Women in Operational Career Fields: Lessons Learned From Male-Dominated Civilian Industries

Response to DACOWITS RFI 13

Prepared for the September 2018 DACOWITS Quarterly Business Meeting

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Introduction

The Defense Advisory Committee on Women in the Services (DACOWITS) requested a literature review on three to five traditionally male-dominated civilian industries that closely resemble U.S. military operational career fields. Of particular interest to the committee was (1) identifying the gender distribution in each selected civilian career field and (2) summarizing the strategies, if any, used to recruit and retain women in these fields.

Bottom Line Up Front

▶ Women in male-dominated civilian career fields encounter many of the same barriers as women in operational career fields in the military. Common factors that contribute to the persistence of a gender gap in these fields include gender discrimination, sexual harassment and sexual assault in the workplace, stereotypes about women's competency, lack of work-life balance, and inflexible work schedules.

▶ Strategies that have been used successfully to recruit women in male-dominated civilian industries include targeted marketing and recruitment efforts as well as training or apprenticeship programs to prepare women for entering the field.

▶ Retention strategies that have proved most effective include expanding family-friendly policies and flexible work schedules and building professional support through mentoring programs and other career opportunities.

▶ Many male-dominated civilian industries have not been proactively working to employ more women. Achieving more gender diversity in the workplace is not a priority for all industries, even those with a very small percentage of women in the field.

▶ The strategies that have been most commonly used to recruit and retain women in male-dominated civilian career fields have, to some extent, also been used by the military. However, room for improvement remains.

Chapter 1 reviews a statement of the problem regarding the retention of women in the military and the issue of male-dominated civilian occupations. It also describes the process used to select the five career fields that this report profiles in depth. Chapter 2 provides a detailed discussion of five male-dominated civilian career fields, including identifying strategies that have been used to recruit and retain women. Chapter 3 concludes the discussion by identifying the pattern of challenges for women in male-dominated career fields and what strategies have been used successfully to attract and keep women in these industries.

Chapter 1. Statement of the Problem

This chapter provides an overview of the representation of women in the military (Section A) and selected male-dominated civilian career fields (Section B), as well as a comparison between male-dominated civilian career fields and the military (Section C).

A. Women in the U.S. Military

The military is a male-dominated institution. For much of American history, military service has been considered a responsibility for men, and restrictions have been placed on women's ability to serve. The Women's Armed Services Integration Act in 1948 allowed women to become permanent members of the military, and policy changes in December 2015 lifted all remaining combat restrictions on women's military service.[1] However, women continue to be a statistical minority in the military. Women made up 16.2 percent of the active duty force as of June 2018[2] and 19.3 percent of the Guard and Reserve as of 2016.[3] The Military Service Academies had the highest representation of women, who comprised 26.03 percent of the student body as of June 2018 (see Figure 1).[4]

Figure 1. Active Duty Females by Rank/Grade and Service as of June 2018
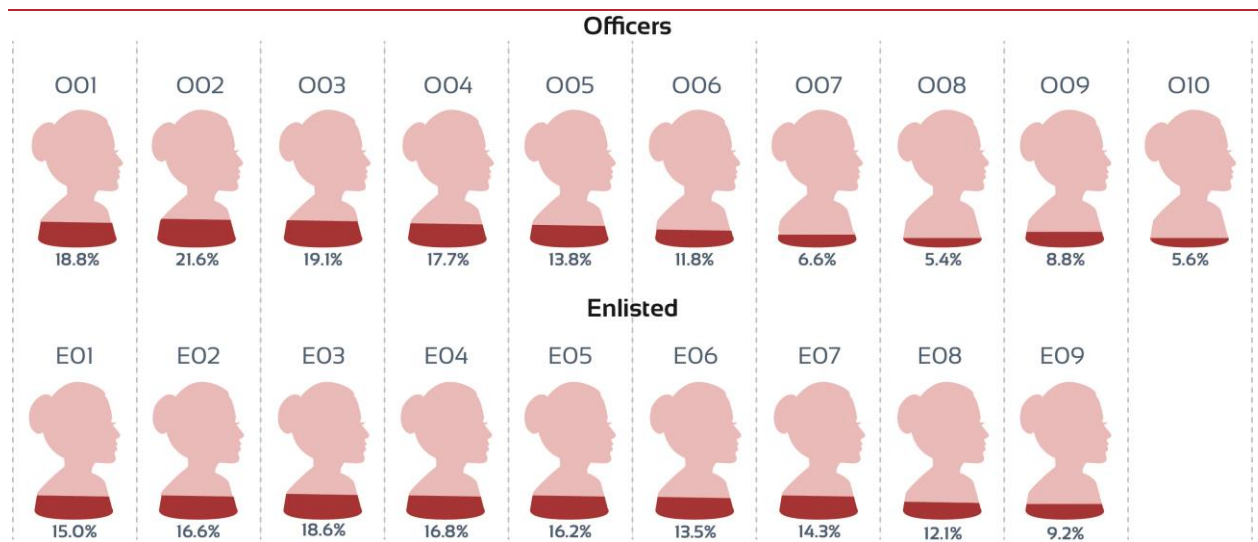
This figure does not include data for warrant officers, who in June 2018 made up 1.5 percent of the military. Among warrant officers, women made up a disproportionately small percentage of higher ranking officers. Women were most represented in the lowest rank, WO1 (9.6 percent), and least represented in the highest rank, WO5 (7.6 percent).
Source: DoD. (2018). *Active Duty Master Personnel File* [Dataset]. Retrieved from https://www.dmdc.osd.mil/appj/dwp/dwp_reports.jsp

