Rossen, 2017).

Also, I would argue work place atmosphere must be progressing towards making it easier for women to work and also have a family. An example is expanding support by organizations for paternity/ maternity leave and employers supporting breastfeeding mothers better by giving them time and a proper place to pump. Facebook is an example of a company supporting working parents by providing four months paid leave to both men and women after the birth or adoption of a child (Adamczyk, 2015). The Marine Corps has also made strides in this area by increasing paid maternity leave from six to 12 weeks (Brilakis, 2016). Finally, a structural equation modeling multivariate analysis conducted by Woodruff (2017) called "Gender and Deployment Effects on Pro-Organizational Behaviors of U.S. Soldiers" indicates that the number of deployments does not depreciate women's attitudes and behaviors towards the military.

B. PART 2. MILITARY GENDER INTEGRATION

The second part of the literature review explores the status of gender integration in several countries. This review seeks to better understand the successes and failures or benefits and costs of gender integration by using information gathered from the

performance of units in countries that have integrated and those that have not. Topic headings covered include leadership, unit cohesion, sexual harassment and assault, physiological differences and strength, and intangible benefits of women in the workplace.

1. Leadership

The most prominent argument against gender integration is that combat effectiveness will be degraded due to loss of unit cohesion and the lowering of physical standards because of the physiological differences between men and women. However, Jeff Wooten completed a dissertation in August 2015 where he focused his research on three countries that have had women integrated for over 15 years: Norway, Canada, and Israel. He concluded through meta-analysis and literary review that the primary change required for successful integration is leadership (Wooten, 2015). Additionally, a survey and regression analysis conducted by CNA (2014), suggests “that junior enlisted male Marines may be more receptive to gender integration policy changes, while company-grade officers may be less receptive” (p. 56). This finding is concerning as combat arms Company-grade officers are tasked with leading a platoon or company of Marines, which could have a negative effect on integration efforts.

In Cawkill’s (2009) study, Canadian women confirmed that as long they can meet the standards and professionalism is upheld integration has been successful. Leaders must be fully accepting and a proponent for integration for the organization to successfully integrate. Therefore, integration is a “leadership challenge, not a measure of masculinity” (Wooten, 2015, p. 54). The Army Lessons Learned Center stated:

Cohesion of mixed gender combat arms units was a leadership challenge. In a nonhomogeneous environment, there needed to be a search for common ground or a point on which all team members could identify, and it was considered a leadership responsibility to provide the framework and common ground to facilitate team building. (1998, as cited in Cawkill, Knight, & Spear, 2009, and Wooten, 2015)

Successful integration of women requires the commitment and visible involvement of senior leaders: “RAND analysis suggests that countries with a high institutional

commitment to integration have achieved at least a moderate degree of success and that most countries have achieved a high degree of success” (Schaefer et al., 2015, p. 46).

2. Unit Cohesion

Several resources reveal a long history of women fulfilling combat roles even when officially not authorized to do so by congress. Wooten and Skaine both remark on “Molly Pitcher” the wife of a man that operated a cannon during the Revolutionary War. After he fell from an injury she took over operating his cannon. Additionally, a more contemporary account of a woman performing in combat is that of Silver Star Recipient Sergeant Leigh Ann Hester U.S. Army Military Policeman. While serving in Operation Iraqi Freedom in 2005, she performed in combat during an insurgent attack on a convoy her team was shadowing by firing grenades and a rifle volley killing three insurgents (Skaine, 2011). Additionally, an excerpt from Skaine’s (2011) book, *Women in Combat*, highlights the impact on unit cohesion as recorded throughout history: “and yet in the many historical and contemporary cases I have read about involving women and men in combat situations, I have yet to come across one which states that the presence of women DID distract men, undermine the cohesion and effectiveness of the unit and endanger the mission” (p. 63).

Wooten (2015) also found that women who volunteer for combat assignment do not degrade combat effectiveness, unit readiness, or unit cohesion. CNA (2014) study results show that male Marines are more supportive of voluntary classification of women into combat arms MOSs than involuntary assignment.

Those who oppose gender integration in combat arms MOSs often lament that unit cohesion will be significantly degraded. On the contrary, a study conducted by the National Defense Research Institute (2010) on the effects of sexual orientation on military unit effectiveness, divides cohesion into two separate categories: task cohesion and social cohesion. Unit effectiveness and cohesion are not primarily based on who you like or enjoy company with (social cohesion) but it is most influenced by task performance and the collective effort of the group (task cohesion). Therefore, argues Wooten (2015), gender becomes less of a factor in cohesion as competence and trust are established through training and superior work performance.

3. Sexual Harassment / Assault and Gender Discrimination

To bolster Wooten's finding in the previous paragraph, the Canadian Armed Forces found that separating recruits by gender in recruit training significantly degrades future unit cohesion, so they took gender integration a step further than any other country by introducing coed living spaces into recruit training so that all recruits regardless of gender eat, sleep, and train together (Wooten, 2015). Study of unisex rooms revealed that gender was made insignificant and sexual assault declined as each individual was viewed more as just a fellow soldier (Wooten, 2015).

Integration mitigates the occurrence of sexual harassment and assault as reported by the three countries Wooten evaluated in his study. Additionally, he quoted the Chairman of the Joint Chiefs of Staff as saying in a 2013 press conference:

We've had this ongoing issue with sexual harassment, sexual assault. I believe it's because we've had separate classes of military personnel. At some level....when you have one part of the population that is designated as warriors and another part that is designated as something else, I think that disparity begins to establish a psychology that in some cases led to that environment. I have to believe, the more we can treat people equally, the more they are likely to treat each other equally. (Wooten, 2015, p. 89)

Rhonda Cornum, one of two U.S. military women taken prisoner in the 1991 Persian Gulf War is quoted by Skaine (2011):

Women should be evaluated on their own talents. Every 15 seconds in America, some woman is assaulted. Why are they worried about a woman getting assaulted once every 10 years in a war overseas? It's ridiculous. [Some say] men are predisposed to protect women and may relent to seeing a woman being raped... Then why do the services have to establish a sexual harassment program? (p. 58)

These statements by reputable sources further underscore the advantages of gender integration. Advantages noted include less gender discrimination, lower accounts of sexual harassment and assault and an increase in knowledge, skills, and abilities.

4. Physiological Differences / Physical Strength

Women know how to fight; they just fight differently. Instead of trying to get women to fight like a man, what if we embrace our differences and enhance the combat environment for both genders?

Wooten (2015) argues that physical strength is inconsequential when “over the past 13 years, more than 60 percent of American combat casualties have been the result of improvised explosive devices (Barbero, 2013); therefore, the question of physical strength as a discriminatory factor in deciding which soldiers should serve in direct ground combat units seems irrelevant” (p. 58). This argument is a little weak by itself, but if you add in Wooten’s (2015) argument: one can argue size is more important than gender and that the capabilities of the smaller men overlap with larger women; then, the fact that ground troops are still expected to move on foot carrying gear and weapons and are expected to engage the enemy with a certain lack of fatigue can be addressed.

In 2009, Captain Stone prepared a report referenced in the book *Women in Combat* by Skaine (2011): He found that the Physical Fitness Test should be standardized, women are physiologically different but efforts should focus on the gender overlap. There are women who perform equal to or better than some of their male counterparts. He said, “These women can perform combat duties with a unified combat standard and proper training” (Skaine, 2011, p. 59).

Outlined in the DoD Fragmentary Order 4 of December 2015, gender neutral standards have been created for combat arms MOS assignment to facilitate the integration of women. Concerns brought up by the fragmentary order about integrating women include reference to a study that women sustain injuries at higher rates than men, that special preference cannot be used to sustain a certain level of women, and that women must be relegated to proper roles when deployed to countries that do not have the same principles as the United States (DoD, 2015). Some of the concerns raised by this fragmentary order can bolster psychological hesitations by women from attempting to compete for combat arms MOSs for fear of being treated as less than worthy/equal.

A memorandum signed by then Secretary of Defense Ash Carter in December of 2015 reflects the same sentiments concluded by Wooten earlier that year. The Secretary wrote, “Concerns about possible reductions in combat effectiveness can be addressed by effective leadership and gender-neutral standards.... The primary factor in developing cohesion is the ability of all members of the team to perform assigned mission essential tasks effectively” (DoD, 2015, p. 2).

5. Intangible Benefits of Women in the Workplace

Some of the countries in Wooten’s (2015) study that have integrated women identified several characteristics that women perform superior to men in the military working environment. The Israeli Defense Force (IDF), for example, recognized that women often display superior abilities in areas such as discipline, organization, multitasking, drive, and marksmanship (Wooten, 2015).

A recent article by *Business Insider* quotes Kevin O’Leary of “Shark Tank” as saying that the only CEOs making money for him right now are women (Kane, 2017). Libby Kane (2017) of *Business Insider* published his theory as to why he thinks the women are outperforming the men:

One, women are better at time management... “If you want something done, give it to a busy women.” There’s a lot of truth to that in a private, small company, because they’re allocating their and their employee’s time. Two, women set more attainable goals. Guys tend to set goals that are very hard to achieve, outlier goals, and when they’re achieved it’s a huge success, they feel great, but they don’t mind getting 50 percent of the way there. But what they don’t realize is happening within a small business is that when you don’t achieve your goals consistently, morale starts to slump and you get higher employee turnover.

Women set goals that are achievable — they get achieved 80 percent, 90 percent, 95 percent of the time, company morale goes up, and there’s a really sticky culture developing. So employee turnover is less. These are really interesting attributes, and when you have less turnover of employees, productivity goes up and basically, your use of capital, your return on assets, goes higher, and the outcomes are better.

O’Leary is adamant that he’s not out to start “gender warfare” — “I would give money to a goat if I get a good return,” he’s said repeatedly — but his conclusion is, he told the audience at GrowCo, “the outcomes have been

very, very good on these women-run businesses because they know what they're doing with time, and goal-setting, and these things matter in micro-communities where culture is a big deal. (n.p.)

Testament after testament declare women are force multipliers. During a senate hearing in 2009, the Secretary of the Army argued to keep women in combat support roles by stating “Women in uniform today are not just invaluable, they’re irreplaceable” (Skaine, 2011, p. 18). Additionally, as described in *Women in Combat*, by Skaine:

During Desert Storm, one commander, maybe even never had read the policy [an amendment to title 10 USC that required congressional approval to have women in direct combat or collocated with those units], sent a woman, a Lt. Col. Intelligence officer, across the line, this was before the war started, into Iraq. So they asked him, “Why did you do that?” He said, “Because she was the best intelligence officer I had.” According to the policy, he probably shouldn’t have done that. (p. 18)

Evidence shows that women have played an important role in war and sometimes in combat. An important reminder is that death, as shown in Table 4–Table 6, does not discriminate. Skaine’s reference book provides biographical sketches on 28 women who fought and some died in combat. Many of the women are pioneers in the military and most have earned combat specific awards. For example, Specialist Veronica Alfaro, U.S. Army, earned the Bronze Star Medal in Iraq in 2008 for actions taken while serving as a convoy driver during an insurgent ambush (Skaine, 2011). She maneuvered her vehicle to provide the best firing position for the gunner and also exited the vehicle and fired upon the enemy to help save other injured convoy drivers (Skaine, 2011). A particularly relevant quote by Skaine (2011), “*The Washington Post* reported that accounts by men who have fought alongside women suggest that what’s true for women generally, may not be true for women who join the military” (p. 61).

Table 4. Operation Iraqi Freedom (OIF) – Military Deaths (2003–2010).
Source: DoD (2018).

<i>Gender</i>	<i>Deaths</i>	<i>Percent</i>
<i>Female</i>	110	2.49
<i>Male</i>	4,301	97.50

Table 5. Operation Enduring Freedom – Military Deaths (2001–2014).
Source: DoD (2018).

<i>Gender</i>	<i>Deaths</i>	<i>Percent</i>
<i>Female</i>	50	2.13
<i>Male</i>	2,296	97.86

Table 6. Operation Freedom’s Sentinel (OFS) – Military Deaths (2015–present). Source: DoD (2018).

<i>Gender</i>	<i>Deaths</i>	<i>Percent</i>
<i>Female</i>	4	8.51
<i>Male</i>	43	91.48

It is hard to draw the line between exposing women to danger or assigning combat and noncombat billets. For example, corpsmen or nurses, and women spies, have died performing these duties (Skaine, 2011). I can attest to this through personal experience; while deployed, the joint base on which I was stationed attacked, and aircraft maintenance, administrative, and other noncombat arms Marines found themselves being shot at as six AV-8B Harriers were destroyed by the insurgents. Two Marines killed and nine personnel wounded (Starr, Lawrence, & Sterling, 2012)

6. Foreign Militaries

A study conducted in 2015 by RAND on the impact of integrating women into the U.S. Marine Corps infantry found that foreign militaries that had leadership commitment to integration, recruitment and retention policies that target women, and continual revision of gender-neutral physical standards had the keys to success for gender integration (Schaefer et al., 2015). Table 7 shows a positive relationship between a country’s institutional commitment to integration and the level of success.

Table 7. Assessment of Integration Success and Institutional Commitment in Foreign Militaries. Source: Schaefer et al. (2015).

Assessment of Integration Success and Institutional Commitment in Foreign Militaries			
Integration Success	Institutional Commitment		
	High	Moderate	Low
High	Australia Canada Denmark Norway Sweden Israel		
Moderate	Germany Netherlands New Zealand South Africa	Albania Belgium Finland Hungary Italy Romania Slovenia Spain	France
Low		Croatia Greece Latvia Lithuania Mexico Russia	Poland Portugal Slovakia Ukraine

a. United Kingdom

The United Kingdom (UK) is naturally the first group of countries compared to the U.S. military. The U.S. tends to specifically self-identify with the UK mainly because the primary language is English. This sentiment is reflected in the UK as pontificated in Winston Churchill’s 1946 “Iron Curtain” speech where he calls upon united “English-speaking peoples” to bring peace and balance of power: “Neither the sure prevention of war, nor the continuous rise of world organization will be gained without what I have called the fraternal association of the English-speaking peoples. This means a special relationship between the British Commonwealth and Empire and the United States of America” (CIA, 1946).

Therefore, a Ministry of Defense (MOD) study that profiled the militaries of 18 countries is an appropriate place to start. The U.K. continues to exclude women from serving in what they call “ground close combat roles.” These are occupations whose primary function is to “close with and kill the enemy” (Cawkill, 2009). The conclusions of this study finds that the integration of women into close combat roles around the world remains low because of traditional gender stereotyping such as lack of resiliency and the physical limitations of many women. Additionally, the author of the U.K. study briefing

paper found that most women are not attracted to the requirements of working in combat roles (Brooke-Holland, 2016).

The government of the U.K. understands that some women will meet the physical standards but the concern is that they will degrade unit cohesion. The 2014 review considered 21 factors that contribute to combat effectiveness and found that the most prevalent factor was team cohesion as effected by physiological differences between men and women (Cawkill, 2009). This study used information from literature reviews, focus groups, subject matter experts (SME) and consulted the Defense Science and Technology Laboratory (Dstl) to confirm the validity of the results. The study listed three out of the 21 factors that contribute to combat effectiveness categorized as “difficult to mitigate:” morbidity, deployability, and survivability and lethality. The rest of the factors were improved by adding women, had neutral effects, or could be mitigated. Morbidity represents the rate of non-battle injuries; the study found that British women soldiers have an injury rate of about 15–20 percent higher than men. Deployability refers to medically qualifying for deployment; this study found women are ten times more likely to be nondeployable due to injury. Survivability and Lethality are estimated based on fatigue; this study describes women as fatiguing faster due to her smaller size while carrying the same combat load thus affecting their maneuverability and accuracy when utilizing a weapon (MOD, 2014). The ministry of defense has decided that integrating women increases risk but does not provide any gains therefore additional physiological research has been called for.

Several countries to include Norway, Canada, Denmark, Netherlands, France, Israel, and Germany have integrated women into direct combat occupations. (Cawkill, 2009) According to Cawkill et al. (2009), unfortunately, the number of women in combat roles is too small to provide statistical significance in an empirical examination of the effects of women on unit cohesion and operational effectiveness.

b. Australia

Australia opened all occupations to women in January of 2013 with an implementation deadline of 2016. Information about the integration of women into

occupations such as the infantry and special operations is unavailable at this time but as indicated in the RAND 2015 study on Implications of Integrating Women into the Marine Corps Infantry, an important challenge in the integration process is institutional commitment (Schaefer Et al., 2015). The current Australian Chief of Army is a Special Forces officer and his leadership commitment to integration is presented in an article published by the Australian Strategic Policy Institute leadership:

Campbell says the experience of the infantry in Western armies indicates that Australia could in time have about 80 women in combat roles in infantry units. “That’s 80 women dispersed over seven infantry battalions. I’m very comfortable with that. I don’t mind how many women join the infantry other than that they pass the physical employment standard (developed by the Defense Science and Technology Group) and that they are volunteers,” Campbell says. And I don’t mind how many women join any other part of the force because I know the more competition there is for employment, the more I have to choose from and the greater will be the talent and skills and abilities of the Army. (Nicholson, 2017)

This article continues to state how women have served in combat such as chinook helicopter pilots. Also, women have been members of boarding parties for counter-piracy operations (Nicholson, 2017). Women are already in combat but there is more work to be done.

c. *Canada*

Canada, for example, has had no gender limitations since 1989 (year 2000 for submarines) but there is no information on whether any women have ever qualified and served in the elite Joint Task Force 2 a special operations command (“Women Canadian Armed Forces,” 2014). According to a news publication on the Canadian government website, women make up about 14.8 percent of the active and reserve force and 2.4 percent of active duty combat arms (5.6 percent of reserves) (“Women Canadian Armed Forces,” 2014).

d. *Norway*

A study conducted by Dahl, Kotsadam, and Root (2018) on Norwegian military recruits, indicates that male recruit perceptions of female recruit’s abilities and

contributions increase by 14 percentage points when units are integrated. Men in the integrated units perceive that mixed gender units perform equally as well as or better than male only units. Dahl, Kotsadam, and Rooth (2018) observe: “These findings provide evidence that even in a highly gender-skewed environment, gender stereotypes are malleable and can be altered by integrating members of the opposite sex.”

Norway authorized women to serve in combat roles in 1984 and established in 2014, an all-female yearlong special forces training program and all-female unit called Jegertroppen or “Hunter Troop” (Angerer, 2017). The military commanders saw an operational need for elite trained women for use during deployments in combat zones to interact with women and gather intelligence (Angerer, 2017). Women are authorized to serve in the regular special forces but none have qualified. Also in 2014, Norway passed ground-breaking legislation by including women in conscript service, the first North Atlantic Treaty Organization (NATO) country to do so (Permanent Delegation of Norway (PDN), 2017). Universal conscription has given the Ministry of Defense the ability to increase female representation from 18 percent per class to 25 percent in the current class of recruits (women make up 10.8 percent of the military currently) (PDN, 2017). Norway recognizes that by increasing the representation of women and not excluding half the nation’s population the armed forces have the opportunity to take advantage of recruiting the most competent citizens thereby increasing combat effectiveness (PDN, 2017). Additionally, they recognize that by creating a more gender balanced force several positive changes occur. These include expanded citizen knowledge of the armed forces, broader knowledge and skills are brought into the force, and the work environment changes in a positive way (PDN, 2017). Statistics provided by Colonel Botillen (2017) of the Norwegian armed forces:

Statistics from the first class of universal conscripts:

- 43 percent of all conscripts live in mixed sex rooms, 63 percent of the women live in mixed sex rooms.
- 85 percent of all conscripts living in mixed sex rooms are positive to it, 72 percent of all conscripts not living in mixed sex rooms are positive to it.

– 84 percent of all conscripts would have completed compulsory military service if it was voluntary, 90 percent of the women would have completed compulsory service if it was voluntary.” (n.p.)

Integrated living arrangements have been established in some units for many years now and is seen as normal. Service members also report that mixed sex rooms have reduced the instances of sexual harassment/assault (Wooten, 2015).

e. Israel

Israeli commanders have recognized that women often exhibit superior skills in areas such as discipline and motivation, maintaining alertness, shooting abilities, managing tasks in an organized manner, and displaying knowledge and professionalism in the use of weapons. (Wooten, 2015)

Women in combat arms occupations of the IDF don’t actually deploy outside the borders of Israel. They are typically placed in the border patrol along countries that Israel has peace treaties with like Egypt and Jordan (Cawkill, 2009). Additionally, even after incorporating the first woman in 1995 there still exist significant barriers and inequalities for women as traditional roles and stigmas limit how a woman is allowed to serve. Caspit (2017) a reporter for the Al-Monitor news outlet wrote,

Regular troops in compulsory service can refuse to serve with women and this will be respected by the IDF. One thing protecting the female’s right to serve in the IDF is the fact that Israeli men volunteering to serve in combat units is declining necessitating the use of women to fill border patrol units so that men can be freed to deploy for war.

7. Domestic Military Integration

This section provides an overview of the progress of integration in the U.S. military. Each of the armed services have used RAND Corp. to research the effects of gender integration.

a. Army Gender Integration Study

A gender integration study was conducted over a two-year period by the Army’s Training and Doctrine Command Analysis Center. The study team used a method they called ‘triangulation’ to combine qualitative and quantitative data through the use of surveys, focus groups, and SME interviews. The investigators determined multivariate

regression analysis was unnecessary because they were able to collect enough evidence through descriptive statistics. After surveying over 60,000 soldiers, conducting 130 focus groups, and consulting SME among the senior leaders of the Army, the authors compiled a short list of priority concerns that must be addressed to mitigate risks and more effectively integrate women into combat roles. The authors of the study advised Headquarters, U. S. Army to continue to progress with gender integration but concluded that several final recommendations should be utilized to mitigate risks.

The most important concern to the study population, was the establishment of gender-neutral MOS-specific physical standards. The respondents believe standards must remain high to avoid unnecessary loss of life (Arnhart, 2015). Those surveyed fear the standards will be lowered to integrate women especially if a mandatory population level is established (Arnhart, 2015). Related to this were concerns of higher injury rates in women, pregnancy, and promotion equality effecting unit readiness and morale.

Second, the Sexual Harassment and Assault Response and Prevention (SHARP) program needs a robust review of strategies to help soldiers address concerns in this area. Men are afraid of false accusations by women and women are afraid of being harassed and/or assaulted (Arnhart, 2015). According to Arnhart (2015), 38 percent of female soldiers say they would not pursue a combat role because of this perceived inhospitable environment. Many male soldiers reported having been taught by their chain of command to avoid all but required contact with female soldiers (Arnhart, 2015). One of the recommendations is to assign women together.

Third, ground combat arms units fear a reduction in unit cohesion if women are permitted to join their ranks (Arnhart, 2015). With the current hyper masculine command climate of the all-male units, men fear they will no longer be able to bond with “locker room” talk or other activities that may constitute sexual harassment or equal opportunity issues (Arnhart, 2015).

b. Marine Corps Integration

A thesis completed by Dove and Richmond in 2017 estimated logistic and multinomial logistic regression models and found that physical health and performance

account for almost 80 percent of failures at the Marine Corps' Infantry Training Battalion. They suggest that physical fitness is the most important requirement prior to sending Marines to this school to qualify to serve in the infantry.

A 2015 RAND study using regression analysis predicts that women will likely increase by 75–100 per year in the next few years. This is calculated by looking at data of the total number of accessions over time. (Schaefer et al., 2015)

Women have already proved their ability to physically and mentally qualify for a myriad of previously closed MOSs. Some achievements are listed below:

- Five female officers have completed the Army's Ranger Course (Myers, 2017a),
- ten lieutenants graduated from the Army Infantry Basic Officer Leaders Course (Myers, 2017a),
- one female has graduated special operations school to serve with the elite 75th Ranger Regiment (Myers, 2017b),
- six women have earned the Army's expert infantryman badge (Myers, 2017c),
- one female officer has completed the Marine Corps Infantry Officer Course (HQMC, 2017a),
- one female officer has graduated from the Marine Corps Amphibian Assault course (HQMC, 2017b),
- hundreds of enlisted female Marines have qualified for previously closed combat arms occupations (Seck, 2017), and
- in the Navy women have been integrated in to submarine units. (Navy Personnel Command, 2017)

U.S. Senator Tammy Duckworth is quoted in a *Task & Purpose* article as saying,

“This historic achievement is a reminder of the great things we can achieve when women are seen and treated as equals and given the same chance to contribute to their country.” The Democrat from Illinois was among the first Army women to fly combat missions during Operation Iraqi Freedom. (Dolasinski, 2018)

Results of the Ground Combat Element Integration Task Force study approved by Colonel Moore in a report on 14 August 2015 lists disparaging findings on the success of women in the study. The conclusions are that women are less capable than men in the areas of “performance, fatigue, workload, and cohesion” (Moore, 2015). Additionally, gender integrated units perform worse than all-male units, and women obtain higher injuries than men.

C. PART 3. MILITARY TO CIVILIAN OCCUPATION CROSSWALK RESEARCH

The DOL has created resources for workers interested in transitioning occupations. A website called My Next Move for Veterans (MNMV) was developed by Occupational Information Network (O*NET) for the DOL. This website uses comparisons of job tasks or duties supplemented with expert opinions to provide civilian occupation matches for veterans and military members who are searching for a job as they transition to the civilian sector. Creating matches between the military and civilian occupations is also known as a “crosswalk” of occupations.

A research and analysis study conducted by RAND in 2017 titled “Helping Soldiers Leverage Army Knowledge, Skills, and Abilities in Civilian Jobs,” surveyed 1,128 active duty enlisted Army soldiers. The surveys used in the analysis were the same surveys generated by O*NET for civilian occupation analysis but instead in this study applied to military members (Wenger et al., 2017). The O*NET database contains information on 761 civilian occupations covering the modules and content areas provided in Table 8 (Wenger et al., 2017). The RAND study on military occupations only used the asterisked modules in the table because the other areas were not conducive to survey analysis or must be tailored to each occupation (Wenger et al., 2017).

Table 8. O*NET Modules and Content Areas. Source: Wenger et al. (2017).

Worker-Oriented Modules	Job-Oriented Modules
1. Worker Characteristics Abilities* Occupational interests Work values Work styles*	4. Occupational Requirements Work activities* Organizational context Work context*
2. Worker Requirements Skills* Knowledge* Education	5. Workforce Characteristics Labor market information Occupational outlook
3. Experience Requirements Education and training * Basic skills – entry requirements Cross functional skills – entry requirements Licensing	6. Occupation-Specific Information Tasks Tools Technology

SOURCE: O*NET Resource Center (undated).

* Indicates module was administered to Army enlisted personnel.

The survey enabled the research group to compare knowledge, skills, and abilities (KSAs), work style, work context, and work activities (both technical and nontechnical attributes of workers and occupations). Figure 3 defines the categories used in the survey and lists the number of questions in each.

Figure 3. Definition of Categories Surveyed. Source: Wenger et al. (2017).

- Knowledge (33 questions): sets of facts and principles needed to address problems and issues that are part of a job.
- Skills (35 questions): the abilities to perform a task well, usually developed over time through training or experience.
- Abilities (52 questions): enduring talents that can help a person do a job.
- Work Activities (41 questions): a set of similar actions that are performed together in many different jobs.
- Work Context (57 questions): work setting and its possible hazards, pace of work, and dealings with other people.
- Work Styles (16 questions): personal characteristics that can affect how well someone does a job.

The output from the RAND research is a better crosswalk than the website MNMV because it takes into account additional information such as soft skills or nontechnical skills (leadership, team work, coaching, mentoring, persistence, and attention to detail), job density in the U.S. economy, median wage, and the fact that most enlisted leaving the service have less than a Bachelor's degree when determining good matches (Hardison et al., 2017).

To quantify the outcomes of the survey and goodness of fit for each occupation RAND Corp created a distance measurement and rescaled the data to fit on a scale from zero to 100 for each occupation and designated a score of 80 and above as a good match. A score of zero being the worst match and 100 a perfect match. A simplified explanation of the scale is if a civilian occupation scored a zero the civilian survey respondents for that occupation would have answered the questions exactly opposite the military survey respondents, which means that the KSAs and work attributes would have been listed in opposing levels of importance.

The crosswalk developed in this study is still not perfect as there may be heterogeneity among sub-MOS categories such as paygrades because of the small sample sizes (Hardison et al., 2017). Additionally, there is still work to be done as the researchers were only able to obtain a sufficient sample size for 10 MOSs that make up 40 percent of the Army's active duty force (Hardison et al., 2017). The MOSs analyzed include: "infantryman, combat engineer, cannon crewmember, cavalry scout, armor crewman, military police, intelligence analyst, health care specialist, wheeled vehicle mechanic, and unit supply specialist" (Hardison, et al., 2017).

Table 9 is an example crosswalk output for an infantryman. The best match for an infantryman is a firefighter. Firefighters prioritized the same KSA's and work attributes that infantrymen prioritized, see Table 10. Additionally, the density of the number of jobs in the U.S. economy is large the median wage is appropriate, and the education level only requires a high school diploma. MNMV does not list firefighter for any of the MOSs analyzed in this study but it is a top general choice for all MOSs in the study (Hardison et al., 2017). Firefighters listed priorities such as close-knit teamwork, clear communication, and coordination when fighting a fire, which is very similar to what the infantrymen

surveyed listed. MNMV does recommend police work as one of the top choices but police officers tend to work independently or with a two or three-person team and rarely coordinate large team actions (Hardison et al., 2017).

Table 9. RAND Study Output for Infantryman Compared to My Next Move for Veterans. Source: Wenger Et al. (2017).

12 High-Quality Civilian Occupation Matches for Infantrymen (MOS 11B)						
Civilian Occupation	Number of U.S. Jobs	Median Wages	Education at Entry	Distance Metric	My Next Move for Veterans	Distance Metric
Firefighters	308,790	\$45,970	High school diploma	93	Construction laborers (E1)	64
Captains, mates, and pilots of water vessels	30,690	\$72,340	Postsecondary certification	88	Correctional officers and jailers (E4)	76
First-line supervisors of fire fighting and prevention workers	59,870	\$70,670	High school diploma	86	Light truck or delivery service drivers (E4)	49
First-line supervisors of mechanics, installers, and repairers	434,810	\$62,150	High school diploma	84	Maintenance workers, machinery (E4)	64
Septic tank servicers and sewer pipe cleaners	24,350	\$34,810	Less than high school	83	Police and sheriff's patrol officers (E4)	80
Millwrights	39,290	\$50,460	High school diploma	82	Probation officers and correctional treatment specialists (E4)	55
Fire inspectors and investigators	11,370	\$56,130	Some college	82	Security guards (E4)	42
Aircraft cargo handling supervisors	5,750	\$47,760	High school diploma	81	Supervisors of correctional officers (E5)	71
Ship engineers	10,060	\$68,100	Postsecondary certification	81	Supervisors of transportation machine and vehicle operators (E5)	79
Structural iron and steel workers	60,010	\$48,200	High school diploma	80	Training and development specialists (E6)	53
Manufactured building and mobile home installers	3,280	\$29,600	Less than high school	80	Training and development managers (E7)	56
Police and sheriff's patrol officers	638,810	\$56,810	High school diploma	80	Emergency management directors (E7)	73

Table 10. Top-Rated Occupation Attributes for Firefighters and Infantrymen's Ratings of Those Attributes. Source: Wenger et al. (2017).

Knowledge (33 Questions)	Skills (35 Questions)	Abilities (52 Questions)
Customer and personal service (15)	Coordination (7)	Problem sensitivity (20)
Public safety and security (1)	Monitoring (11)	Reaction time (5)
Education and training (3)	Active listening (5)	Oral comprehension (34)
Mechanical (4)	Critical thinking (3)	Static strength (7)
Geography (2)	Speaking (8)	Multi-limb coordination (43)
		Oral expression (30)
		Manual dexterity (18)
		Trunk strength (4)
Work Activities (41 Questions)	Work Context (57 Questions)	Work Styles (16 Questions)
Performing general physical activities (1)	Wear common protective or safety equipment (12)	Dependability (4)
Handling and moving objects (5)	In an enclosed vehicle or equipment (19)	Cooperation (8)
Operating vehicles, mechanized devices, or equipment (9)	Face-to-face discussions (3)	Stress tolerance (1)
Monitor processes, materials, or surroundings (17)	Freedom to make decisions (34)	Self-control (6)
Making decisions and solving problems (2)	Responsible for others' health and safety (8)	Integrity (5)
	Work with work group or team (2)	
	Outdoors, exposed to weather (4)	
	Impact of decisions on co-workers or company results (20)	

NOTES: Attributes are listed in the order they are ranked by firefighters. Rankings by infantrymen are shown in parentheses. Soft skills are shown in shaded cells.

The richness of data from the surveys both in this study and the O*NET database can help military personnel better translate their skills and experience to civilian employers

and help employers understand the skills military members have. Crosswalk tools should take into account the soft skills military members obtain during their service (Hardison et al., 2017).

A second occupational crosswalk tool called Veterans and Military Occupational Finder utilizes Holland personality types to allow users to understand how they might apply skills developed in the military in a civilian occupation. Each of the six personality codes [realistic(R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C)] corresponds to personality traits and occupation types. Users take an assessment to determine their personality type and compare this code with codes provided in a one to one military to civilian occupation crosswalk to explore aspects of the job they had in the military that they like and dislike. This information is used to explore occupations that the user might aspire to do (Messer, n.d.). Table 11 is a sample of the handbook, which shows a Marine Corps Combat Engineer would be a match for a Civilian Construction Carpenter with a Holland Occupation Code of RC. The realistic (R) type is described below the table.

Table 11. Veterans and Military Occupation Finder Holland Occupation Codes.
Source: Messer et al. (n.d.)

MOC	Military Title	O*NET Code	O*NET Title	HOC
1371	Combat Engineer	47-2031.01	Construction Carpenter	RC
1302	Combat Engineer Officer	17-2051.00	Civil Engineer	IR
4641	Combat Photographer	27-4021.00	Photographer	AR

Realistic (R) types usually have mechanical and athletic abilities; they like to work outdoors and with tools and machines. They typically like to work with things more than with people. The R type is described as conforming, frank, genuine, hardheaded, honest, humble, materialistic, modest, natural, normal, persistent, practical, shy, and thrifty. Realistic occupations include skilled trades, technical occupations, and some service occupations.

Another study completed by RAND Corp. in 2017 titled “What Veterans Bring to Civilian Workplaces: A Prototype Toolkit” identifies skills that Marines obtain through courses and on-the-job training to help translate military KSAs to those found in the civilian sector.

Table 12 lists the top nontechnical skills obtained by Marines in various career courses such as corporal’s course, Table 13 depicts how critical each nontechnical skill is

to performing in the infantry and artillery, and Appendix A is a handout for employers, which also includes a description of each attribute in detail and provides vignettes that are extremely helpful in translating the experiences and soft skills that veterans have.

Table 12. Summary of Top Nontechnical Skills Addressed in Marine Corps Courses. Source: Hardison et al. (2017).

Skill Addressed	Recruit Training (entry-level personnel E-1–E-2) ^a	Corporals Course (mid-level personnel: E-4) ^b	Sergeants Course (mid- to senior- level personnel: E-5) ^b	Career Course (senior-level personnel: E-6) ^b	Advanced Course (senior-level personnel: E-7) ^b
Handling work stress	See note a				
Being dependable and reliable	See note a				
Persistence	See note a				
Interpersonal skills	See note a				
Conscientiousness and attention to detail	See note a				
Teamwork and team-building		◆			
Critical thinking		◆	◆	◆	
Leading, motivating, and inspiring others to accomplish organizational goals		◆	◆	◆	
Oral communication			◆	◆	
Written communication			◆	◆	
Decisionmaking/decisiveness			◆	◆	◆
Training others			◆		◆

NOTES: The absence of a ◆ does NOT indicate that instruction in the skill is absent from the course, only that it was not among the “top skills” most emphasized in the course according to the SMEs interviewed. See www.rand.org/t/RR1919 for a full description of the methodology used to construct the table. Table information describes the courses during the 2014 to 2015 time frame during which this study was conducted. Courses before or after that period may differ.

^a Recruit Training materials were not available in our pilot study. We anticipate that a review of those materials would produce results similar to those found in the Army. However, this premise has not yet been confirmed.

^b Completed by most, but not all Marines.

Table 13. Summary of Nontechnical Skills Utilized in Marine Corps On-the-Job Experiences. Hardison et al. (2017).

Tier	Nontechnical Skill	E-4 (mid-level personnel)		E-5 (mid- to senior-level personnel)		E-6 (senior-level personnel)	
		Infantry (n≈43)	Artillery (n≈46)	Infantry (n≈49)	Artillery (n≈26)	Infantry (n≈22)	Artillery (n≈18)
I	Decisionmaking/decisiveness	■	■	■	■	■	■
	Being dependable and reliable	■	■	■	□	■	■
	Critical thinking	■	■	■	■	■	▲
	Leading, motivating, and inspiring others	■	□	■	■	■	□
	Training others	□	■	■	■	□	■
	Oral communication	□	■	□	▲	■	□
	Managing/supervising the work of others	□	■	▲	■	■	■
	Situational awareness	□	□	□	■	□	□
II	Teamwork and team-building	■	■	▲	□	▲	■
	Adaptability	□	▲	■	▲	■	■
	Operating safely	▲	■	▲	□	▲	■
	Handling work stress	□	■	▲	□	▲	■
	Continuous learning	□	■	▲	□	▲	□
	Conscientiousness and attention to detail	□		□	□	■	□
III	Behaving ethically	▲	▲	▲	▲	▲	▲
	Interpersonal skills	▲	▲	▲	▲	▲	▲
	Persistence	▲	▲	▲	▲	▲	▲
	Project planning	▲	▲	▲	▲	▲	▲
	Written communication	▲	▲	▲	▲	▲	▲

NOTES: ■ = Top most critical skills; □ = Next most critical skills; ▲ = Remaining critical skills.

The topics discussed in the literature review are important for understanding the roles women have in today's economy and the potential of their future employment. Trends such as the decline in the polarization of gender dominated fields in the civilian sector and militaries around the globe recognizing the benefits of gender integration in combat arms

occupations provide a positive outlook for increasing female representation in the Marine Corps. Identifying how Marine Corps occupations can translate into civilian occupations is essential for identifying how the number of women in civilian sector occupations might reflect a feasible upper bound in military occupations recently opened to women.

I use the military crosswalk generated by O*NET in addition the crosswalk created by Wenger et al. to identify civilian counterparts in census data extracted from IPUMS. These crosswalks establish a link to evaluate how the percentage of women in civilian occupations might forecast a possible female representation level in the U.S. Marine Corps.

The next chapter explains my methodology for applying the previously obtained crosswalks and historical economic trends in women workplace representation to expand upon and analyze the potential of women's representation in U.S. Marine Corps occupational fields.

III. DATA / METHODOLOGY

In order to better forecast potential female representation across the USMC occupational fields, I first develop an MOS to Standard Occupational Classification (SOC) crosswalk, I then examine gender representation levels in each MOS and SOC, as a percent male/female for both civilian and military occupational fields, using the framework of hedonic regressions. Section A describes the process of creating the occupational crosswalk in detail. Section B contains the methodology used to estimate regression models relating skills and abilities required to perform civilian occupations with USMC MOSs.

A. CROSSWALK DEVELOPMENT

The SOC is used by federal agencies to classify workers into occupational categories for statistical analysis (BLS, 2018a). Data for occupational analysis is collected through the U.S. Census and made available to the public on the Integrated Public Use Microdata Series (IPUMS) website and my data extract from IPUMS is credited to Ruggles et al. (2017). Additionally, I use data on U.S. Marine Corps personnel maintained in the Total Force Data Warehouse (TFDW). It is important to note that female representation extracted from the TFDW is based on the end of the calendar year statistics.

Starting with information contained in the U.S. Marine Corps MOS Manual, I begin Table 14 by working through each occupational field in the manual and identifying primary MOSs (PMOS) for group I commissioned officers only (group I officers are unrestricted regular/reserve officers, group II are limited duty officers, and group III are warrant officers) and PMOS for enlisted that can be fulfilled by those in grades Sergeant and below (I do not use PMOS designated for senior enlisted only). I make this distinction because the primary group of interest are first term Marines for whom the USMC competes with the civilian market to recruit and retain. This is also the primary group, from which female Marines would access into previously closed direct combat MOSs. Additionally, I am only interested in primary MOSs because additional, exception, free, and necessary MOSs require a PMOS to be on record in addition to supplementary training or experience. Appendix A contains the glossary and business rules for the USMC MOS manual, which

defines the different types of MOSs. Basic MOSs are only applicable after initial recruit training during follow on training and education prior to fleet assignment. All of these are excluded to capture the primary population of interest and for best comparison with the civilian labor market. Appendix B lists the MOS groups I create and SOC titles with their associated code. I group similar MOSs in each occupational field, show in Table 15, when they satisfy one or a combination of the following: they are designated as related MOSs in the MOS Manual, have similar descriptions in the manual, have the same or similar top SOCs, or top matches identified by MNMV. Over the past 17 years, the USMC occupational fields and MOSs have undergone several reclassifications. The following resources were referenced to better map reclassifications of MOSs over the years: NAVMC 1200.1C, NAVMC 1200.1B, NAVMC 1200.1A Ch1, MCO 1200.17E, MarAdmin 484/17, MarAdmin 490/17, MarAdmin 495/17, MarAdmin 305/12, MarAdmin 430/17, and MarAdmin 497/14. To better represent gender changes over this time period obsolete MOSs are included in Tables 14, 15, and 16. In appendix C I list the source for the SOC crosswalk designation. A majority of the SOCs are delineated in the calendar year 2018 MOS manual. Although, some of those listed as sourced from the MOS manual in appendix C may have originated with the related SOC in the MOS manual but because not every available O*NET SOC is available in the IPUMS census data I had to choose the closest related SOC provided in the IPUMS data warehouse. Therefore, some SOCs listed as sourced from the MOS manual do not exactly match the MOS manual listing.

Table 14. MOS to SOC Crosswalk with Gender Representation Levels

United States Marine Corps TFDOW													U.S. Census Data IPUMS							
		2017		2015		2010		2005		2000			2015		2010		2005		2000	
MOS	# in MOS	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	MOS Manual SOC	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male
01XX Manpower & Administration																				
grp1	O 457	32.2%	67.8%	31.0%	69.0%	33.1%	66.9%	31.2%	68.8%	29.3%	70.7%	11-3131	59.1%	40.9%	48.5%	51.5%	58.2%	41.8%	55.1%	44.9%
grp2	E 6,074	23.4%	76.6%	21.6%	78.4%	22.8%	77.2%	15.9%	84.1%	13.2%	86.8%	43-4161	80.2%	19.8%	80.7%	19.3%	84.6%	15.4%	75.1%	24.9%
02XX Intelligence																				
grp1	O 754	10.1%	89.9%	8.4%	91.6%	5.6%	94.4%	6.6%	93.4%	5.5%	94.5%	11-1021	30.8%	69.2%	29.2%	70.8%	27.6%	72.4%	26.3%	73.7%
0203	O 216	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-1021	3.8%	96.2%	4.1%	95.9%	5.2%	94.8%	8.8%	91.2%
grp2	O 134	13.4%	86.6%	10.2%	89.8%	10.1%	89.9%	7.9%	92.1%	9.2%	90.8%	33-1012	14.8%	85.2%	15.1%	84.9%	14.6%	85.4%	12.2%	87.8%
0211	E 529	4.0%	96.0%	2.6%	97.4%	0.7%	99.3%	0.0%	100.0%	0.0%	100.0%	17-1021	21.4%	78.6%	19.2%	80.8%	18.2%	81.8%	18.5%	81.5%
0231	E 2,072	14.8%	85.2%	13.3%	86.7%	14.6%	85.4%	11.6%	88.4%	7.9%	92.1%	33-3021	25.5%	74.5%	24.0%	76.0%	27.6%	72.4%	20.8%	79.2%
grp3	E 618	11.5%	88.5%	11.0%	89.0%	10.1%	89.9%	8.1%	91.9%	7.3%	92.7%	17-3031	9.9%	90.1%	9.5%	90.5%	9.9%	90.1%	8.4%	91.6%
03XX Infantry																				
0302	O 1,981	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-1021	3.8%	96.2%	4.1%	95.9%	5.2%	94.8%	2.8%	97.2%
0370	O 178	0.0%	100.0%	0.0%	100.0%	N/A	N/A	N/A	N/A	N/A	N/A	47-1011	2.8%	97.2%	2.9%	97.1%	3.0%	97.0%	2.7%	97.3%
grp1	E 21,097	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-2011	4.5%	95.5%	4.0%	96.0%	4.2%	95.8%	3.5%	96.5%
grp2	E 1,499	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	53-5020	6.2%	93.8%	3.8%	96.2%	2.8%	97.2%	3.9%	96.1%
04XX Logistics																				
0402	O 1,499	15.3%	84.7%	15.2%	84.8%	11.9%	88.1%	11.5%	88.5%	10.8%	89.2%	13-1081	33.7%	66.3%	33.6%	66.4%	34.6%	65.4%	32.8%	67.2%
0411	E 943	17.5%	82.5%	17.2%	82.8%	16.5%	83.5%	16.0%	84.0%	17.4%	82.6%	11-3051	20.1%	79.9%	18.0%	82.0%	16.1%	83.9%	16.2%	83.8%
grp1	E 2,156	13.1%	86.9%	12.2%	87.8%	9.6%	90.4%	8.6%	91.4%	8.9%	91.1%	43-5011	29.8%	70.2%	31.4%	68.6%	35.2%	64.8%	24.6%	75.4%
0451	E 241	8.3%	91.7%	7.5%	92.5%	5.8%	94.2%	7.5%	92.5%	4.8%	95.2%	53-2010	6.1%	93.9%	4.8%	95.2%	5.8%	94.2%	4.1%	95.9%
0471	E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	39-4031	27.1%	72.9%	18.5%	81.5%	30.7%	69.3%	28.4%	71.6%
05XX MAGTF Plans																				
0511	E 300	12.3%	87.7%	11.6%	88.4%	9.6%	90.4%	7.6%	92.4%	14.2%	85.8%	43-5061	58.8%	41.2%	57.2%	42.8%	56.1%	43.9%	53.1%	46.9%
0532	E 1	0.0%	100.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13-1199	56.7%	43.3%	57.1%	42.9%	63.3%	36.7%	56.2%	43.8%
06XX Communications																				
0602	O 1,027	9.5%	90.5%	8.6%	91.4%	7.4%	92.6%	7.6%	92.4%	7.5%	92.5%	11-1021	30.8%	69.2%	29.2%	70.8%	27.6%	72.4%	26.3%	73.7%
grp1	E 5,056	8.8%	91.2%	10.0%	90.0%	10.1%	89.9%	8.7%	91.3%	4.0%	96.0%	2740XX	10.0%	90.0%	11.9%	88.1%	12.0%	88.0%	14.2%	85.8%
grp2	E 4,344	8.1%	91.9%	8.1%	91.9%	7.3%	92.7%	8.8%	91.2%	5.9%	94.1%	49-209X	6.8%	93.2%	4.5%	95.5%	3.8%	96.2%	6.6%	93.4%
08XX Field Artillery																				
0802	O 833	0.6%	99.4%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	47-1011	2.8%	97.2%	2.9%	97.1%	3.0%	97.0%	2.7%	97.3%
0811	E 1,852	0.1%	99.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	53-5020	6.2%	93.8%	3.8%	96.2%	2.8%	97.2%	3.9%	96.1%
grp1	E 822	0.8%	99.2%	0.1%	99.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	43-9011	44.8%	55.2%	48.8%	51.2%	49.0%	51.0%	51.6%	48.4%
11XX Utilities																				
grp1	E 1,410	9.1%	90.9%	8.2%	91.8%	10.7%	89.3%	14.0%	86.0%	13.0%	87.0%	47-2111	2.1%	97.9%	2.2%	97.8%	2.3%	97.7%	2.6%	97.4%
1161	E 391	2.6%	97.4%	2.9%	97.1%	1.6%	98.4%	1.8%	98.2%	0.8%	99.2%	49-9021	1.1%	98.9%	1.2%	98.8%	1.5%	98.5%	1.9%	98.1%
1171	E 683	10.2%	89.8%	11.0%	89.0%	7.8%	92.2%	10.7%	89.3%	7.4%	92.6%	51-8031	5.0%	95.0%	4.9%	95.1%	5.4%	94.6%	5.6%	94.4%
13XX Engineer, Construction, Facilities, and Equipment																				
1302	O 577	10.4%	89.6%	10.0%	90.0%	8.3%	91.7%	9.1%	90.9%	6.2%	93.8%	11-9021	7.4%	92.6%	7.2%	92.8%	7.4%	92.6%	6.7%	93.3%
1316	E 256	5.9%	94.1%	6.0%	94.0%	2.2%	97.8%	3.3%	96.7%	2.8%	97.2%	51-4120	5.1%	94.9%	5.4%	94.6%	6.4%	93.6%	7.1%	92.9%
1341	E 1,248	5.4%	94.6%	6.1%	93.9%	3.3%	96.7%	2.7%	97.3%	3.1%	96.9%	49-3031	1.2%	98.8%	1.2%	98.8%	1.6%	98.4%	1.2%	98.8%
1345	E 1,569	5.7%	94.3%	4.2%	95.8%	0.9%	99.1%	0.7%	99.3%	1.6%	98.4%	47-1011	2.8%	97.2%	2.9%	97.1%	3.0%	97.0%	2.7%	97.3%
1361	E 119	9.2%	90.8%	6.3%	93.8%	2.7%	97.3%	2.5%	97.5%	15.8%	84.2%	17-1010	27.4%	72.6%	27.2%	72.8%	23.6%	76.4%	21.1%	78.9%
1371	E 3,009	4.2%	95.8%	5.7%	94.3%	2.5%	97.5%	1.9%	98.1%	1.2%	98.8%	47-5031	9.3%	90.7%	9.3%	90.7%	9.2%	90.8%	7.0%	93.0%
1391	E 1,416	6.9%	93.1%	7.5%	92.5%	5.3%	94.7%	5.2%	94.8%	8.2%	91.8%	53-7070	5.3%	94.7%	2.9%	97.1%	4.5%	95.5%	3.5%	96.5%
18XX Tank, Assault Amphibious Vehicle and Amphibious Combat Vehicle																				
grp1	O 311	0.3%	99.7%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-1021	3.8%	96.2%	4.1%	95.9%	5.2%	94.8%	2.8%	97.2%
grp2	E 1,742	0.2%	99.8%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-2011	4.5%	95.5%	4.0%	96.0%	4.2%	95.8%	3.5%	96.5%
21XX Ground Ordnance Maintenance																				
grp1	E 1,559	4.6%	95.4%	3.9%	96.1%	3.2%	96.8%	2.6%	97.4%	3.9%	96.1%	49-9098	6.7%	93.3%	6.7%	93.3%	6.9%	93.1%	11.7%	88.3%
grp2	E 1,199	0.3%	99.7%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.1%	99.9%	49-3031	1.2%	98.8%	1.2%	98.8%	1.6%	98.4%	1.2%	98.8%
2161	E 149	2.7%	97.3%	1.2%	98.8%	1.8%	98.2%	1.3%	98.7%	0.7%	99.3%	51-4041	4.5%	95.5%	4.3%	95.7%	5.5%	94.5%	5.4%	94.6%
2171	E 455	1.1%	98.9%	1.2%	98.8%	1.4%	98.6%	3.7%	96.3%	3.2%	96.8%	49-9060	11.2%	88.8%	10.5%	89.5%	10.0%	90.0%	11.8%	88.2%
23XX Ammunition & Explosive Ordnance Disposal																				
2311	E 1403	18.5%	81.5%	15.9%	84.1%	13.2%	86.8%	13.4%	86.6%	11.4%	88.6%	47-5031	9.3%	90.7%	9.3%	90.7%	9.2%	90.8%	7.0%	93.0%
26XX Signals Intelligence/Ground Electronic Warfare																				
grp1	E 1,648	10.6%	89.4%	9.4%	90.6%	9.2%	90.8%	8.6%	91.4%	9.1%	90.9%	43-9011	44.8%	55.2%	48.8%	51.2%	49.0%	51.0%	51.6%	48.4%
grp2	E 571	15.3%	84.7%	12.6%	87.4%	16.0%	84.0%	14.0%	86.0%	14.5%	85.5%	2740XX	10.0%	90.0%	11.9%	88.1%	12.0%	88.0%	14.2%	85.8%
28XX Ground Electronics Maintenance																				
grp1	E 2,603	5.2%	94.8%	4.5%	95.5%	2.5%	97.5%	2.5%	97.5%	3.1%	96.9%	49-2020	9.7%	90.3%	12.4%	87.6%	11.7%	88.3%	12.9%	87.1%
30XX Supply Chain Material Management																				
3002	O 616	14.1%	85.9%	12.5%	87.5%	10.4%	89.6%	11.4%	88.6%	9.2%	90.8%	11-3061	47.2%	52.8%	45.0%	55.0%	11.7%	88.3%	40.2%	59.8%
3043	E 3,259	21.4%	78.6%	20.6%	79.4%	19.4%	80.6%	14.5%	85.5%	13.8%	86.2%	43-5081	34.4%	65.6%	36.7%	63.3%	36.5%	63.5%	35.7%	64.3%
3051	E 2,106	25.9%	74.1%	27.1%	72.9%	19.5%	80.5%	17.4%	82.6%	10.2%	89.8%	43-5011	29.8%	70.2%	31.4%	68.6%	35.2%	64.8%	24.6%	75.4%
3052	E 198	23.2%	76.8%	20.3%	79.7%	22.0%	78.0%	24.8%	75.2%	14.9%	85.1%	51-9111	53.9%	46.1%	57.1%	42.9%	56.6%	43.4%	58.4%	41.6%

United States Marine Corps TFDW												U.S. Census Data IPUMS									
2017				2015		2010		2005		2000		MOS Manual SOC	2015		2010		2005		2000		
MOS	# in MOS	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male		% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	
31XX Distribution Management																					
3112 E	510	26.3%	73.7%	25.1%	74.9%	18.4%	81.6%	17.1%	82.9%	14.9%	85.1%	13-1081	33.7%	66.3%	33.6%	66.4%	34.6%	65.4%	32.8%	67.2%	
33XX Food Service																					
3381 E	1,881	23.9%	76.1%	20.1%	79.9%	14.1%	85.9%	13.2%	86.8%	12.7%	87.3%	35-2010	39.1%	60.9%	41.0%	59.0%	43.0%	57.0%	44.2%	55.8%	
34XX Financial Management																					
3404 O	279	14.3%	85.7%	10.7%	89.3%	9.3%	90.7%	11.3%	88.7%	15.4%	84.6%	11-3031	53.6%	46.4%	54.4%	45.6%	52.3%	47.7%	53.3%	46.7%	
3432 E	766	21.8%	78.2%	17.5%	82.5%	18.1%	81.9%	13.1%	86.9%	15.5%	84.5%	43-3051	88.1%	11.9%	90.2%	9.8%	89.4%	10.6%	89.1%	10.9%	
3451 E	334	9.6%	90.4%	11.0%	89.0%	13.6%	86.4%	16.3%	83.7%	14.5%	85.5%	43-3031	86.9%	13.1%	88.8%	11.2%	89.0%	11.0%	89.9%	10.1%	
35XX Motor Transport																					
3521 E	3,276	5.3%	94.7%	4.1%	95.9%	2.6%	97.4%	3.2%	96.8%	4.3%	95.7%	49-3023	1.5%	98.5%	1.4%	98.6%	2.0%	98.0%	2.0%	98.0%	
3531 E	6,968	10.6%	89.4%	8.9%	91.1%	4.5%	95.5%	5.6%	94.4%	6.7%	93.3%	53-3030	5.8%	94.2%	5.3%	94.7%	5.4%	94.6%	6.0%	94.0%	
44XX Legal Support																					
4402 O	536	13.1%	86.9%	13.5%	86.5%	12.5%	87.5%	10.7%	89.3%	7.1%	92.9%	23-10XX	40.1%	59.9%	36.7%	63.3%	35.1%	64.9%	30.7%	69.3%	
4421 E	459	23.1%	76.9%	21.3%	78.7%	23.2%	76.8%	16.2%	83.8%	16.7%	83.3%	23-2011	83.5%	16.5%	85.9%	14.1%	85.1%	14.9%	86.2%	13.8%	
45XX Communication Strategy & Operations																					
4502 O	145	33.1%	66.9%	29.1%	70.9%	23.1%	76.9%	25.0%	75.0%	21.4%	78.6%	11-2031	64.9%	35.1%	61.4%	38.6%	61.4%	38.6%	55.6%	44.4%	
4512 E	131	32.1%	67.9%	24.1%	75.9%	18.0%	82.0%	15.5%	84.5%	10.8%	89.2%	51-5113	41.9%	58.1%	49.4%	50.6%	19.8%	80.2%	17.2%	82.8%	
4531 E	276	34.4%	65.6%	28.1%	71.9%	25.0%	75.0%	19.9%	80.1%	22.1%	77.9%	27-3031	64.9%	35.1%	65.2%	34.8%	65.0%	35.0%	62.8%	37.2%	
grp1 E	321	37.5%	62.5%	29.3%	70.7%	19.0%	81.0%	19.8%	80.2%	11.3%	88.7%	27-4021	48.4%	51.6%	45.9%	54.1%	42.2%	57.8%	38.7%	61.3%	
55XX Music																					
grp1 E	642	13.1%	86.9%	12.8%	87.2%	14.1%	85.9%	16.1%	83.9%	N/A	N/A	27-2040	28.8%	71.2%	30.8%	69.2%	30.6%	69.4%	31.7%	68.3%	
57XX Chemical, Biological, Radiological & Nuclear (CBRN) Defense																					
5711 E	678	9.1%	90.9%	6.4%	93.6%	6.3%	93.7%	4.9%	95.1%	5.7%	94.3%	19-4031	33.1%	66.9%	36.5%	63.5%	36.1%	63.9%	33.6%	66.4%	
58XX Military Police, Investigations, & Corrections																					
5803 O	274	10.2%	89.8%	8.3%	91.7%	5.3%	94.7%	7.7%	92.3%	3.6%	96.4%	33-1012	28.7%	71.3%	27.1%	72.9%	26.5%	73.5%	25.0%	75.0%	
5811 E	2,985	10.1%	89.9%	8.3%	91.7%	6.1%	93.9%	7.4%	92.6%	6.2%	93.8%	33-3021	25.5%	74.5%	24.0%	76.0%	27.6%	72.4%	20.8%	79.2%	
5831 E	601	9.2%	90.8%	11.0%	89.0%	9.3%	90.7%	10.3%	89.7%	11.0%	89.0%	33-3010	27.3%	72.7%	28.2%	71.8%	27.5%	72.5%	26.2%	73.8%	
59XX Aviation Command and Control (C2) Electronics Maintenance																					
5939 E	184	4.3%	95.7%	4.0%	96.0%	4.6%	95.4%	1.4%	98.6%	7.7%	92.3%	27-40XX	10.0%	90.0%	11.9%	88.1%	12.0%	88.0%	14.2%	85.8%	
grp1 E	955	4.5%	95.5%	4.5%	95.5%	5.1%	94.9%	5.4%	94.6%	5.0%	95.0%	49-209X	6.8%	93.2%	4.5%	95.5%	3.8%	96.2%	6.6%	93.4%	
5951 E	57	7.0%	93.0%	3.9%	96.1%	N/A	N/A	N/A	N/A	N/A	N/A	49-9060	11.2%	88.8%	10.5%	89.5%	10.0%	90.0%	11.8%	88.2%	
60/61/62XX Aircraft Maintenance / Organizational Avionics Maintenance																					
6002 O	306	13.7%	86.3%	11.6%	88.4%	8.1%	91.9%	7.1%	92.9%	8.1%	91.9%	49-1011	7.3%	92.7%	7.4%	92.6%	8.1%	91.9%	14.2%	85.8%	
6042 E	317	21.1%	78.9%	22.4%	77.6%	16.8%	83.2%	8.9%	91.1%	18.9%	81.1%	51-4120	5.1%	94.9%	5.4%	94.6%	6.4%	93.6%	7.1%	92.9%	
6046 E	1,112	23.2%	76.8%	22.7%	77.3%	19.4%	80.6%	14.7%	85.3%	16.9%	83.1%	43-5061	58.8%	41.2%	57.2%	42.8%	56.1%	43.9%	53.1%	46.9%	
6048 E	1,044	5.7%	94.3%	4.5%	95.5%	4.2%	95.8%	3.4%	96.6%	8.3%	91.7%	49-9098	6.7%	93.3%	6.7%	93.3%	6.9%	93.1%	11.7%	88.3%	
grp1 E	7860	4.6%	95.4%	3.6%	96.4%	3.3%	96.7%	2.3%	97.7%	1.8%	98.2%	49-3011	5.5%	94.5%	4.9%	95.1%	5.2%	94.8%	5.2%	94.8%	
6073 E	955	4.6%	95.4%	5.5%	94.5%	2.4%	97.6%	2.5%	97.5%	3.1%	96.9%	49-3040	1.3%	98.7%	1.3%	98.7%	1.3%	98.7%	0.8%	99.2%	
6074 E	170	5.9%	94.1%	8.1%	91.9%	5.0%	95.0%	3.1%	96.9%	N/A	N/A	51-9010	11.0%	89.0%	13.7%	86.3%	10.6%	89.4%	14.3%	85.7%	
grp2 E	1,312	5.5%	94.5%	3.6%	96.4%	2.6%	97.4%	1.5%	98.5%	2.7%	97.3%	53-2010	6.1%	93.9%	4.8%	95.2%	5.8%	94.2%	4.1%	95.9%	
6258 E	212	7.1%	92.9%	3.6%	96.4%	0.0%	100.0%	N/A	N/A	N/A	N/A	49-2011	25.1%	74.9%	32.8%	67.2%	25.1%	74.9%	32.9%	67.1%	
63/64XX Organizational Avionics Maintenance																					
grp1 E	4,619	9.1%	90.9%	7.7%	92.3%	7.4%	92.6%	6.2%	93.8%	5.4%	94.6%	49-2091	11.1%	88.9%	8.2%	91.8%	5.6%	94.4%	9.7%	90.3%	
6469 E	681	8.1%	91.9%	5.5%	94.5%	6.8%	93.2%	5.8%	94.2%	3.1%	96.9%	49-1011	7.3%	92.7%	7.4%	92.6%	8.1%	91.9%	7.9%	92.1%	
6492 E	390	3.8%	96.2%	3.4%	96.6%	5.5%	94.5%	6.3%	93.7%	3.4%	96.6%	49-9060	11.2%	88.8%	10.5%	89.5%	10.0%	90.0%	11.8%	88.2%	
6499 E	286	9.4%	90.6%	6.9%	93.1%	N/A	N/A	N/A	N/A	N/A	N/A	49-9021	1.1%	98.9%	1.2%	98.8%	1.5%	98.5%	1.9%	98.1%	
65XX Aviation Ordnance																					
grp1 E	2,184	6.9%	93.1%	6.5%	93.5%	5.7%	94.3%	7.1%	92.9%	7.9%	92.1%	49-9071	3.7%	96.3%	3.5%	96.5%	4.3%	95.7%	6.1%	93.9%	
66XX Aviation Logistics																					
6602 O	242	15.3%	84.7%	11.9%	88.1%	7.3%	92.7%	13.8%	86.2%	10.5%	89.5%	11-3071	18.4%	81.6%	17.9%	82.1%	16.4%	83.6%	16.7%	83.3%	
6672 E	1,514	21.1%	78.9%	22.7%	77.3%	20.3%	79.7%	18.6%	81.4%	19.1%	80.9%	43-5081	34.4%	65.6%	36.7%	63.3%	36.5%	63.5%	35.7%	64.3%	
6694 E	383	7.0%	93.0%	5.8%	94.2%	6.9%	93.1%	6.8%	93.2%	N/A	N/A	11-3021	28.6%	71.4%	30.3%	69.7%	29.4%	70.6%	29.9%	70.1%	
68XX Meteorology & Oceanography (METOC)																					
6842 E	315	16.2%	83.8%	13.3%	86.7%	7.5%	92.5%	4.9%	95.1%	5.6%	94.4%	19-2021	21.4%	78.6%	23.7%	76.3%	16.1%	83.9%	11.9%	88.1%	
70XX Airfield Services																					
grp1 E	1,124	16.2%	83.8%	15.2%	84.8%	14.4%	85.6%	11.8%	88.2%	9.1%	90.9%	55-2020	21.1%	78.9%	18.8%	81.2%	16.3%	83.7%	20.5%	79.5%	
7051 E	919	2.5%	97.5%	2.8%	97.2%	2.0%	98.0%	4.5%	95.5%	5.4%	94.6%	33-2011	4.5%	95.5%	4.0%	96.0%	4.2%	95.8%	3.5%	96.5%	
72XX Aviation Command & Control Operations																					
grp1 O	365	15.1%	84.9%	13.3%	86.7%	12.7%	87.3%	16.4%	83.6%	11.3%	88.7%	53-2020	21.1%	78.9%	18.8%	81.2%	16.3%	83.7%	20.5%	79.5%	
7204 O	53	1.9%	98.1%	1.8%	98.2%	0.0%	100.0%	0.0%	100.0%	N/A	N/A	53-2020	21.1%	78.9%	18.8%	81.2%	16.3%	83.7%	20.5%	79.5%	
7212 E	342	4.1%	95.9%	1.0%	99.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	49-1011	7.3%	92.7%	7.4%	92.6%	8.1%	91.9%	7.9%	92.1%	
grp2 E	1,352	9.3%	90.7%	8.1%	91.9%	6.0%	94.0%	6.8%	93.2%	6.9%	93.1%	53-2020	21.1%	78.9%	18.8%	81.2%	16.3%	83.7%	20.5%	79.5%	
73XX Navigators & Unmanned Aircraft System Officers/Operators																					
7315 O	115	4.3%	95.7%	1.1%	98.9%	N/A	N/A	N/A	N/A	N/A	N/A	53-2010	6.1%	93.9%	4.8%	95.2%	5.8%	94.2%	4.1%	95.9%	
7314 E	194	5.7%	94.3%	4.7%	95.3%	4.9%	95.1%	3.9%	96.1%	5.1%	94.9%	17-2070	9.4%	90.6%	9.3%	90.7%	7.3%	92.7%	8.9%	91.1%	
7372 E	10	0.0%	100.0%	0.0%	100.0%	7.1%	92.9%	3.6%	96.4%	2.6%	97.4%	53-2010	6.1%	93.9%	4.8%	95.2%	5.8%	94.2%	4.1%	95.9%	
75XX Pilots/Naval Flight Officers																					
grp1 O	3,918	3.8%	96.2%	3.4%	96.6%	2.7%	97.3%	2.4%	97.6%	1.2%	98.8%	53-2010	6.1%	93.9%	4.8%	95.2%	5.8%	94.2%	4.1%	95.9%	

Table 15. Groups of Similar MOSs

Group Name	MOSs	Group Name	MOSs
Mnpwr-grp1	0102, 0180*	SigIntGrndWar-grp2	2641, 2671*, 2673*, 2674*, 2676*
Mnpwr-grp2	0111, 0121*, 0151*	GrndEleMaint-grp1	2821*, 2831, 2841, 2847, 2887
Intel-grp1	0202, 0207	CommStratOp-grp1	4302*, 4502
Intel-grp2	0204, 0206	CommStratOp-grp2	4612*, 4512
Intel-grp3	0241, 0261	CommStratOp-grp3	4341*, 4531
Infantry-grp1	0311, 0331, 0341, 0351, 0352	CommStrat-grp4	4541, 4571, 4641*, 4671*
Infantry-grp2	0313, 0321	Music-grp1	5512, 5524
Log-grp1	0431, 0481	AviationC2Maint-grp1	5942*, 5948, 5952, 5953, 5954, 5974, 5979
Comm-grp1	0621, 0627	AirMaint-grp1	6062, 6112, 6113, 6114, 6116, 6122, 6124, 6132, 6152, 6153, 6154, 6156, 6212, 6213, 6216, 6217, 6218, 6222, 6223, 6252, 6253, 6256, 6257, 6282, 6283, 6286, 6287, 6288
Comm-grp2	0612, 0631, 0651, 0671	AirMaint-grp2	6172, 6173, 6174, 6176, 6276
Arty-grp1	0842, 0844, 0847, 0861	AvionicsMaint-grp1	6312*, 6313, 6314, 6317, 6323, 6324, 6326, 6332, 6333, 6336, 6337, 6338, 6386, 6414*, 6423, 6432, 6433*, 6483
Utilities-grp1	1141, 1142	AviatnOrd-grp1	6531, 6541
Tank-grp1	1802, 1803	AirfieldServices-grp1	7011, 7041
Tank-grp2	1812, 1833, 1834	AviationC2Ops-grp1	7220, 7208, 7210
GrndOrd-grp1	2111, 2131	AviationC2Ops-grp2	7234*, 7236, 7242, 7257, 7251, 7252, 7253, 7254
GrndOrd-grp2	2141, 2146, 2147	Pilot-NFO-grp1	7507 7509 7516 7518 7521 7523 7531 7532 7541 7543 7556 7557 7560 7562 7563 7564 7565 7566 7567 7568 7597 7598 7524 7525 7578 7580 7588
SigIntGrndWar-grp1	2621, 2631, 2651,		
* indicates MOS is obsolete but still relevant for historical data			

The following paragraph provides examples of how I group MOSs within occupational fields. The intelligence occupational field has five officer MOSs. I leave Ground intel as a stand-alone MOS because it is the only one that requires completion of infantry officer course prior to designation. I group signals and human intelligence MOS because the description of these MOSs are similar as they require tactical performance from the officer. The third and final intelligence officer group is Marine Air-Ground Task Force (MAGTF) and air intelligence; these MOSs have similar duties outlined in the MOS Manual. I group 0241 and 0261 enlisted intelligence MOSs because they have the same top civilian SOC listed on MNMV and in the MOS Manual. The enlisted communications MOSs 0621 and 0627 do not have a civilian SOC listed in the MOS Manual but they are listed as related military skills in the manual and have the same top matches on MNMV.

I use a second table, Table 16 for the primary population of interest, by restricting the age range to 18–26. I am interested in the age range 18–26, because this is the typical age range of first term officer and enlisted Marines, which is the traditional new accession target group that the U.S. Marine Corps will be competing with the civilian labor market to recruit. Therefore, by including only those in the age range of 18 to 26 I further restrict the data beyond the restrictions set for Table 14.

Table 16. Age Restricted (18-26) MOS to SOC Crosswalk with Gender Representation Levels

United States Marine Corps TFDW												U.S. Census Data IPUMS									
2017				2015		2010		2005		2000		MOS Manual SOC	2015		2010		2005		2000		
MOS	# in MOS	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male		% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	
01XX Manpower & Administration																					
grp1 O	76	44.7%	55.3%	50.0%	50.0%	48.1%	51.9%	48.6%	51.4%	39.3%	60.7%	11-3131	38.2%	0.6178	0.5063	0.494	0.4863	0.5137	54.6%	45.4%	
grp2 E	4,378	24.8%	75.2%	23.1%	76.9%	25.9%	74.1%	16.6%	83.4%	13.2%	86.8%	43-4161	73.5%	0.265	0.7229	0.277	0.8742	0.1258	67.5%	32.5%	
02XX Intelligence																					
grp1 O	49	30.6%	69.4%	17.0%	83.0%	17.1%	82.9%	25.6%	74.4%	17.9%	82.1%	11-1021	41.7%	0.5832	0.3907	0.609	0.4004	0.5996	37.4%	62.6%	
0203 O	98	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-1021	4.9%	0.9511	0.0963	0.904	0.2074	0.7926	11.6%	88.4%	
grp2 O	49	26.5%	73.5%	11.9%	88.1%	12.0%	88.0%	15.9%	84.1%	15.6%	84.4%	33-1012	24.4%	0.7564	0.2155	0.785	0.1381	0.8619	15.4%	84.6%	
0211 E	83	12.0%	88.0%	8.5%	91.5%	1.2%	98.8%	0.0%	100.0%	0.0%	100.0%	17-1021	25.3%	0.747	0.2073	0.793	0.3505	0.6495	21.2%	78.8%	
0231 E	1,495	16.2%	83.8%	14.1%	85.9%	17.2%	82.8%	14.0%	86.0%	9.7%	90.3%	33-3021	44.2%	0.5577	0.4533	0.547	0.4879	0.5121	30.4%	69.6%	
grp3 E	147	13.7%	86.3%	11.3%	88.7%	11.4%	88.6%	12.4%	87.6%	9.5%	90.5%	17-3031	10.7%	0.8927	0.0677	0.932	0.0737	0.9263	9.9%	90.1%	
03XX Infantry																					
0302 O	466	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-1021	4.9%	0.9511	0.0963	0.904	0.2074	0.7926	11.6%	88.4%	
0370 O	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	47-1011	3.2%	0.9682	0.0305	0.97	0.0383	0.9618	3.3%	96.7%	
grp1 E	19,634	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-2011	6.7%	0.933	0.063	0.937	0.0604	0.9396	5.0%	95.0%	
grp2 E	634	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	53-5020	10.1%	0.8989	0.0769	0.923	0.0779	0.9221	11.5%	88.5%	
04XX Logistics																					
0402 O	321	20.9%	79.1%	25.1%	74.9%	18.4%	81.6%	22.9%	77.1%	20.4%	79.6%	13-1081	30.6%	0.6942	0.3446	0.655	0.3961	0.6039	39.1%	60.9%	
0411 E	672	18.9%	81.1%	18.8%	81.2%	17.0%	83.0%	17.2%	82.8%	20.7%	79.3%	11-3051	24.1%	0.759	0.2804	0.72	0.2224	0.7776	24.4%	75.6%	
grp1 E	1,839	13.6%	86.4%	13.0%	87.0%	10.6%	89.4%	9.3%	90.7%	10.6%	89.4%	43-5011	26.9%	0.7309	0.2559	0.744	0.3083	0.6917	17.5%	82.5%	
0451 E	151	9.9%	90.1%	9.4%	90.6%	8.4%	91.6%	8.0%	92.0%	7.4%	92.6%	53-2010	11.3%	0.8866	0.072	0.928	0.0447	0.9553	8.6%	91.4%	
0471 E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	39-4031	34.3%	0.6571	0.2788	0.721	0.2089	0.7911	20.0%	80.0%	
05XX MAGTF Plans																					
0511 E	198	15.2%	84.8%	13.0%	87.0%	9.4%	90.6%	7.2%	92.8%	14.6%	85.4%	43-5061	55.5%	0.4452	0.607	0.393	0.5978	0.4022	57.6%	42.4%	
0532 E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13-1199	63.4%	0.3658	0.6378	0.362	0.7194	0.2806	56.8%	43.2%	
06XX Communications																					
0602 O	212	11.8%	88.2%	11.8%	88.2%	8.5%	91.5%	12.7%	87.3%	10.3%	89.7%	11-1021	41.7%	0.5832	0.3907	0.609	0.4004	0.5996	37.4%	62.6%	
grp1 E	4,577	8.9%	91.1%	9.9%	90.1%	10.5%	89.5%	8.9%	91.1%	4.2%	95.8%	2740XX	11.5%	0.8846	0.129	0.871	0.0923	0.9077	17.0%	83.0%	
grp2 E	3,972	7.9%	92.1%	8.1%	91.9%	7.5%	92.5%	9.0%	91.0%	6.2%	93.8%	49-209X	9.7%	0.9029	0.0697	0.93	0.019	0.981	7.7%	92.3%	
08XX Field Artillery																					
0802 O	153	3.3%	96.7%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	47-1011	3.2%	0.9682	0.0305	0.97	0.0383	0.9618	3.3%	96.7%	
0811 E	1,469	0.1%	99.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	53-5020	10.1%	0.8989	0.0769	0.923	0.0779	0.9221	11.5%	88.5%	
grp1 E	1,255	1.0%	99.0%	0.1%	99.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	43-9011	37.8%	0.6216	0.4201	0.58	0.3845	0.6155	47.7%	52.3%	
11XX Utilities																					
grp1 E	1,161	8.3%	91.7%	7.5%	92.5%	10.3%	89.7%	15.5%	84.5%	14.9%	85.1%	47-2111	2.8%	0.9717	0.0288	0.971	0.0284	0.9716	2.4%	97.6%	
1161 E	326	3.1%	96.9%	3.5%	96.5%	1.8%	98.2%	2.3%	97.7%	0.7%	99.3%	49-9021	0.9%	0.9913	0.0137	0.986	0.0152	0.9848	1.4%	98.6%	
1171 E	586	10.1%	89.9%	11.0%	89.0%	8.4%	91.6%	12.8%	87.2%	8.7%	91.3%	51-8031	4.8%	0.9524	0.0304	0.97	0.0865	0.9135	5.2%	94.8%	
13XX Engineer, Construction, Facilities, and Equipment																					
1302 O	135	13.3%	86.7%	14.5%	85.5%	11.9%	88.1%	21.4%	78.6%	20.5%	79.5%	11-9021	11.6%	0.8843	0.1016	0.898	0.0695	0.9305	8.7%	91.3%	
1316 E	203	6.9%	93.1%	6.2%	93.8%	2.8%	97.2%	3.2%	96.8%	2.8%	97.2%	51-4120	3.1%	0.9687	0.0401	0.96	0.0238	0.9762	5.4%	94.6%	
1341 E	999	5.7%	94.3%	6.9%	93.1%	3.9%	96.1%	2.6%	97.4%	2.8%	97.2%	49-3031	2.2%	0.9776	0.0136	0.986	0.015	0.985	1.3%	98.7%	
1345 E	1,316	5.9%	94.1%	4.8%	95.2%	0.9%	99.1%	0.6%	99.4%	1.5%	98.5%	47-1011	3.2%	0.9682	0.0305	0.97	0.0383	0.9618	3.3%	96.7%	
1361 E	86	11.6%	88.4%	6.7%	93.3%	1.8%	98.2%	2.1%	97.9%	18.5%	81.5%	17-1010	37.8%	0.6221	0.4111	0.589	0.3305	0.6695	34.4%	65.6%	
1371 E	2,399	4.3%	95.7%	6.7%	93.3%	2.8%	97.2%	2.3%	97.7%	1.4%	98.6%	47-5031	11.5%	0.8849	0.132	0.868	0.2625	0.7375	7.1%	92.9%	
1391 E	1,143	6.7%	93.3%	7.9%	92.1%	5.4%	94.6%	4.9%	95.1%	9.3%	90.7%	53-7070	5.9%	0.9408	0.0184	0.982	0.058	0.942	6.1%	93.9%	
18XX Tank, Assault Amphibious Vehicle and Amphibious Combat Vehicle																					
grp1 O	58	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-1021	4.9%	0.9511	0.0963	0.904	0.2074	0.7926	11.6%	88.4%	
grp2 E	1,291	0.3%	99.7%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	33-2011	6.7%	0.933	0.063	0.937	0.0604	0.9396	5.0%	95.0%	
21XX Ground Ordnance Maintenance																					
grp1 E	1,228	5.2%	94.8%	4.7%	95.3%	3.5%	96.5%	2.5%	97.5%	3.9%	96.1%	49-9098	6.3%	0.9374	0.0303	0.97	0.0208	0.9792	4.1%	95.9%	
grp2 E	849	0.5%	99.5%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.1%	99.9%	49-3031	2.2%	0.9776	0.0136	0.986	0.015	0.985	1.3%	98.7%	
2161 E	97	4.1%	95.9%	0.9%	99.1%	1.5%	98.5%	1.5%	98.5%	0.9%	99.1%	51-4041	4.4%	0.9563	0.0281	0.972	0.0541	0.9459	5.5%	94.5%	
2171 E	360	1.1%	98.9%	0.5%	99.5%	0.5%	99.5%	3.2%	96.8%	3.8%	96.2%	49-9060	13.0%	0.8698	0.1287	0.871	0.2047	0.7953	15.1%	84.9%	
23XX Ammunition & Explosive Ordnance Disposal																					
2311 E	1152	20.5%	79.5%	17.6%	82.4%	14.1%	85.9%	15.0%	85.0%	12.6%	87.4%	47-5031	11.5%	0.8849	0.132	0.868	0.2625	0.7375	7.1%	92.9%	
26XX Signals Intelligence/Ground Electronic Warfare																					
grp1 E	1,746	11.6%	88.4%	10.3%	89.7%	9.8%	90.2%	9.5%	90.5%	10.1%	89.9%	43-9011	37.8%	0.6216	0.4201	0.58	0.3845	0.6155	47.7%	52.3%	
grp2 E	447	17.4%	82.6%	14.4%	85.6%	17.4%	82.6%	17.6%	82.4%	17.6%	82.4%	2740XX	11.5%	0.8846	0.129	0.871	0.0923	0.9077	17.0%	83.0%	
28XX Ground Electronics Maintenance																					
grp1 E	2,527	5.4%	94.6%	5.0%	95.0%	2.8%	97.2%	2.4%	97.6%	3.3%	96.7%	49-2020	12.2%	0.8776	0.1224	0.878	0.1088	0.8912	8.5%	91.5%	
30XX Supply Chain Material Management																					
3002 O	103	19.4%	80.6%	14.5%	85.5%	11.7%	88.3%	26.3%	73.7%	17.1%	82.9%	11-3061	51.7%	48.3%	44.7%	55.3%	56.7%	43.3%	55.1%	44.9%	
3043 E	2,317	22.9%	77.1%	22.8%	77.2%	21.2%	78.8%	15.1%	84.9%	14.7%	85.3%	43-5081	25.0%	75.0%	25.0%	75.0%	24.7%	75.3%	23.5%	76.5%	
3051 E	1,644	28.2%	71.8%	30.6%	69.4%	22.0%	78.0%	19.6%	80.4%	11.5%	88.5%	43-5011	26.9%	73.1%	25.6%	74.4%	30.8%	69.2%	17.5%	82.5%	
3052 E	147	25.2%	74.8%	23.1%	76.9%	24.5%	75.5%	27.7%	72.3%	16.7%	83.3%	51-9111	42.3%	57.7%	43.9%	56.1%	49.5%	50.5%	46.8%	53.2%	

United States Marine Corps TFDW													U.S. Census Data IPUMS									
2017				2015		2010		2005		2000		MOS Manual SOC	2015		2010		2005		2000			
MOS	# in MOS	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male		% Female	% Male	% Female	% Male	% Female	% Male	% Female	% Male		
31XX Distribution Management																						
3112 E	349	30.4%	69.6%	30.8%	69.2%	20.7%	79.3%	19.3%	80.7%	14.8%	85.2%	13-1081	30.6%	69.4%	34.5%	65.5%	39.6%	60.4%	39.1%	60.9%		
33XX Food Service																						
3381 E	1,363	26.7%	73.3%	22.2%	77.8%	15.4%	84.6%	14.6%	85.4%	13.4%	86.6%	35-2010	26.2%	73.8%	26.0%	74.0%	26.0%	74.0%	25.3%	74.7%		
34XX Financial Management																						
3404 O	53	24.5%	75.5%	14.0%	86.0%	27.3%	72.7%	26.9%	73.1%	18.8%	81.3%	11-3031	53.4%	46.6%	57.7%	42.3%	60.8%	39.2%	60.0%	40.0%		
3432 E	550	23.8%	76.2%	17.7%	82.3%	19.4%	80.6%	12.4%	87.6%	15.1%	84.9%	43-3051	77.6%	22.4%	80.1%	19.9%	83.2%	16.8%	81.7%	18.3%		
3451 E	212	7.1%	92.9%	10.4%	89.6%	12.6%	87.4%	16.3%	83.7%	15.6%	84.4%	43-3031	68.4%	31.6%	75.1%	24.9%	78.9%	21.1%	82.1%	17.9%		
35XX Motor Transport																						
3521 E	2,900	5.4%	94.6%	4.4%	95.6%	2.6%	97.4%	3.2%	96.8%	4.5%	95.5%	49-3023	1.9%	98.1%	1.4%	98.6%	1.8%	98.2%	2.3%	97.7%		
3531 E	6,224	11.2%	88.8%	9.7%	90.3%	4.6%	95.4%	5.7%	94.3%	6.9%	93.1%	53-3030	8.7%	91.3%	7.4%	92.6%	7.1%	92.9%	8.0%	92.0%		
44XX Legal Support																						
4402 O	4	0.0%	100.0%	0.0%	100.0%	50.0%	50.0%	50.0%	50.0%	0.0%	100.0%	23-10XX	57.1%	42.9%	57.1%	42.9%	59.6%	40.4%	50.8%	49.2%		
4421 E	294	23.1%	76.9%	23.0%	77.0%	24.5%	75.5%	17.0%	83.0%	13.6%	86.4%	23-2011	70.8%	29.2%	76.6%	23.4%	75.9%	24.1%	78.4%	21.6%		
45XX Communication Strategy & Operations																						
4502 O	25	51.7%	48.3%	56.5%	43.5%	31.8%	68.2%	45.5%	54.5%	50.0%	50.0%	11-2031	74.0%	26.0%	72.9%	27.1%	76.0%	24.0%	58.7%	41.3%		
4512 E	117	32.5%	67.5%	27.5%	72.5%	21.3%	78.7%	17.0%	83.0%	7.2%	92.8%	51-5113	48.3%	51.7%	35.4%	64.6%	40.3%	59.7%	45.1%	54.9%		
4531 E	241	35.3%	64.7%	31.3%	68.7%	28.0%	72.0%	19.5%	80.5%	22.2%	77.8%	27-3031	73.8%	26.2%	71.5%	28.5%	69.5%	30.5%	65.4%	34.6%		
grp1 E	282	38.7%	61.3%	32.8%	67.2%	20.2%	79.8%	20.4%	79.6%	12.7%	87.3%	27-4021	56.0%	44.0%	62.3%	37.7%	69.1%	30.9%	57.6%	42.4%		
55XX Music																						
grp1 E	329	13.7%	86.3%	13.7%	86.3%	15.3%	84.7%	17.1%	82.9%	N/A	N/A	27-2040	25.6%	74.4%	29.0%	71.0%	22.4%	77.6%	25.2%	74.8%		
57XX Chemical, Biological, Radiological & Nuclear (CBRN) Defense																						
5711 E	493	10.1%	89.9%	6.7%	93.3%	7.0%	93.0%	5.9%	94.1%	7.0%	93.0%	19-4031	42.7%	57.3%	43.9%	56.1%	41.3%	58.7%	38.9%	61.1%		
58XX Military Police, Investigations, & Corrections																						
5803 O	60	15.0%	85.0%	8.6%	91.4%	6.5%	93.5%	20.0%	80.0%	6.9%	93.1%	33-1012	31.7%	68.3%	21.2%	78.8%	38.6%	61.4%	24.9%	75.1%		
5811 E	2,338	11.1%	88.9%	9.2%	90.8%	6.3%	93.7%	8.4%	91.6%	7.1%	92.9%	33-3021	44.2%	55.8%	45.3%	54.7%	48.8%	51.2%	30.4%	69.6%		
5831 E	447	10.5%	89.5%	12.5%	87.5%	9.7%	90.3%	11.9%	88.1%	13.1%	86.9%	33-3010	25.7%	74.3%	27.4%	72.6%	31.5%	68.5%	29.1%	70.9%		
59XX Aviation Command and Control (C2) Electronics Maintenance																						
5939 E	122	4.1%	95.9%	3.4%	96.6%	4.2%	95.8%	6.7%	93.3%	0.0%	100.0%	27-40XX	11.5%	88.5%	12.9%	87.1%	9.2%	90.8%	17.0%	83.0%		
grp1 E	734	4.1%	95.9%	4.1%	95.9%	5.1%	94.9%	6.3%	93.7%	5.3%	94.7%	49-209X	9.7%	90.3%	7.0%	93.0%	1.9%	98.1%	7.7%	92.3%		
5951 E	43	9.3%	90.7%	2.6%	97.4%	N/A	N/A	N/A	N/A	N/A	N/A	49-9060	13.0%	87.0%	12.9%	87.1%	20.5%	79.5%	15.1%	84.9%		
60/61/62XX Aircraft Maintenance / Organizational Avionics Maintenance																						
6002 O	35	28.6%	71.4%	37.5%	62.5%	25.0%	75.0%	29.0%	71.0%	16.2%	83.8%	49-1011	11.4%	88.6%	13.6%	86.4%	20.9%	79.1%	12.9%	87.1%		
6042 E	230	24.3%	75.7%	24.9%	75.1%	20.3%	79.7%	8.6%	91.4%	23.4%	76.6%	51-4120	3.1%	96.9%	4.0%	96.0%	2.4%	97.6%	5.4%	94.6%		
6046 E	797	24.7%	75.3%	25.3%	74.7%	21.9%	78.1%	17.1%	82.9%	20.2%	79.8%	43-5061	55.5%	44.5%	60.7%	39.3%	59.8%	40.2%	57.6%	42.4%		
6048 E	815	6.3%	93.7%	4.8%	95.2%	4.9%	95.1%	4.1%	95.9%	11.1%	88.9%	49-9098	6.3%	93.7%	3.0%	97.0%	2.1%	97.9%	4.1%	95.9%		
grp1 E	5786	5.2%	94.8%	4.2%	95.8%	4.0%	96.0%	2.7%	97.3%	2.2%	97.8%	49-3011	8.6%	91.4%	6.0%	94.0%	7.0%	93.0%	6.4%	93.6%		
6073 E	719	5.1%	94.9%	5.7%	94.3%	2.2%	97.8%	2.7%	97.3%	4.5%	95.5%	49-3040	1.6%	98.4%	1.3%	98.7%	2.0%	98.0%	1.4%	98.6%		
6074 E	120	5.0%	95.0%	8.8%	91.2%	6.8%	93.2%	4.5%	95.5%	N/A	N/A	51-9010	15.0%	85.0%	17.9%	82.1%	12.5%	87.5%	18.5%	81.5%		
grp2 E	804	7.3%	92.7%	4.4%	95.6%	3.1%	96.9%	1.8%	98.2%	3.6%	96.4%	53-2010	11.3%	88.7%	7.2%	92.8%	4.5%	95.5%	8.6%	91.4%		
6258 E	138	9.4%	90.6%	3.5%	96.5%	N/A	N/A	N/A	N/A	N/A	N/A	49-2011	7.3%	92.7%	29.8%	70.2%	0.0%	100.0%	32.2%	67.8%		
63/64XX Organizational Avionics Maintenance																						
grp1 E	3,513	10.1%	89.9%	8.5%	91.5%	8.3%	91.7%	7.1%	92.9%	6.2%	93.8%	49-2091	15.0%	85.0%	9.2%	90.8%	2.9%	97.1%	9.7%	90.3%		
6469 E	486	8.6%	91.4%	5.6%	94.4%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	49-1011	11.4%	88.6%	13.6%	86.4%	20.9%	79.1%	12.9%	87.1%		
6492 E	287	4.2%	95.8%	3.3%	96.7%	5.8%	94.2%	6.3%	93.7%	4.3%	95.7%	49-9060	13.0%	87.0%	12.9%	87.1%	20.5%	79.5%	15.1%	84.9%		
6499 E	209	10.0%	90.0%	7.0%	93.0%	N/A	N/A	N/A	N/A	N/A	N/A	49-9021	0.9%	99.1%	1.4%	98.6%	1.5%	98.5%	1.4%	98.6%		
65XX Aviation Ordnance																						
grp1 E	1,737	7.5%	92.5%	6.7%	93.3%	6.0%	94.0%	7.8%	92.2%	9.4%	90.6%	49-9071	3.5%	96.5%	6.6%	93.4%	6.3%	93.7%	10.4%	89.6%		
66XX Aviation Logistics																						
6602 O	34	20.6%	79.4%	17.2%	82.8%	7.7%	92.3%	46.4%	53.6%	6.3%	93.8%	11-3071	17.9%	82.1%	17.0%	83.0%	11.7%	88.3%	14.9%	85.1%		
6672 E	1,024	21.8%	78.2%	23.9%	76.1%	22.2%	77.8%	20.2%	79.8%	23.3%	76.7%	43-5081	25.0%	75.0%	25.0%	75.0%	24.7%	75.3%	23.5%	76.5%		
6694 E	269	9.3%	90.7%	6.9%	93.1%	8.2%	91.8%	7.0%	93.0%	N/A	N/A	11-3021	30.9%	69.1%	33.3%	66.7%	30.3%	69.7%	31.4%	68.6%		
68XX Meteorology & Oceanography (METOC)																						
6842 E	189	22.2%	77.8%	16.9%	83.1%	8.8%	91.2%	5.7%	94.3%	10.7%	89.3%	19-2021	33.7%	66.3%	49.7%	50.3%	24.8%	75.2%	23.0%	77.0%		
70XX Airfield Services																						
grp1 E	791	18.6%	81.4%	17.4%	82.6%	16.4%	83.6%	13.3%	86.7%	9.7%	90.3%	55-2020	26.0%	74.0%	26.7%	73.3%	23.2%	76.8%	32.0%	68.0%		
7051 E	666	2.6%	97.4%	3.0%	97.0%	1.8%	98.2%	5.1%	94.9%	5.7%	94.3%	33-2011	6.7%	93.3%	6.3%	93.7%	6.0%	94.0%	5.0%	95.0%		
72XX Aviation Command & Control Operations																						
grp1 O	103	19.4%	80.6%	13.0%	87.0%	21.8%	78.2%	35.7%	64.3%	21.4%	78.6%	53-2020	26.0%	74.0%	26.7%	73.3%	23.2%	76.8%	32.0%	68.0%		
7204 O	16	6.3%	93.8%	5.3%	94.7%	0.0%	100.0%	0.0%	100.0%	N/A	N/A	53-2020	26.0%	74.0%	26.7%	73.3%	23.2%	76.8%	32.0%	68.0%		
7212 E	264	5.3%	94.7%	1.3%	98.7%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	49-1011	11.4%	88.6%	13.6%	86.4%	20.9%	79.1%	12.9%	87.1%		
grp2 E	960	10.9%	89.1%	8.1%	91.9%	6.2%	93.8%	7.6%	92.4%	8.1%	91.9%	53-2020	26.0%	74.0%	26.7%	73.3%	23.2%	76.8%	32.0%	68.0%		
73XX Navigators & Unmanned Aircraft System Officers/Operators																						
7315 O	14	14.3%	85.7%	0.0%	100.0%	N/A	N/A	N/A	N/A	N/A	N/A	53-2010	11.3%	88.7%	7.2%	92.8%	4.5%	95.5%	8.6%	91.4%		
7314 E	129	8.5%	91.5%	6.3%	93.7%	5.0%	95.0%	3.9%	96.1%	7.5%	92.5%	17-2070	14.3%	85.7%	12.0%	88.0%	8.7%	91.3%	14.7%	85.3%		
7372 E	N/A	N/A	N/A	N/A	N/A	0.0%	100.0%	1.8%	98.2%	2.3%	97.7%	53-2010	11.3%	88.7%	7.2%	92.8%	4.5%	95.5%	8.6%	91.4%		
75XX Pilots/Naval Flight Officers																						
grp1 O	326	0.0675	0.9325	0.0803	0.9197	0.05319	0.9468	0.0584	0.9416	5.0%	95.0%	53-2010	11.3%	0.8866	0.072	0.928	0.0447	0.9553	8.6%	91.4%		

A majority of the occupational fields have a related civilian occupation identified in the MOS manual that I entered into the table. For those that do not have a related civilian occupation with SOC or the SOC that is listed in the manual is not available in the U.S Census data, I use a variety of methods to identify a civilian crosswalk. Appendix C details my sources for SOCs. For MOSs that do not have a related civilian occupation identified in the manual (Intelligence, Infantry, Communications, Field Artillery, CBRN, and Aviation Command and Control) I first try to match a U.S. Army occupation from a study funded by RAND authored by Wenger et al. titled, “Helping Soldiers Leverage Army Knowledge, Skills, And Abilities in Civilian Jobs.” In this study the authors attempt to better translate a soldier’s occupational experience for a more successful transition/crosswalk to the civilian work force than what is already provided in existing crosswalks. This study surveyed soldiers to identify the best civilian job by comparing and matching occupations with the most similar “soft skills” or KSAs required on the job (more detail in the literature review chapter). Wenger et al. (2017) wrote,

It appears that infantrymen and firefighters are a good match because of the overlap between their KSAs and work attributes, including both soft skills, such as teamwork, communications, critical thinking, dependability, and stress tolerance, and the physical requirements of the jobs, such as strength, reaction time, handling and moving objects, and working outdoors.

Wenger et al. (2017) were only able to provide a robust crosswalk with large enough sample sizes for 10 of the Army MOSs, five of which I was able to match with U.S. Marine Corps MOSs that still needed a SOC match as shown in Table 17. I match the U.S. Army occupations to U.S. Marine Corps occupations by reading the occupation descriptions in the U.S. Marine Corps MOS Manual and the U.S. Army occupation descriptions provided in the Wenger et al. study. Table 17 also lists the highest rated general and specific civilian occupation match as identified by Wenger Et al. and top matches identified by MNMV.

Table 17. USMC Occupational Fields with no Related SOC in the MOS Manual

USMC Occupational Fields: No Civilian Occupational Crosswalk Identified				
Occ field code	Military Occupation Title	RAND Study		Civilian Occupation Recommended by My Next Move for Veterans
		Army Occupation Title	Top General Match	Top Specific Match
02 / 26	Intelligence	Intelligence Analyst	33-3021 Detectives and Criminal investigators	11-1021 General and Operations Managers
03	Infantry	Infantry	33-2011 Firefighters	N/A. second top general match is 53-5021 Captains, mates, and pilots of water vessels
03	Reconnaissance (NMOS for officers) / Special Operations	Calvary Scout	53-5021 Captains, mates, and pilots of water vessels/ Firefighters	53-4031 Railroad Conductors and Yardmasters
06	Communications	N/A	N/A	N/A
08	Field Artillery	Cannon Crewmember	53-5021 Captains, mates, and pilots of water vessels	49-9051 Electrical Power-line installers and repairers
18	Tank / AAV	M1 Armor Crewman/ Wheeled Vehicle Repairer?	33-2011 Firefighters	N/A. second top general match 53-5021 Captains, mates, and pilots of water vessels
57	CBRN Defense	N/A	N/A	N/A
72	Aviation Command and Control	N/A	N/A	N/A

For the remaining Marine Corps MOSs that do not have a crosswalk match I use MNMV. This website is a streamlined product of O*NET that provides occupational data for job seekers. As described on the DOL (2018b) website, “Both applications were developed for the U.S. Department of Labor by the National Center for O*NET Development.” This website only provides occupational crosswalk information for enlisted Marines so I was only able to match the remaining enlisted MOSs, in the occupational fields of communications, chemical biological radiation nuclear (CBRN), and aviation command & control, using the best match as identified by the website.

For the remaining officer MOSs (intelligence, infantry, communications, tank/ AAV, CBRN, aviation command & control, and navigators & unmanned aircraft system officers/operators) I research relevant and related SOC by reviewing the occupation

description in the MOS manual and matches found for enlisted MOSs in the same occupational field as my basis for identifying the officer matches. For example, “Fire fighter” is determined to be the best match for enlisted infantryman therefore I use “First-Line Supervisors of Firefighting and Prevention Work” as the infantry officer match. Tables 14 and Table 15 are the final military to civilian occupational crosswalk result with each occupational field for both officer and enlisted MOS matched with a SOC.

Finally, after identifying civilian crosswalks for every occupational field, I use the TFDW and IPUMS data to create gender representation percentages for the most robust U.S. Census years (2000, 2005, 2010, 2015) for each occupation group. I start with 2000 because in the early 2000s women’s labor force participation rates began to level off and 9/11 occurred prompting a personnel increase in the military to combat terrorism. I begin my data tables at this point in time to capture gender participation from 2000 forward. Comparison of gender representation can suggest a feasible level of female representation in the Marine Corps to support establishing empirically researched gender integration goals. The civilian occupational gender representation percentages are used to begin proposing an upper bound of female representation across the U.S. Marine Corps occupational fields. For example, in Table 14 females represent 4.5 percent of the firefighter population. Fire fighters are a crosswalk for infantry group 1 (0311 Rifleman, 0331 Machine Gunner, 0341 Mortarman, 0351 Infantry Assault Marine, 0352 Antitank Missile Gunner) that currently has approximately 0 percent female representation. Based off this information it would be appropriate for manpower planners to assume that female representation in this community will be difficult to surpass the civilian fire fighter female representation level. This information could potentially be used for force shaping goals to include policy that could affect recruiter missions and retention efforts.

Table 18 provides gender integration levels for PMOS occupational fields for years 2000, 2005, 2010, 2015, and 2017. The population of Marines in each occupational field includes both officer and enlisted to include warrant officers, limited duty officers, and senior enlisted Marines. To standardize the occupational fields across all years represented I had to delete occupational field 09 from year 2010, delete occupational field 40 from year 2005, and merge occupational fields 43 and 46 into 45, in accordance with MarAdmin 484/

17, for every year except 2017 because these two were already merged for this year. Also, in 2005 and 2000 occupational field 48 did not exist so it is marked as N/A. Occupational field 48 is an exception in this table as it is not a PMOS. I included occupational field 48 in the table because I found it interesting that in 2017 the Marine Corps has dedicated the fulfillment of almost a quarter of recruiter billets to female Marines.

Table 18. PMOS Occupational Fields Gender Representation Unrestricted
(Entire USMC Population)

PMOS Occ Field	2017		2015		2010		2005		2000	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
01	24.6%	75.4%	22.0%	78.0%	23.3%	76.7%	17.9%	82.1%	15.1%	84.9%
02	11.5%	88.5%	10.3%	89.7%	9.4%	90.6%	7.9%	92.1%	5.9%	94.1%
03	0.1%	99.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
04	13.9%	86.1%	13.5%	86.5%	11.2%	88.8%	10.5%	89.5%	10.5%	89.5%
05	12.5%	87.5%	12.3%	87.7%	9.8%	90.2%	7.3%	92.7%	14.1%	85.9%
06	8.5%	91.5%	8.3%	91.7%	8.3%	91.7%	7.8%	92.2%	6.4%	93.6%
08	0.7%	99.3%	0.1%	99.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
11	8.4%	91.6%	8.0%	92.0%	8.2%	91.8%	11.2%	88.8%	9.8%	90.2%
13	5.5%	94.5%	6.1%	93.9%	3.2%	96.8%	2.9%	97.1%	3.4%	96.6%
18	0.8%	99.2%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
21	2.5%	97.5%	2.1%	97.9%	1.6%	98.4%	1.7%	98.3%	2.2%	97.8%
23	12.5%	87.5%	10.6%	89.4%	8.8%	91.2%	10.5%	89.5%	8.4%	91.6%
26	12.8%	87.2%	11.2%	88.8%	11.9%	88.1%	10.9%	89.1%	11.1%	88.9%
28	4.7%	95.3%	4.0%	96.0%	2.7%	97.3%	3.1%	96.9%	3.6%	96.4%
30	22.8%	77.2%	22.1%	77.9%	19.1%	80.9%	16.3%	83.7%	12.5%	87.5%
31	26.1%	73.9%	24.5%	75.5%	19.0%	81.0%	17.5%	82.5%	15.6%	84.4%
33	23.9%	76.1%	20.2%	79.8%	14.3%	85.7%	13.5%	86.5%	13.6%	86.4%
34	18.4%	81.6%	15.0%	85.0%	16.2%	83.8%	14.0%	86.0%	15.8%	84.2%
35	8.6%	91.4%	6.9%	93.1%	4.1%	95.9%	4.6%	95.4%	5.2%	94.8%

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41	9.2%	90.8%	9.2%	90.8%	9.4%	90.6%	10.6%	89.4%	9.2%	90.8%
44	18.6%	81.4%	17.6%	82.4%	18.0%	82.0%	16.1%	83.9%	15.1%	84.9%
45	32.6%	67.4%	28.4%	71.6%	22.3%	77.7%	20.3%	79.7%	16.9%	83.1%
48	24.0%	76.0%	21.1%	78.9%	15.6%	84.4%	N/A	N/A	N/A	N/A
55	16.5%	83.5%	16.3%	83.7%	16.4%	83.6%	15.6%	84.4%	16.8%	83.2%
57	9.2%	90.8%	6.3%	93.7%	5.5%	94.5%	5.1%	94.9%	5.0%	95.0%
58	10.3%	89.7%	9.6%	90.4%	7.1%	92.9%	8.1%	91.9%	6.9%	93.1%
59	4.6%	95.4%	4.7%	95.3%	5.6%	94.4%	5.5%	94.5%	5.0%	95.0%
60	10.6%	89.4%	9.6%	90.4%	8.4%	91.6%	6.3%	93.7%	6.0%	94.0%
61	4.9%	95.1%	3.6%	96.4%	3.3%	96.7%	2.0%	98.0%	2.0%	98.0%
62	4.8%	95.2%	4.5%	95.5%	3.4%	96.6%	2.9%	97.1%	2.0%	98.0%
63	9.2%	90.8%	7.6%	92.4%	7.3%	92.7%	6.7%	93.3%	5.6%	94.4%
64	9.0%	91.0%	6.4%	93.6%	7.3%	92.7%	7.2%	92.8%	6.1%	93.9%
65	6.4%	93.6%	6.1%	93.9%	5.7%	94.3%	6.9%	93.1%	7.5%	92.5%
66	18.2%	81.8%	18.0%	82.0%	16.9%	83.1%	16.8%	83.2%	18.1%	81.9%
68	15.2%	84.8%	13.6%	86.4%	7.9%	92.1%	6.1%	93.9%	7.5%	92.5%
70	10.1%	89.9%	8.9%	91.1%	9.1%	90.9%	8.5%	91.5%	7.2%	92.8%
72	9.6%	90.4%	7.7%	92.3%	5.8%	94.2%	5.9%	94.1%	5.6%	94.4%
73	4.6%	95.4%	5.8%	94.2%	4.4%	95.6%	2.2%	97.8%	4.8%	95.2%
75	4.3%	95.7%	3.8%	96.2%	3.2%	96.8%	2.8%	97.2%	1.8%	98.2%

B. HEDONIC ANALYSIS OF SKILLS AND ABILITIES

It is not enough to just crosswalk USMC MOSs to civilian labor market SOC and use the gender representation in those civilian occupations as the upper bound for equivalent USMC occupations. The female representation levels in the SOC do not take into account the additional skills and abilities required to perform duties as a Marine. A postal clerk in the Marine Corps, for example, is not only required to perform her duties to the standards of the civilian equivalent postal worker but also to perform her duties as a rifleman. As quoted by Keane (2012), “‘Every Marine is, first and foremost, a rifleman. All other conditions are secondary.’ This quote, spoken by Gen. Alfred M. Gray, 29th Commandant of the Marine Corps, is printed in rifle data books issued to recruits during training and to Marines for their annual marksmanship qualification.” A postal clerk in the Marine Corps must also be able to qualify to standard on the rifle, gas mask, physical fitness test, combat fitness test, height and weight measurements and Marine Corps Martial Arts to name a few. To properly represent a possible upper bound of female attainment in each MOS group these skills and abilities need to be taken into account.

In order to properly weight the female representation levels in the civilian equivalent occupations, I use four broad skills categories (cognitive skills, language skills,

physical skills, and social skills) created by Bacolod and Rangel in a 2017 study. Bacolod and Rangel created the skills categories because it is not possible to use all of the job skills variables collected in O*NET in one regression due to high collinearity. In this study they also rescaled each of the four indices to have a mean value of 1 and a standard deviation of .1 for ease of interpretation. Appendix D contains two tables from the Bacolod and Rangel study. The first table shows examples with definitions of variables that were used to create the indices and the second table shows the top and bottom occupations associated with each index. For example, Appendix D Table 2 lists firefighter as one of the top five occupations requiring the highest demand for physical skills. As explained in Chapter III, Section A, the firefighter occupation is mapped to the infantry and artillery MOSs. The firefighter physical skills index is 1.23. This is more than two standard deviations higher than the mean physical skills requirements for all civilian occupations. A more detailed explanation of how the indices were created are found in the Bacolod and Rangel 2017 study.

I estimate 10 separate ordinary least squares (OLS) regression models – five to capture the effects on female representation for each year evaluated (2017, 2015, 2010, 2005, and 2000) and five to capture effects on the ratio of females to males for each year of interest. Table 21 in Chapter IV, Section B, displays the outcome of the first model expressed in the following equation:

$$\begin{aligned} FemaleUSMCrepresentation_i = & \beta_0 + \beta_1 * Cognitive_{Index} + \beta_2 * \\ & Language_{Index} + \beta_3 * Physical_{Index} + \beta_4 * Social_{Index} + \varepsilon_i \end{aligned}$$

In this regression, FemaleUSMCrepresentation is a vector of year i 's female representation in the MOS groups listed in Table 14 where $\beta_1 - \beta_4$ is the index information for the sample of MOS groups representative of the specific FemaleUSMCrepresentation outcome.

The second regression includes a female to male ratio vector outcome with the same $\beta_1 - \beta_4$ sample information as model 1. Model 2 is expressed in the following equation:

$$\begin{aligned} Female\ to\ Male\ Ratio_i = & \beta_0 + \beta_1 * Cognitive_{Index} + \beta_2 * Language_{Index} + \\ & \beta_3 * Physical_{Index} + \beta_4 * Social_{Index} + \varepsilon_i \end{aligned}$$

Finally, marginal effects of both models on female representation in MOS groups are evaluated using skill indices of associated civilian occupations. These outcomes predict a skills and abilities tailored female representation upper bound.

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IV. RESULTS

The data and methodologies used in Chapter III create a rich environment for analysis. I break my analysis into two sections the first concerns the crosswalk created in Chapter III and the second describes the effects of skills and abilities required to perform USMC MOSs on the civilian occupation female representation levels.

A. CROSSWALK

One potentially significant limitation of the data, especially the further back in time I analyzed, was that MOSs get redesignated, terminated, and created. Documentation of MOS code changes gets sparser the further back in time I look. It is difficult to capture these changes accurately in year 2000 for example.

I find that most previously male only MOSs map to severely male-dominated SOC with female representation hovering at or below five percent. The civilian labor market is essentially a free market where individuals can choose their occupation with arguably lower barriers to entry than the military. As noted earlier, civilians are not required to move and PCS every three years, maintain required levels of combat and physical fitness, etc. Yet, the female representation remains low in the civilian occupations that map to the MOSs that were previously gender restricted prior to the 2013 integration mandate. While there may be a desire to increase female representation across the USMC as a whole, I find that many MOSs have mapped SOC that sit below the current eight percent Corps-wide female representation level. This data can thus provide realistic expectations for gender integration goals as I predict that female representation in USMC MOS' will remain lower than the related civilian occupation.

By populating two tables of data we can see, for example, that in the civilian labor market female air traffic controllers have gotten older and female fire fighters have gotten younger. In Table 14 with all age groups fire fighters sit at 4.5 percent female but in the 18 to 26 age range, Table 16, females represent 6.7 percent of fire fighters. This could indicate that MOSs such as 0311-rifleman and 7051—Expeditionary Firefighting and Rescue Specialist might be more attractive to potential recruits in today's environment and female

millennial generation. The tables also show that these two MOS' percent female do not change when the age range is restricted, which indicate that the majority of the population of these MOS is in the 18–26 age range. This means that 0311 and 7051 are more likely to behave like the civilian labor market behavior in the 18–26 range vice the all ages range. This points towards a larger percent of female representation in these two MOSs, which is promising for gender integration levels.

Table 18 shows a gradual increase in female representation for a majority of occupational fields. By 2017 none of the occupational fields represented in the table have 100 percent male representation.

The civilian occupations represented in Table 14 have an average female representation of 21.9 percent. This is quite low when compared to the complete civilian labor market where women represent almost 47 percent of the civilian labor force (DOL, 2017). This data point further reinforces the occupational segregation experienced in the Marine Corps. While the Marine Corps does crosswalk to some female-dominated occupations in the civilian labor market such as human resource assistant (80.2 percent), payroll and timekeeping clerks (88.1 percent), and public relations specialist (64.9 percent), the crosswalk is predominantly matched with male-dominated occupations.

The 33–2011 firefighter occupation is the designated crosswalk for infantry and field artillery. This occupation is sitting at 4.5 percent female representation as of the 2015 census report. In analyzing why this occupation has such a low female representation level there are several potential barriers to entry. First, 70 percent of the firefighter population is voluntary; “However, 49 percent of the U.S. population is protected by the ‘all career’ fire departments” (Haynes & Stein, 2017). Voluntary firefighters do not get paid. They do get reimbursed for expenses such as gas and food when they respond to a service call. (Zigmont, 2018). This is in addition to a rigorous training and certification standard and a minimum number of volunteer hours required per week, which can make it difficult for many people to have the resources available to serve in the firefighter occupation. In comparison, an additional barrier added to some combat arms MOSs (0311, 0313, 0321, 0331, 0341, 0351, 0352, 0811, 0842, 0844, 0847, 0861, 1371, 1812, 1833, 2131, 2141, 2146, 2147, and 7212) is the MOS Classification Standards that require a minimum of: 6

pullups, 24:51 3 mile run, 3:12 Maneuver Under Fire Course, 3:26 Movement to Contact Course, and 60 ammo can lifts (CMC, 2017a). Dove and Richmond found that both cognitive and physical abilities have a significant correlation with predictors for successful graduation from the infantry training battalion MOS school (2017).

Figure 4 is a bar graph depicting female and male representation in each PMOS occupational field as of 2017, ranked in ascending order by female representation. The first occupational field with the fewest females is 03—infantry, followed by 08—field artillery, and then 18—tank/AAV. The occupational fields with the highest percent female are: third highest 01—manpower & administration, followed by second highest 31—distribution management, and the highest representation of females is in 45—communication strategy & operations. Out of 39 PMOS occupational fields in Figure 4, roughly half (19), are populated by 10 percent female Marine representation or higher. Figure 4 is a clear depiction of the gender disparity across the Marine Corps. Figure 5 shows the changes in female representation since 2000 in each of the PMOS occupational fields at the most robust IPUMS data census years (every five years). As mentioned in Chapter III occupational field 48—recruiting and retention is not a PMOS but a FMOS. As seen in Figures 4 and 5 the female representation has grown significantly; up 8.5 percentage points from 2010. Civilian occupation equivalents are listed in Table 19 for the bottom three and top three MOSs based on female representation levels.

Figure 4. 2017 Gender Distribution by PMOS Occupational Field

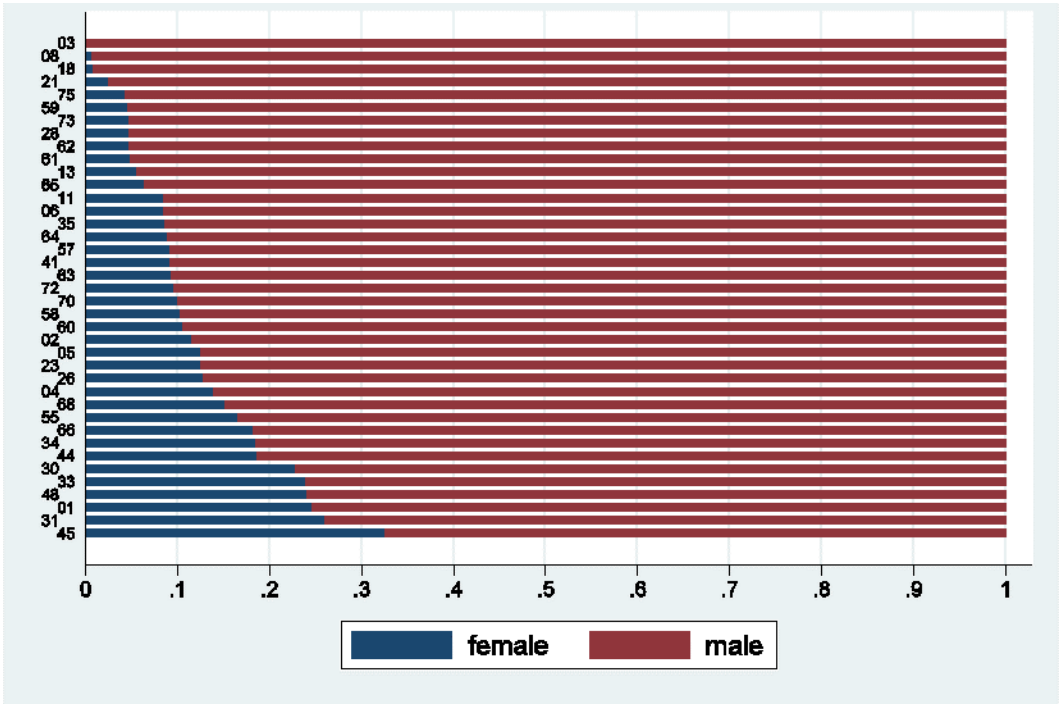


Figure 5. Female Representation by PMOS Occupational Field for Years 2000–2015



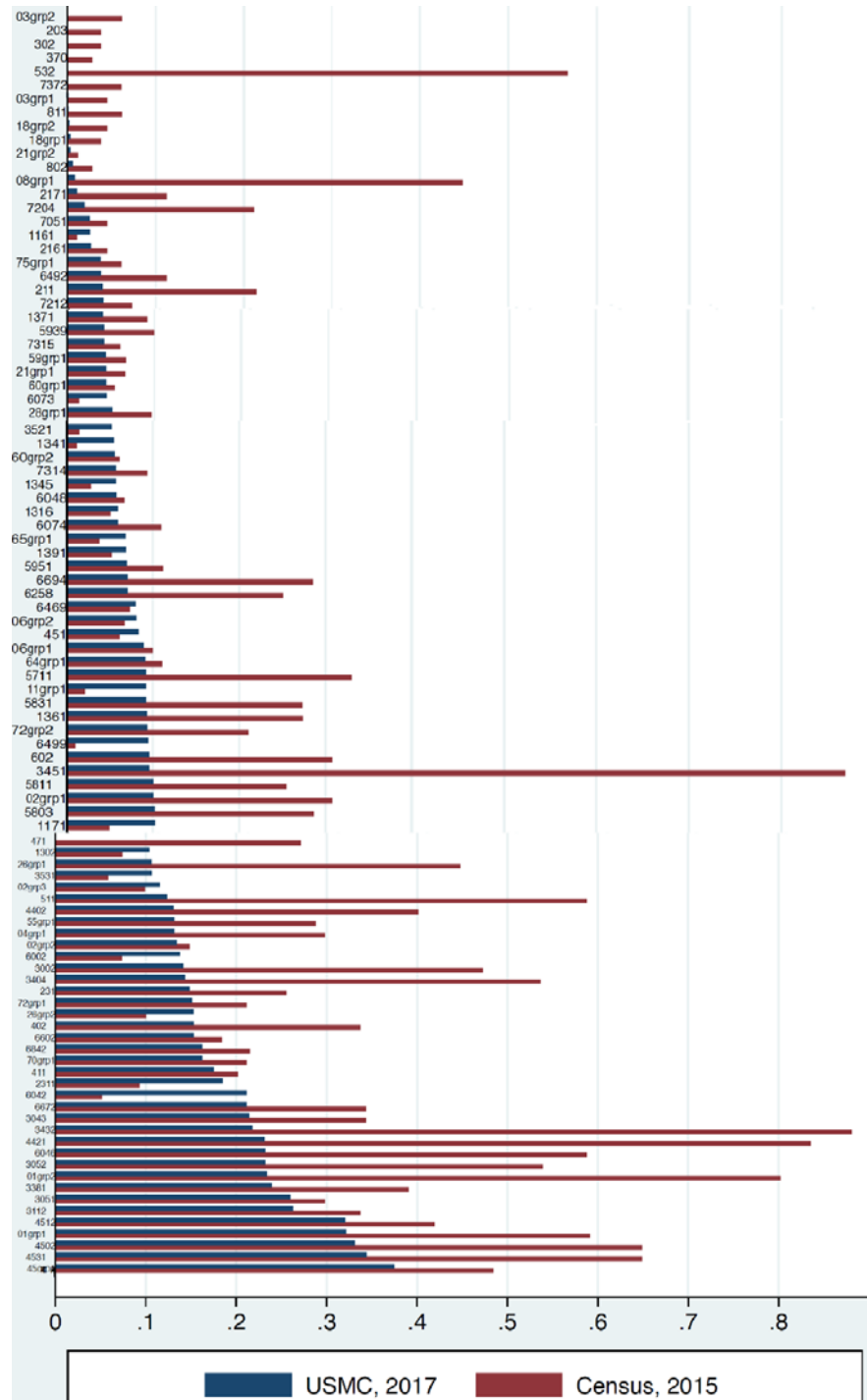
Table 19. Bottom and Top Three PMOS Occupational Fields by Female Representation

PMOS Occ Field	Female %	SOC	Female %
03	0.1	33-2011	4.5
08	0.7	53-5020	6.2
18	0.8	33-2011	4.5
01	24.6	43-4161	80.2
31	26.1	13-1081	33.7
45	32.6	27-3031	64.9

Table 19 shows the potential upper bound of female representation without adjusting for skills and abilities. The next section takes into account the additional requirements of being a Marine and adjusts the potential upper bound based on this information.

Finally, Figure 6 is a graphical representation of the level of females in the MOS versus the SOC, sorted on the y-axis by female representation level in USMC MOSs.

Figure 6. Proportion of Female in USMC vs Civilian Occupations



B. SKILLS AND ABILITIES ADJUSTMENT

Marginal effects provide a good approximation of the amount of change in gender representation that is related to occupational content in terms of skill and ability demands. This approach is called hedonic analysis in the economics literature, attributed to Sherwin Rosen's 1974 landmark contribution. Hedonic regression methods can reveal the value of the characteristics (independent variable) analyzed as formed from market values (Rosen, 1974). The characteristics are not desired or present in isolation but each has an implicit market value (Rosen, 1974). The characteristic coefficients represent value to the consumer and can reveal resource costs (Rosen, 1974).

It is important to note that skill categories I use as independent variables in the regression models are correlated. The social and language indices are very highly positively correlated. The physical index is negatively correlated with the other three indices, most notably being the language index. Significantly more important as separate categories they have an independent effect and they are not complementary or substitutable.

Table 20. Correlation Matrix of Skills Categories

	Cognitive	Language	Physical	Social
Cognitive	1			
Language	0.4105	1		
Physical	-0.153	-0.4718	1	
Social	0.3767	0.6556	-0.0913	1

Notes:

- (1) Physical is negatively correlated with all 3 but Language is very negatively correlated
- (2) Social and Language are very highly positively correlated the highest of all the X's
- (3) Language and Cognitive & Social and Cognitive are somewhat positively correlated

Of note this section is missing skill index data for five out of 98 PMOS groups identified in Table 14 in Chapter III. These groups are 01grp1, 0532, 5951, 2171, and 6492 because the skills indices were unavailable in the O*NET data pull for the mapped SOC's 11-3131/11-3121, 13-1199/11-9161, and 49-9060/15-1151.

1. OLS Analysis

Table 21 is the output of Model 1. This table displays the effects of a one-unit increase in the skill required/demanded to perform an occupation on female representation. The scaling of the indices as described in Chapter III, Section B, means that one-unit is equal to .1 in the in each category. The cognitive and physical demand indices are significant to the 1 percent ($p < .01$) level for all five years collected. For example, the cross-section of the cognitive index and year 2017 female representation in Table 21 tells us that a one-unit increase in cognitive skill demand for a Marine MOS is associated with a 4.73 percent decline in female representation. Similarly, a one-unit increase in physical skill demand for a Marine MOS is associated with a 3.4 percent decline in female representation.

Table 21. Effects of Occupational Skill and Ability Demands on Female Representation

	2017	2015	2010	2005	2000
Cognitive_indx	-0.4733*** [0.1145]	-0.4538*** [0.1020]	-0.4016*** [0.0939]	-0.3551*** [0.0920]	-0.3203*** [0.0815]
Language_indx	0.1732 [0.1926]	0.1726 [0.1717]	0.255 [0.1555]	0.0956 [0.1503]	0.1819 [0.1373]
Physical_indx	-0.3398*** [0.0922]	-0.3011*** [0.0822]	-0.2441*** [0.0733]	-0.2114*** [0.0708]	-0.2208*** [0.0639]
Social_indx	0.0921 [0.1505]	0.048 [0.1342]	-0.0709 [0.1214]	0.0451 [0.1178]	-0.0316 [0.1065]
Constant	0.6584*** [0.2050]	0.6335*** [0.1828]	0.5457*** [0.1627]	0.5066*** [0.1572]	0.4679*** [0.1421]
Observations	92	92	89	88	84
R-squared	0.301	0.315	0.318	0.245	0.315
Notes:					
(1) Standard errors in brackets					
(2) significance level *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$					
(3) Number of observations is a count of the MOS groups					

Table 22 is the output of Model 2. This table displays the effects of a one-unit increase in the skill required/demanded to perform an occupation on the ratio of female to male representation. The cognitive and physical demand indices are significant to the 1 percent ($p < .01$) level. For example, the cross-section of the cognitive index and year 2017

female/male ratio in Table 22 tells us that a one-unit increase in cognitive skill demand for a Marine MOS is associated with a 6.57 percent decline in the female to male ratio for that MOS. Similarly, a one-unit increase in physical skill demand for a Marine MOS is associated with a 4.7 percent decline in the female to male ratio.

Table 22. Effect of Occupational Skill and Ability Demands on the Ratio of Female to Male Representation

	2017	2015	2010	2005	2000
Cognitive_idx	-0.6573*** [0.1686]	-0.6078*** [0.1382]	-0.5226*** [0.1190]	-0.4476*** [0.1151]	-0.3983*** [0.0993]
Language_idx	0.2041 [0.2837]	0.2138 [0.2325]	0.3616* [0.1972]	0.111 [0.1879]	0.2352 [0.1673]
Physical_idx	-0.4699*** [0.1358]	-0.3993*** [0.1113]	-0.2931*** [0.0930]	-0.2539*** [0.0886]	-0.2652*** [0.0779]
Social_idx	0.1903 [0.2217]	0.0987 [0.1817]	-0.1074 [0.1540]	0.0638 [0.1473]	-0.0311 [0.1298]
Constant	0.8693*** [0.3020]	0.8138*** [0.2475]	0.6597*** [0.2063]	0.6203*** [0.1966]	0.5471*** [0.1732]
Observations	92	92	89	88	84
R-squared	0.273	0.306	0.32	0.238	0.318
Notes:					
(1) Standard errors in brackets					
(2) significance level *** p<0.01, ** p<0.05, * p<0.1					
(3) Number of observations is a count of the MOS groups					

2. Marginal Effects

Marginal effects provide a good approximation of the amount of change in the dependent variable (Y) that occurs when a one-unit change is applied to the independent variables (X_k).

Tables 23–26 display the top and bottom PMOS groups by skill. Table 23 lists 7315- Unmanned Aircraft System MAGTF Officer as the PMOS group requiring the highest level of cognitive skills to perform the occupational duties and 3043- Supply Chain and Materiel Management Specialist as requiring the least amount of cognitive skills. The 7315 occupation is almost two standard deviations above the mean in demand for cognitive

skills. As compared to the other index levels for 7315 [language(1.03), physical(.945), social(1.04)], all are within the first standard deviation of the mean. So this MOS in particular stands out in its requirement/demand for cognitive skills above all other categories. The top PMOS groups include: Pilot/NFO, Tactical Systems Operator/Mission Specialist, Airborne and Air Delivery Specialist, Helicopter Crew Chief, Air Traffic Control Officer, Expeditionary Airfield System Technician/Aviation Operations Specialist, Automotive Maintenance Technician, METOC Analyst Forecaster, Fixed-Wing Aircraft Airframe Mechanic.

Table 23. Cognitive Skills, Top 10 and Bottom Five PMOS Groups

PMOS	Female	soccode	Cognitive Index	Language Index	Physical Index	Social Index
Top 10						
7315	4.3%	532011	1.1812	1.0302	0.9450	1.0452
75grp1	3.8%	532011	1.1812	1.0302	0.9450	1.0452
7372	0.0%	532011	1.1812	1.0302	0.9450	1.0452
0451	8.3%	532011	1.1812	1.0302	0.9450	1.0452
60grp2	5.5%	532011	1.1812	1.0302	0.9450	1.0452
72grp1	15.1%	532021	1.1537	1.0740	0.8828	1.0160
70grp1	16.2%	532021	1.1537	1.0740	0.8828	1.0160
3521	5.3%	493023	1.1311	0.9833	1.0921	0.9557
6842	16.2%	192021	1.1301	1.1056	0.8719	1.0418
6258	0.0708	492011	1.1094	1.0054	0.9918	0.9635
Bottom 5						
2161	2.7%	514041	0.8860	0.8989	1.0756	0.9071
3531	10.6%	533033	0.8714	0.9159	1.1264	0.9402
3052	23.2%	519111	0.8534	0.9133	1.1630	0.8980
6672	21.1%	435081	0.8518	0.9000	1.0286	0.8943
3043	21.4%	435081	0.8518	0.9000	1.0286	0.8943

Table 24 lists 4531-Combat Mass Communicator as the PMOS group requiring the highest level of language skills to perform the occupational duties and 2161- Machinist as requiring the least amount of language skills. The 4531 occupation is two standard deviations above the mean in demand for language skills. As compared to the other index levels for 4531 [cognitive(1.03), physical(.873), social(1.14)], cognitive demand for this MOS sits close to the mean demand while physical and social are beyond one standard

deviation of the mean. So this MOS in particular stands out in its requirement/demand for language skills and it also has a high demand for social skills. On the contrary, physical skills are not as prized for the performance of this occupation. The top PMOS groups include: Judge Advocate, Metal Worker, Individual Material Readiness List Asset Manager, Legal Services Specialist, and Military Police Officer.

Table 24. Language Skills, Top and Bottom Six PMOS Groups

PMOS	Female	soccode	Cognitive Index	Language Index	Physical Index	Social Index
Top 6						
4531	34.4%	273031	1.0346	1.2076	0.8729	1.1399
4402	13.1%	231023	1.1073	1.1780	0.9081	1.1527
1316	5.9%	113011	1.0285	1.1219	0.8885	1.0561
6042	21.1%	113011	1.0285	1.1219	0.8885	1.0561
4421	23.1%	232011	0.9152	1.1174	0.9025	0.8589
5803	10.2%	331012	0.9918	1.1085	1.0572	1.1370
Bottom 6						
3531	10.6%	533033	0.8714	0.9159	1.1264	0.9402
3052	23.2%	519111	0.8534	0.9133	1.1630	0.8980
6672	21.1%	435081	0.8518	0.9000	1.0286	0.8943
3043	21.4%	435081	0.8518	0.9000	1.0286	0.8943
55grp1	13.1%	272042	0.9592	0.8996	0.9958	0.9639
2161	2.7%	514041	0.8860	0.8989	1.0756	0.9071

Table 25 lists 03grp1- Rifleman, etc., as the PMOS group requiring the highest level of physical skills to perform the occupational duties and 4502- Communication Strategy and Operations Officer as requiring the least amount of physical skills. The 03grp1 occupation is over two standard deviations above the mean in demand for physical skills. As compared to the other index levels for 03grp1 [cognitive(1.08), language(1.00), social(1.06)], all are within the first standard deviation of the mean. So this MOS in particular stands out in its requirement/demand for physical skills above all other categories. The top PMOS groups include: AAV Crewmember, Expeditionary Firefighting and Rescue (EFR) Specialist, Small Arms Repairer/Technician, Flight Equipment Technician, and Packing Specialist.

Table 25. Physical Skills, Top Six and Bottom Five PMOS Groups

PMOS	Female	soccode	Cognitive Index	Language Index	Physical Index	Social Index
Top 6						
03grp1	0.0%	332011	1.0823	1.0055	1.2349	1.0615
18grp2	0.2%	332011	1.0823	1.0055	1.2349	1.0615
7051	2.5%	332011	1.0823	1.0055	1.2349	1.0615
21grp1	4.6%	499098	1.0109	0.9452	1.1918	0.9801
6048	5.7%	499098	1.0109	0.9452	1.1918	0.9801
3052	23.2%	519111	0.8534	0.9133	1.1630	0.8980
Bottom 5						
0211	4.0%	171021	1.0806	0.9848	0.8713	0.9208
0402	15.3%	131081	1.0223	1.0344	0.8713	1.0732
6694	7.0%	113021	1.0326	1.0682	0.8719	1.0688
3112	26.3%	131081	1.0223	1.0344	0.8713	1.0732
4502	33.1%	112031	1.0053	1.0956	0.8713	1.1297

Table 26 lists 4402- Judge Advocate as the PMOS group requiring the highest level of Social skills to perform the occupational duties and 60grp1-Aircraft Intermediate Level Hydraulic/Pneumatic Mechanic as requiring the least amount of Social skills. The 4402 occupation is beyond one standard deviation above the mean in demand for social skills. As compared to the other index levels for 4402 [cognitive(1.11), language(1.18), physical(.908)], cognitive and language demands are high for this MOS while physical demands are fairly low. So this MOS in particular has high requirements and demands for social, language, and cognitive skills but physical skills are not as highly desired for the performance of this occupation. The top PMOS groups include: Military Police, Intelligence Specialist, Combat Mass Communicator, and Military Police Officer.

Table 26. Social Skills, Top and Bottom Five PMOS Groups

PMOS	Female	soccode	Cognitive Index	Language Index	Physical Index	Social Index
Top 5						
4402	13.1%	231023	1.1073	1.1780	0.9081	1.1527
5811	10.1%	333021	1.0715	1.1031	1.0535	1.1452
0231	14.8%	333021	1.0715	1.1031	1.0535	1.1452
4531	34.4%	273031	1.0346	1.2076	0.8729	1.1399
5803	10.2%	331012	0.9918	1.1085	1.0572	1.1370
Bottom 5						
6672	21.1%	435081	0.8518	0.9000	1.0286	0.8943
3043	21.4%	435081	0.8518	0.9000	1.0286	0.8943
1171	10.2%	518031	0.9953	0.9469	1.0684	0.8754
4421	23.1%	232011	0.9152	1.1174	0.9025	0.8589
60grp1	4.6%	493011	0.9896	1.0199	1.0722	0.8561

In Table 27, the PMOS occupational fields are displayed with the predicted upper bound of female representation adjusted for the additional skills and abilities required to serve as a Marine. I use the margins command in STATA to calculate these new percentages. This is accomplished by applying the skills index output for each PMOS group to the 2017 female representation levels. I do not include occupational field 48 – recruiting and retention in this table as it is a FMOS nor 41 – Marine Corps Community Services as it is limited to Marines in the Warrant Officer ranks and senior enlisted only.

Additionally, the 2017 population in each occupational field is listed as supplied from TFDW. The data contained a population of 184,674 Marines for 2017; subtracting out occupational fields 41 and 48 left me with 171,650. I calculate the weighted averages to determine the aggregate upper bound of female representation with a result of 18.6 percent without considering skills and abilities. I find that conditional on simplifying assumptions made for this thesis in order to include skills and abilities adjustments, the aggregate upper bound is only 8.82 percent. Naturally this number should be subject to further analysis.

Table 27. Predicted Female Upper Bound Adjusted for Skills and Abilities
Required to Perform the Occupation

PMOS Occ Field	2017 Population	2017 Female %	SOC	Predicted Upper Bound for Female %	Predicted Upper Bound Adjusted for Skills and Abilities Required to Perform the Job
03	30,000	0.1%	33-2011	4.5%	0.0%
08	4,991	0.7%	53-5020	6.2%	9.5%
18	229	0.8%	33-2011	4.5%	0.0%
21	4,118	2.5%	49-9098	6.7%	2.9%
75	5,156	4.3%	53-2010	6.1%	5.3%
59	4,451	4.6%	49-2094	6.8%	8.1%
73	366	4.6%	17-3024	9.4%	10.6%
28	4,439	4.7%	49-2094	9.7%	8.3%
62	4,118	4.8%	49-3011	5.5%	8.1%
61	5,934	4.9%	53-2010	6.1%	5.3%
13	9,160	5.5%	47-5031	9.3%	5.1%
65	2,833	6.4%	49-9031	3.7%	5.1%
11	3,044	8.4%	47-2111	2.1%	10.9%
06	15,244	8.5%	27-4012	10.0%	11.8%
35	13,029	8.6%	53-3030	5.8%	10.7%
64	2,781	9.0%	49-2091	11.1%	8.1%
57	885	9.2%	19-4031	33.1%	11.1%
63	4,511	9.2%	49-2091	11.1%	8.1%
72	2,691	9.6%	53-2020	21.1%	13.1%
70	2,304	10.1%	53-2020	21.1%	13.1%
58	4,451	10.3%	33-3021	25.5%	9.2%
60	5,540	10.6%	43-5061	58.8%	18.0%
02	4,950	11.5%	33-3021	25.5%	9.2%
05	321	12.5%	43-5011	29.8%	18.0%
23	2,432	12.5%	47-5031	9.3%	5.1%
26	3,167	12.8%	43-9011	44.8%	16.3%
04	5,859	13.9%	43-5011	29.8%	17.3%
68	395	15.2%	19-2021	21.4%	11.4%
55	889	16.5%	27-2040	28.8%	11.1%
66	2,352	18.2%	43-5081	34.4%	14.4%
34	1,507	18.4%	43-3051	88.1%	15.1%
44	1,110	18.6%	23-2011	83.5%	12.5%
30	6,760	22.8%	43-5081	34.4%	14.4%
33	2,128	23.9%	35-2010	39.1%	13.2%
01	7,777	24.6%	43-4161	80.2%	17.9%
31	568	26.1%	13-1081	33.7%	15.6%
45	1160	32.6%	27-3031	64.9%	18.6%
Total	171,650	Weighted Averages		18.6%	8.82%

V. CONCLUSIONS/RECOMMENDATIONS

The purpose of this study is to create an empirically justified upper bound of female representation across Marine Corps occupations. By identifying appropriate crosswalks and applying skills and abilities factors through hedonic regression analysis I hope to further enable Marine leadership to appropriately apply resources towards recruiting and retaining women.

A. CONCLUSIONS

Developing this mapping of civilian standard occupational codes (SOCs) to military occupational specialties (MOSs) reveals a very heavily male-dominated civilian sector for equivalent Marine occupations; specifically, the previously male only Marine occupations primarily sit at or below 5 percent female representation in the civilian sector. This highlights the occupational segregation across civilian labor markets indicating a low supply of female workers choosing such jobs.

In addition, there is substantial variation in results of the occupational comparisons; for example, the 31 distribution management occupations have similar gender representation (26.1 percent with its civilian equivalent logisticians. In contrast, the 01 manpower and administration occupational field (third highest in female representation at 24.6 percent) maps to the 43–4161 human resources assistant civilian occupational field (the highest civilian female representation at 80.2 percent).

Finally, I predict that substantial efforts may have to be expended for female representation in the U.S. Marine Corps to reach 10 percent as an aggregate. I find that conditional on simplifying assumptions made for this thesis, the aggregate upper bound is only 8.82 percent. Naturally this number should be subject to further analysis.

B. LIMITATIONS

While each occupation with skills and abilities data available on O*NET has a large enough number of observations for complete and accurate assessment, using surveys as the base of data may not capture the most accurate skill requirements. The survey questions

are answered by how strongly a respondent feels, through his/her experience, that a particular skill is required to perform the job. A more accurate representation might be if a consulting firm were hired to observe and document individuals performing their daily duties across all MOSs and potentially quantifying the results for data analysis. This would give a more accurate cross-occupation scale of skills and abilities requirements.

Additionally, the skills and abilities assessment is not available for all occupations mapped to MOS groups in this study nor are they available for military occupations themselves. Therefore, the results of this study are an approximation of the demands required to perform in a MOS.

I found a potentially significant limitation of the USMC TFDW data, especially the further back in time I analyzed, was that MOSs get redesignated, terminated, and created. Documentation of MOS code changes gets sparser the further back in time I look so it is difficult to capture these changes accurately in year 2000 for example. This makes a longitudinal study at the MOS level much more difficult.

C. RECOMMENDATIONS

For more thorough results, I recommend that further sensitivity analysis be conducted to reduce the effect of simplifying assumptions made to complete this thesis. This analysis should include additional work on defining the skills and abilities affects.

Furthermore, I recommend one of two suggested data collection methods be conducted. Either a survey is collected from Marine respondents on MOS knowledge, skills, and abilities, work styles, work context, and work activities or a contracted firm is hired to observe and document daily activities required of each MOS. A survey analysis should be conducted similar to the study by Wenger et al.; that creates a crosswalk based on survey responses of Marines in each MOS at each grade level. This survey should provide the amount of time spent on Marine required skills and abilities that are not required in their crosswalk identified civilian equivalent occupations. Survey data or observed and documented data would allow for a more accurate crosswalk of occupations and more accurately portray what female representation could potentially be in the USMC MOSs.

Finally, I recommend an additional crosswalk be generated similar to Table 14 in Chapter III that does not remove MOSs based solely on the rank required to fill the MOS. I restricted Table 14 by removing any MOS designated for sergeant and above, limited duty officers, or warrant officers. Additionally, I do not consider non-PMOSs (FMOS, AMOS, NMOS). It would be interesting to see if leaving these MOSs in the data set changes the outcomes.

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APPENDIX A. MOS MANUAL GLOSSARY AND BUSINESS RULES

NAVMC 1200.1C

	Glossary and Business Rules
Categories of MOSS	Occupational Fields 01-79, 80XX, and 90XX.
OccFld 01-79	Occupational Fields that contains all types of MOSS related to a specific occupational field.
80XX: Miscellaneous Requirement MOSS	These MOSSs are MOSSs that do not fit into a regular OccFlds but are used on the Marine Corps Table of Organization.
90XX: Reporting MOS	These MOSSs do not exist on the Marine Corps Table of Organization. They are used to meet Department of Navy and Department of Defense reporting requirements.
Types of MOSSs	Basic, Primary MOS (PMOS), Necessary MOS (NMOS), Free MOS (FMOS), Exception MOS (EMOS) and Additional MOS (AMOS).
Additional MOS (AMOS)	Any existing PMOS awarded to a Marine who already holds a PMOS. Example: After a lateral move a Marine's previous PMOS becomes an AMOS. Marines are not promoted in an AMOS.
Basic MOS	Entry-level MOSSs required for the P2T2 T/O for entry-level Marines or others not yet qualified by initial skills training. In addition, when a Reserve Component (RC) Marine transfers to a new unit and does not possess the MOS required for the billet filled, he will be assigned a Basic MOS until the completion of required formal school training or is otherwise certified to be MOS qualified.
Billet Designators	An FMOS requirement indicator as a BMOS that can be filled by any Marine appropriate grade that is included in the MOS definition (i.e. MOS 8007 Billet Designator-Unrestricted Ground Officer (I) FMOS). Normally, FMOS as a skill designator cannot be a BMOS in the Total Force Structure Management System (TFSMS).
Core Plus Skills	Tasks that are mission, advanced, rank, or billet Specific. These tasks are taught, executed, and evaluated at the unit. Core plus tasks relate to 2000 level Individual Training Standards in the Ground Training and Readiness (T&R) Manual.
Core Skills	Those basic skills that "make" a Marine and qualify that Marine for an MOS. Core skills comprise the set of core tasks for each MOS as found in the relevant to 1000 level Individual Training Standards in the Ground Training and Readiness (T&R) Manual.
Exception MOS (EMOS)	Non-PMOS that is generally FMOS but include exceptions that require a PMOS.

Free MOS (FMOS)	Non-PMOS that can be filled by any Marine regardless of primary MOS. A free MOS requires skill sets unrelated to primary skills.
Human Resource Development Process (HRDP)	The overarching process that makes the manpower side of combat capability through force structure, manpower, and training sub processes. It determines quantity and skills requirements of the operating force units and supporting establishment, and then attains, classifies, trains, assigns, retains, promotes, and otherwise manages an inventory of Marines to meet those requirements. The HRDP owner is Deputy Commandant Manpower and Reserve Affairs who coordinates with Deputy Commandant Combat Development and Integration for identification and integration of force structure requirements and training.
Initial Strength Test	A gender normed assessment intended to ensure each recruit has the requisite physical strength to conduct recruit training. The performance standards for male recruits are: 2 pullups, 44 crunches, and 13:30 1.5 mile run. The performance standards for female recruits are: 12 second flexed-arm hang, 44 crunches, and 15:00 1.5 mile run. An enlisted applicant (male or female) seeking a Program Enlisted For (PEF) code associated with the following MOSs: 0311, 0313, 0321, 0331, 0341, 0351, 0352, 0811, 0842, 0844, 0847, 0861, 1371, 1812, 1833, 2131, 2141, 2146, 2147, 7212, must meet the following gender neutral standards: 3 pull-ups, 13:30 1.5 mile run, 44 crunches, and 45 ammo can lifts.
MOS Classification Standards	Based on a recruits final CFT and PFT specific event performance, a gender neutral assessment to validate MOS Classification into the following MOSs: 0311, 0313, 0321, 0331, 0341, 0351, 0352, 0811, 0842, 0844, 0847, 0861, 1371, 1812, 1833, 2131, 2141, 2146, 2147, and 7212. The standards are: 6 pullups, 24:51 3 mile run, 3:12 Maneuver Under Fire Course, 3:26 Movement to Contact Course, and 60 ammo can lifts.
Necessary MOS (NMOS)	A non-PMOS that has a prerequisite of one or more PMOSs. This MOS identifies a particular skill or training that is in addition to a Marine's PMOS, but can only be filled by a Marine with a specific PMOS. When entered as a requirement into the Total Force Structure Management System (TFSMS), a billet bearing a necessary MOS must identify a single associated PMOS even if several PMOSs are acceptable prerequisites.

Prerequisite	Possessing physical, mental, or moral qualities necessary to be assigned to a typical billet for an MOS, or to meet formal school screening requirements.
Primary MOS (PMOS)	Used to identify the primary skills and knowledge of a Marine. Only enlisted Marines, Warrant Officers, Chief Warrant Officers, and Limited Duty Officers are promoted in their primary MOS. Changes to an Active Component Marine's PMOS without approval from CMC (MM) and changes to a RC Marine's PMOS without approval from CMC (RA) are not authorized.
Required Training	Initial Skills training expected to be received by Marines after completion of recruit training, where core skills training is provided, normally at an MOS producing formal school course. While preferred, this does not limit attaining MOS qualification to formal school graduation as the only source of MOS qualifying training in most cases. Career MOS or certification training that may or may not result in a new PMOS. Related to but not exactly overlapping the definition for "requirements" below since some requirements may not be related to training, if a community so chooses.
Requirement	Accomplishments necessary to qualify for an MOS, usually described as graduation from a formal school course approved to award the MOS.
Skill Progression Training	Formal schools training for Marines already holding an MOS, but the training relates directly to increasing overall skills and knowledge in the MOS. All holders of the MOS are expected to complete skill progression training and limited career potential may result from failure to do so. All Marines within a given MOS should complete Skill Progression Training.
Skill Enhancement Training	Formal schools or structured training for Marines already holding an MOS. Relates directly to increasing overall skills in the MOS. Usually intended for MOS holders with particular billet requirements. Some Marines within a given MOS may complete Skill Enhancement Training.

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APPENDIX B. MOS AND SOC TITLES

MOS	Most Common MOS title	SOC Code	SOC Title
01XX Manpower & Administration			
grp1	0102 Manpower Officer	11-3131	Human Resources Managers
grp2	0111 Administrative Specialist	43-4161	Human Resources Assistants, Except Payroll and Timekeeping
02XX Intelligence			
grp1	0202 MAGTF Intelligence Officer, 0207Air Intelligence Officer	11-1021	General and Operations Managers
0203	Ground Intelligence Officer	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers
grp2	0206 Signals Intelligence Officer, 0204 Counterintelligence/Human Intelligence Specialist	33-1012	First-Line Supervisors of Police and Detectives
0211	CI/HUMINT (Cpl to MSgt)	17-1020	Surveyors, Cartographers, and Photogrammetrists
0231	Intelligence Specialist (entry level)	33-3021	Police Officers and Detectives
grp3	0261 Geographic Intelligence Specialist (entry level), 0241 Imagery Specialist (MSgt to Sgt)	17-3031	Surveying and mapping tech
03XX Infantry			
0302	Infantry Officer	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers
0370	Special Operations Officer	47-1011	First-Line Supervisors of Construction Trades and Extraction Workers
grp1	0311 Rifleman (Sgt to Pvt), 0331 Machine Gunner (Sgt to Pvt), 0341 Mortarman, 0351 Infantry Assault Marine, 0352 Antitank Missile Gunner	33-2011	Fire fighter
grp2	0313 Light Armored Reconnaissance Marine (Sgt to Pvt), 0321 Reconnaissance Marine (MSgt to Pvt)	53-5020	Captains, mates, and pilots of water vessels
04XX Logistics			
0402	Logistics Officer (mobility officer 0430 must be a Capt)	13-1081	Logisticians
0411	Maintenance Management Specialist (MSgt to Pvt)	11-3051	Industrial Production Managers
grp1	0431 Logistics/Embarkation Specialist (SSgt to Pvt), 0481 Landing Support Specialist (SSgt to Pvt)	43-5011	Cargo and Freight Agent
0451	Airborne & Air Delivery Specialist (MGySgt to Pvt)	53-2010	Aircraft Pilots and Flight Engineers
0471	Personnel Retrieval and Processing Specialist (SSgt to Pvt)	39-4031	Funeral Service Workers
05XX MAGTF Plans			
0511	MAGTF Planning Specialist (MGySgt to Pvt)	43-5061	Production, Planning, and Expediting Clerks
0532	Civil Affairs Specialist (MGySgt to Cpl)	13-1199	Other Business Operations and Management Specialists
06XX Communications			
0602	Communications Officer	11-1021	General and Operations Managers
grp1	0621 Transmissions System Operator (Sgt to Pvt), 0627 Satellite Transmission System Operator (Sgt to Pvt)	27-40XX	Broadcast and Sound Engineering Technicians and Radio Operators
grp2	0612 Tactical Switching Operator (Sgt to Pvt), 0631 Network Administrator (Sgt to Pvt), 0651 Cyber Network Operator (Sgt to Pvt), 0671 Data Systems Administrator (Sgt to Pvt)	49-209X	Electrical and electronics repairers, transportation equipment, and industrial and utility
08XX Field Artillery			
0802	Field Artillery Officer (the rest are WO only or special MOS)	47-1011	First-Line Supervisors of Construction Trades and Extraction Workers
0811	Field Artillery Cannoneer (MGySgt to Pvt)	53-5020	Captains, mates, and pilots of water vessels
grp1	0842 Field Artillery Radar Operator (Sgt to Pvt), 0844 Field Artillery Fire Control Marine (Sgt to Pvt), 0847 Field Artillery Sensor Support Marine (Sgt to Pvt), 0861 Fire Support Marine (MGySgt To Pvt)	43-9011	Computer Operators
11XX Utilities			
grp1	1141 Electrician (SSgt to Pvt), 1142 Engineer Equipment Electrical Systems Technician	47-2111	Electricians
1161	Refrigeration and Air Conditioning Technician (SSgt to Pvt)	49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers
1171	Water Support Technician (SSgt to Pvt)	51-8031	Water and Wastewater Treatment Plant and System Operators
13XX Engineer, Construction, Facilities, and Equipment			
1302	Combat Engineer Officer	11-9021	Construction Managers
1316	Metal Worker (SSgt to Pvt)	51-4120	Welders, Cutters, Solders, and Brazers Workers
1341	Engineer Equipment Mechanic (SSgt to Pvt)	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists
1345	Engineer Equipment Operator (SSgt to Pvt)	47-1011	First-Line Supervisors/Managers of Construction Trades and Extraction Workers
1361	Engineer Assistant (GySgt to Pvt)	17-1010	Architects
1371	Combat Engineer (MGySgt to Pvt)	47-5031	Explosives Workers, Ordnance Handling Experts, and Blasters
1391	Bulk Fuel Specialist (MGySgt to Pvt)	53-7070	Pumping Station Operators
18XX Tank, Assault Amphibious Vehicle and Amphibious Combat Vehicle			
grp1	1802 Tank Officer, 1803 Assault Amphibious Vehicle (AAV) Officer	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers

grp2	1812 Armor Marine (MGySgt to Pvt) , 1833 AAV Crewmember, 1834 ACV Crewmember	33-2011	Fire fighter
21XX Ground Ordnance Maintenance			
grp1	2311 Small Arms Repairer/Technician (GySgt to Pvt), 2131 Towed Artillery Systems Technician	49-9098	Installation, Maintenance and Repair Workers, All Other
grp2	2141 AAV Repairer/Technician (GySgt to Pvt), 2146 MBT Repairer/Technician, 2147 LAV Repairer/Technician	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists / Automotive Service Technicians and Mechanics
2161	Machinist (GySgt to Pvt)	51-4041	Machinist
2171	Electro-optical Ordnance Repairer (GySgt to Pvt)	49-9060	Precision Instrument and Equipment Repairers, All Other
23XX Ammunition & Explosive Ordnance Disposal			
2311	Ammunition Technician (MGySgt to Pvt)	47-5031	Explosive workers, ordnance handling experts, and blasters
26XX Signals Intelligence/Ground Electronic Warfare			
grp1	2621 Signals Intelligence and Electronic Warfare Operator /Analyst (Sgt to Pvt), 2631 Electronic Intelligence (ELINT) Analyst, 2651 ISR Systems Engineer	43-9011	Computer Operators
grp2	2641 Cryptologic Linguist Operator/Analyst, older versions: 2673, 2674, 2676,	27-40XX	Broadcast and Sound Engineering Technicians and Radio Operators
28XX Ground Electronics Maintenance			
grp1	2831 Digital Wideband Systems Maintainer (Sgt to Pvt), 2841 Ground Electronics Transmission system Maintainer, 2847 Ground Electronics Telecommunications System Maintainer, 2887 Artillery Electronics Technician (GySgt to Pvt)	49-2020	Radio and Telecommunications Equipment Installers Repairers
30XX Supply Chain Material Management			
3002	Ground Supply Officer	11-3061	Purchasing Managers
3043	Supply Chain and Materiel Management Specialist (MGySgt to Pvt)	43-5081	Stock Clerks and Order Filler
3051	Inventory Management Specialist (MGySgt to Pvt)	43-5011	Cargo and Freight Agents
3052	Packing Specialist (MGySgt to Pvt)	51-9111	Packaging and Filling Machine Operators and Tenders
31XX Distribution Management			
3112	Distribution Management Specialist (MGySgt to Pvt)	13-1081	Logisticians
33XX Food Service			
3381	Food Service Specialist (MGySgt to Pvt)	35-2010	Chefs and Cooks
34XX Financial Management			
3404	Financial Management Officer	11-3031	Financial Managers
3432	Finance Technician (MGySgt to Pvt)	43-3051	Payroll and Timekeeping Clerks
3451	Financial Management Resource Analyst (MGySgt to Pvt)	43-3031	Bookkeeping, Accounting, and Auditing Clerks
35XX Motor Transport			
3521	Automotive Maintenance Technician (Sgt to Pvt)	49-3023	Automotive Service Technicians and Mechanics
3531	Motor Vehicle Operator (Sgt to Pvt)	53-3030	Driver/Sales Workers and Truck Drivers
44XX Legal Support			
4402	Judge Advocate	23-10XX	Lawyers, and judges, magistrates, and other judicial workers
4421	Legal Services Specialist (MGySgt to Pvt)	23-2011	Paralegals and legal Assistants
45XX Communication Strategy & Operations			
4502	Communication Strategy & Operations Officer	11-2031	Managers in Marketing, Advertising, and Public Relations
4512	Combat Graphics Specialist (Sgt to Pvt)	51-5113	Bookbinders, Printing Machine Operators, and Job Printers
4531	Combat Mass Communicator	27-3031	Public Relations Specialists
grp1	4541 Combat Photographer, 4571 Combat Videographer	27-4021	Photographers
55XX Music			
grp1	5524 Musician, 5512 Commandant's Own	27-2040	Musicians and singers
57XX Chemical, Biological, Radiological & Nuclear (CBRN) Defense			
5711	CBRN Defense Specialist	19-4031	Chemical Technicians
58XX Military Police, Investigations, & Corrections			
5803	Military Police Officer	33-1011	First-Line Supervisors of Correctional Officers
5811	Military Police (MGySgt to Pvt)	33-3021	Police and Sheriff's Patrol Officers
5831	Correctional Specialist (MGySgt to Pvt)	33-3010	Sheriffs, Bailiffs, Correctional Officers, and Jailers
59XX Aviation Command and Control (C2) Electronics Maintenance			
5939	Aviation Communication Systems Technician (MSgt to Pvt)	27-40XX	Broadcast and Sound Engineering Technicians and Radio Operators, and media and communication equipment workers, all other

grp1	5948 Aviation Radar Technician (MSgt to Pvt), 5952 Air Traffic Control Navigational Aids Technician (GySgt to Pvt), 5953 Air Traffic Control Radar Technician (GySgt to Pvt), 5954 Air Traffic Control Communications Technician (GySgt to Pvt), 5974 Tactical Data Systems Technician, 5979 Tactical Air Operations/Air Defense Systems Technician (MSgt to Pvt)	49-209X	Electrical and electronics repairers, transportation equipment, and industrial and utility
5951	Aviation Meteorological Equipment Technician, OMA/IMA (GySgt to Pvt)	49-9060	Precision Instrument and Equipment Repairer, All Other
60/61/62XX Aircraft Maintenance / Organizational Avionics Maintenance			
6002	Aircraft Maintenance Officer	49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers
6042	Individual Material Readiness List (IMRL) Asset Manager (MGySgt to Pvt)	51-4120	Welders, Cutters, Soldiers, and Brazers
6046	Aviation Maintenance Data Specialist (MGySgt to Pvt)	43-5061	Production, Planning, and Expediting Clerks
6048	Flight Equipment Technician (GySgt to Pvt)	49-9098	Helpers--Installation, Maintenance, and Repair Workers
grp1	6062 Aircraft Intermediate Level Hydraulic/ Pneumatic Mechanic (GySgt to Pvt), Aircraft Intermediate level Structures Mechanic, 6112 Helicopter Mechanic, CH-46 (GySgt to Pvt), 6113, 6114, 6116, 6122, 6124, 6132, 6152, 6153, 6154, 6156, 6212 Fixed-Wing Aircraft Mechanic, AV-8/TAV-8 (GySgt to Pvt), 6213, 6216, 6217, 6218, 6222, 6223, 6226, 6252, 6253, 56, 57, 6282, 83, 86, 87, 88	49-3011	Aircraft Mechanics and Service Technicians
6073	Support Equipment Electrician/Refrigeration and Engine /Gas Turbine Technician (GySgt to Pvt)	49-3040	Heavy Vehicle and Mobile Equipment Service Technicians and Mechanics
6074	Cryogenics Equipment Operator (GySgt to Pvt)	51-9010	Chemical Processing Machine Setters, Operators, and Tenders
grp2	Helicopter Crew Chief, CH-46 (GySgt to Pvt), 6173, 6174, 6176, 6276	53-2010	Aircraft Pilots and Flight Engineers
6258	Fixed-Wing Aircraft Airframe Mechanic, F-35B (GySgt to Pvt)	51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers
63/64XX Organizational Avionics Maintenance			
grp1	6313 Aircraft Communications/Navigaton/Radar Systems Technician, EA-6 (GySgt to Pvt), 6314, 13, 17, 23, 24, 26, 32, 33, 36, 37, 38, 86, 6423 Aviation Electronic Micro/Miniature Component and Cable Repair Technician, IMA (GySgt to Pvt), 32, 6483	49-2091	Avionics Technicians
6469	Reconfigurable Transportable Consolidated Automated Support System (RTCASS) Technician, IMA (GySgt to Pvt)	49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers
6492	Aviation Precision Measurement Equipment (PME) Calibration/Repair Technician, IMA (GySgt to Pvt)	49-9060	Precision Instrument and Equipment Repairers, All Other
6499	Mobile Facility Technician (GySgt to Pvt)	49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers
65XX Aviation Ordnance			
grp1	6531 Aircraft Ordnance Technician (SSgt to Pvt), 6541	49-9071	Maintenance and Repair Workers, General
66XX Aviation Logistics			
6602	Aviation Supply Officer	11-3071	Transportation, Storage, and Distribution Managers
6672	Aviation Supply Specialist (MGySgt to Pvt)	43-5081	Stock Clerks and Order Fillers
6694	Aviation Logistics Information Management System (ALIMS) Specialist (MGySgt to Pvt)	11-3021	Computer and Information Systems Managers
68XX Meteorology & Oceanography (METOC)			
6842	METOC Analyst Forecaster (MGySgt to Pvt)	19-2021	Atmospheric and Space Scientists
70XX Airfield Services			
grp1	7011 Expeditionary Airfield Systems Technician (MGySgt to Pvt), 7041 Aviation Operations Specialist (MGySgt to Pvt)	53-2020	Air Traffic Controllers and Airfield Operations Specialists
7051	Expeditionary Firefighting and Rescue (EFR) Specialist (MGySgt to Pvt)	33-2011	Fire Fighters
72XX Aviation Command & Control Operations			
grp1	7220 Air Traffic Control Officer, 7204 Low Altitude Air Defense Officer, 7208 Air Support Control Officer, 7210 Air Defense Control Officer	53-2020	Air Traffic Controllers and Airfield Operations Specialists
7204	Low Altitude Air Defense Officer	53-2020	Air Traffic Controllers and Airfield Operations Specialists
7212	Low Altitude Air Defense (LAAD) Gunner (MGySgt to Pvt)	49-1011	First-Line Supervisors of Mechanics, Installers, & Repairers
grp2	7236 Tactical Air Defense Controller (MGySgt to Pvt), 7242, 7257, 7251, 7252, 7253, 7254	53-2020	Air Traffic Controllers and Airfield Operations Specialists
73XX Navigators & Unmanned Aircraft System Officers/Operators			
7315	Unmanned Aircraft System (UAS) MAGTF Electronic Warfare Officers (EWOs)	53-2010	Aircraft Pilots and Flight Engineers
7314	Unmanned Aircraft System (UAS) Operator (MGySgt to Pvt)	17-2070	Electrical and Electronics Engineers
7372	Tactical Systems Operator/Mission Specialist (MGySgt to LCpl)	53-2010	Aircraft Pilots and Flight Engineers
75XX Pilots/Naval Flight Officers			
grp1	75XX Pilot, NFO	53-2010	Aircraft Pilots and Flight Engineers

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APPENDIX C. CROSSWALK SOURCES

MOS	SOC	SOC Title	Source
01XX Manpower & Administration			
grp1	11-3131	Human Resources Managers	MOS Manual
		Human Resources Assistants, Except Payroll and	MOS Manual
grp2	43-4161	Timekeeping	
02XX Intelligence			
grp1	11-1021	General and Operations Managers	Wenger Et. al RAND study
		First-Line Supervisors of Fire Fighting and	My Interpolation
0203	33-1021	Prevention Workers	
grp2	33-1012	First-Line Supervisors of Police and Detectives	Wenger Et. al RAND study
		Surveyors, Cartographers, and	MNMV
0211	17-1021	Photogrammetrists	
0231	33-3021	Police Officers and Detectives	Wenger Et. al RAND study
grp3	17-3031	Surveying and mapping tech	MOS Manual
03XX Infantry			
		First-Line Supervisors of Fire Fighting and	My Interpolation
0302	33-1021	Prevention Workers	
		First-Line Supervisors of Construction Trades	MNMV
0370	47-1011	and Extraction Workers	
grp1	33-2011	Fire fighter	Wenger Et. al RAND study
grp2	53-5020	Captains, mates, and pilots of water vessels	Wenger Et. al RAND study

04XX Logistics			
0402	13-1081	Logisticians	MOS Manual
0411	11-3051	Industrial Production Managers	MOS Manual
grp1	43-5011	Cargo and Freight Agent	MOS Manual
0451	53-2010	Aircraft Pilots and Flight Engineers (Air Crew Members - MOS manual)	MOS Manual
0471	39-4031	Funeral Service Workers	MOS Manual
05XX MAGTF Plans			
0511	43-5061	Production, Planning, and Expediting Clerks	My Interpolation
0532	13-1199	Other Business Operations and Management Specialists	MNMV
06XX Communications			
0602	11-1021	General and Operations Managers	MOS Manual
grp1	2740XX	Broadcast and Sound Engineering Technicians and Radio Operators	MNMV
grp2	49-209X	Electrical and electronics repairers, transportation equipment, and industrial and utility	MNMV
08XX Field Artillery			
0802	47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	MNMV
0811	53-5020	Captains, mates, and pilots of water vessels	Wenger Et. al RAND study
grp1	43-9011	Computer Operators	My Interpolation
11XX Utilities			
grp1	47-2111	Electricians	MOS Manual
1161	49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	MOS Manual
1171	51-8031	Water and Wastewater Treatment Plant and System Operators	MOS Manual
13XX Engineer, Construction, Facilities, and Equipment			MOS Manual
1302	11-9021	Construction Managers	MOS Manual
1316	51-4120	Welders, Cutters, Solders, and Brazers Workers	MOS Manual
1341	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	MOS Manual
1345	47-1011	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	MOS Manual
1361	17-1010	Architects	MOS Manual
1371	47-5031	Explosives Workers, Ordnance Handling Experts, and Blasters	MOS Manual
1391	53-7070	Pumping Station Operators	MOS Manual

18XX Tank, Assault Amphibious Vehicle and Amphibious Combat Vehicle			
grp1	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	My Interpolation
grp2	33-2011	Fire fighter	Wenger Et. al RAND study
21XX Ground Ordnance Maintenance			
grp1	49-9098	Installation, Maintenance and Repair Workers, All Other	MOS Manual
grp2	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists / Automotive Service Technicians and Mechanics	MOS Manual
2161	51-4041	Machinist	MOS Manual
2171	49-9060	Precision Instrument and Equipment Repairers, All Other	MOS Manual
23XX Ammunition & Explosive Ordnance Disposal			
2311	47-5031	Explosive workers, ordnance handling experts, and blasters	MOS Manual
26XX Signals Intelligence/Ground Electronic Warfare			
grp1	43-9011	Computer Operators	MNMV
grp2	2740XX	Broadcast and Sound Engineering Technicians and Radio Operators	MNMV
28XX Ground Electronics Maintenance			
grp1	49-2020	Radio and Telecommunications Equipment Installers Repairers...	MOS Manual
30XX Supply Chain Material Management			MOS Manual
3002	11-3061	Purchasing Managers	MOS Manual
3043	43-5081	Stock Clerks and Order Filler	MOS Manual
3051	43-5011	Cargo and Freight Agents	MOS Manual
3052	51-9111	Packaging and Filling Machine Operators and Tenders	MOS Manual
31XX Distribution Management			
3112	13-1081	Logisticians	MOS Manual
33XX Food Service			
3381	35-2010	Chefs and Cooks	MOS Manual
34XX Financial Management			
3404	11-3031	Financial Managers	MOS Manual
3432	43-3051	Payroll and Timekeeping Clerks	MOS Manual
3451	43-3031	Bookkeeping, Accounting, and Auditing Clerks	MOS Manual

35XX Motor Transport			
3521	49-3023	Automotive Service Technicians and Mechanics	MOS Manual
3531	53-3030	Driver/Sales Workers and Truck Drivers	MOS Manual
44XX Legal Support			
4402	23-10XX	Lawyers, and judges, magistrates, and other judicial workers	MOS Manual
4421	23-2011	Paralegals and legal Assistants	MOS Manual
45XX Communication Strategy & Operations			
4502	11-2031	Managers in Marketing, Advertising, and Public Relations	MOS Manual
4512	51-5113	Bookbinders, Printing Machine Operators, and Job Printers Job Printers	MOS Manual
4531	27-3031	Public Relations Specialists	MOS Manual
grp1	27-4021	Photographers	MOS Manual
55XX Music			
grp1	27-2040	Musicians and singers	MOS Manual
57XX Chemical, Biological, Radiological & Nuclear (CBRN) Defense			
5711	19-4031	Chemical Technicians	MNMV
58XX Military Police, Investigations, & Corrections			
5803	33-1012	First-Line Supervisors of Correctional Officers	MOS Manual
5811	33-3021	Police and Sheriff's Patrol Officers	MOS Manual
5831	33-3010	Sheriffs, Bailiffs, Correctional Officers, and Jailers	MOS Manual
59XX Aviation Command and Control (C2) Electronics Maintenance			
5939	27-40XX	Broadcast and Sound Engineering Technicians and Radio Operators, and media and communication equipment workers, all other	MOS Manual
grp1	49-209X	Electrical and electronics repairers, transportation equipment, and industrial and utility	MOS Manual
5951	49-9060	Precision Instrument and Equipment Repairer, All Other	MOS Manual

60/61/62XX Aircraft Maintenance / Organizational Avionics Maintenance			
6002	49-1011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	MOS Manual
6042	51-4120	Welders, Cutters, Soldiers, and Brazers	MOS Manual
6046	43-5061	Production, Planning, and Expediting Clerks	MOS Manual
6048	49-9098	Helpers--Installation, Maintenance, and Repair Workers	MOS Manual
grp1	49-3011	Aircraft Mechanics and Service Technicians	MOS Manual
6073	49-3040	Heavy Vehicle and Mobile Equipment Service Technicians and Mechanics	MOS Manual
6074	51-9010	Chemical Processing Machine Setters, Operators, and Tenders	MOS Manual
grp2	53-2010	Aircraft Pilots and Flight Engineers	MOS Manual
6258	49-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	MOS Manual
72XX Aviation Command & Control Operations			
grp1	53-2020	Air Traffic Controllers and Airfield Operations Specialists	My Interpolation
7204	53-2020	Air Traffic Controllers and Airfield Operations Specialists	My Interpolation
7212	49-1011	First-Line Supervisors of Mechanics, Installers, & Repairers	MNMV
grp2	53-2020	Air Traffic Controllers and Airfield Operations Specialists	MNMV
73XX Navigators & Unmanned Aircraft System Officers/Operators			
7315	53-2010	Aircraft Pilots and Flight Engineers	My Interpolation
7314	17-2070	Electrical and Electronics Engineers	MOS Manual
7372	53-2010	Aircraft Pilots and Flight Engineers	MOS Manual
75XX Pilots/Naval Flight Officers			
grp1	53-2010	Aircraft Pilots and Flight Engineers	MOS Manual

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APPENDIX D. SKILLS AND ABILITIES INDICES CATEGORY CHARACTERISTICS TABLES

Table 1. Description of O*NET Variables (Source: Bacolod and Rangel, 2017)

Variable Name	Description
Cognitive Skills	
Active Learning	Understanding the implications of new information for both current and future problem-solving and decision-making
Active Listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate
Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems
Learning Strategies	Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things
Mathematics	Using mathematics to solve problems
Monitoring	Monitoring/assessing performance of yourself, other individuals or organizations to make improvements or take corrective action
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Social Skills	
Coordination	Adjusting actions in relation to others' actions
Instructing	Teaching others how to do something
Negotiation	Bringing others together and trying to reconcile differences
Persuasion	Persuading others to change their minds or behavior
Service Orientation	Actively looking for ways to help people
Social Perceptiveness	Being aware of others' reactions and understanding why they react as they do
Physical Skills	
Dynamic Strength	Ability to exert muscle force repeatedly or continuously over time
Explosive Strength	Ability to use short bursts of muscle force to propel oneself as in jumping or sprinting, or to throw an object
Static Strength	Ability to exert maximum muscle force to lift, push, pull or carry objects
Trunk Strength	Ability to use abdominal and lower back muscles to support part of the body repeatedly or continuously over time without fatiguing
Stamina	Ability to exert physically over long periods of time without getting winded or out of breath
Dynamic Flexibility	Ability to quickly and repeatedly bend, stretch, twist, or reach with body, arms, and/or legs
Extent Flexibility	Ability to bend, stretch, twist, or reach with your body, arms, and/or legs
Gross Body Coordination	Ability to coordinate the movement of arms, legs, and torso together when the whole body is in motion
Gross Body Equilibrium	Ability to keep or regain body balance or stay upright when in an unstable position

Table 2. Top and Bottom Occupations in the O*NET By Skill Index (Source: Bacolod and Rangel, 2017)

Cognitive Skills	
TOP 5	BOTTOM 5
College & High School subject instructors	Crossing Guards
Physicians	Graders & Sorters of Ag Products
Managers in Education	Mail Handlers
Aerospace Engineers	Maids & Lodging Cleaners
Medical Scientists	Vehicle Washers
Social Skills	
TOP 5	BOTTOM 5
Sales Engineers	Furniture Finishers
Clergy	Drillers of Earth
Managers in Education	Metal Platers
Education Counselors	Graders & Sorters of Ag Products
Chief Executives & Public Administrators	Sewing machine operator
Physical Skills	
TOP 5	BOTTOM 5
Dancers	Mathematicians
Firefighting	College subject instructors
Mechanics	Purchasing Managers
Construction Helpers	Economists
Roofers	Chief Executives & Public Administrators

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