Although women's representation in the military and among senior leadership is more robust than ever before, women's rate of attrition from military service is notably higher than that of their male peers. As DACOWITS has previously reported, both female officers and female enlisted personnel are more likely than their male counterparts to leave the military.[5] The disparity between men and women grows with rank; the percentage of women in the highest ranks of military leadership is substantially lower than that of women in the lower ranks.[6] Women have reported various barriers to their continued service, including work-life balance difficulties, family planning issues, logistical challenges for dual-military marriages, male-dominated workplace culture and gender discrimination, lack of female role models and leadership, and the perceived inflexibility of military career paths.[7]

DoD leaders have expressed a desire to increase the representation of women in the military, especially at senior levels of leadership, as part of an overall effort to diversify the force. For example, the 2012 "Diversity and Inclusion Strategic Plan" highlighted retention as imperative to the continued strength of the force; it noted that because of the "significant amount of time it takes to grow senior DoD leaders, it is essential that we act now to tap into that diverse talent pool . . . to meet future demands."[8] The recruitment and retention of women in the military continues to be an important issue for the military's leaders and the civilian public it serves.

Although each of the Services defines the term "operational" differently,[i,ii,iii,iv,v] there is some evidence to suggest that retention rates are often lower for servicewomen in operational specialties compared with those in support-oriented career fields. In response to a March 2018 DACOWITS request for information (RFI), the Navy reported a 1-year retention rate of 88.8 percent for female officers in operational positions compared with 91.9 percent for female officers in nonoperational positions.[9] However, longitudinal data provided by the U.S. Army Resources Command suggest that this gap may widen over time. The data showed that although the retention gap for female officers in Army operational versus support positions was negligible for those in their initial years of service, by the 10-year mark, 33.6 percent of female officers in operational branches were still in the Service compared with 37.2 percent of those in support branches.[10]

B. Women in Male-Dominated Civilian Career Fields

Substantial gender disparities within civilian professions exist in both male- and female-dominated occupations. Disparities are most common in male-dominated civilian occupations that involve significant physical labor (e.g., construction, carpentry) or those that require advanced technical skill or scientific knowledge (e.g., diesel engine mechanics, chemical engineers). Although women have played a steady role in the workforce for some time, male-dominated career fields tend to be higher paying than female-dominated career fields, which are often oriented around support and administrative roles such as teaching, nursing, and secretary/assistant positions.[11]

With the continued persistence of gendered occupations, entire industries lose the benefits of a diverse workforce, which can bring different perspectives to emerging industry problems and create innovations.[12] A diverse workforce can better serve the community it represents, especially in roles such

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[i] The Air Force Officer Classification Directory defines operational career fields for officers as those that directly employ weapon and supporting systems to accomplish the primary operational mission of the Air Force. Enlisted fields include Aircrew Operations, Cyber Warfare, Command and Control Systems Operations, Intelligence, Aircrew Flight Equipment, Safety, Aircrew Protection, and Remotely Piloted Aircraft Source: United States Air Force (2018, March). *Women in Operational Career Fields: United States Air Force Version 2* (Response to RFI 1). Written response provided for the meeting of the DACOWITS Federal Advisory Committee.

[ii] The Army's current operational specialties include Air Defense Artillery, Armor, Aviation, Engineers, Field Artillery, Infantry, Military Police, Special Operations branches (Special Forces, Civil Affairs, Psychological Operations). Source: United States Army. (2018, March). *Women in Operational Career Fields* (Response to RFI 1). Written response provided for the meeting of the DACOWITS Federal Advisory Committee.

[iii] The Coast Guard's ratings were determined to fall under the oversight of its Deputy Commandant for Mission Support or its Deputy Commandant for Operations based on the chain of command for the program management). Other means to determine whether a role is "operational" include factors such as the sea-versus-shore time ratio and the nature of the work. Source: Coast Guard Human Resources Directorate. (2018, March). *Charts for DACOWITS 2018* (Response to RFI 1). Written response provided for the meeting of the DACOWITS Federal Advisory Committee.

[iv] The Marine Corps defines all of its specialties as operational. Source: Hollahan, M.R.. (2018, March). *Memorandum for Defense Advisory Committee on Women in the Services* (Response to RFI 1). Written response provided for the meeting of the DACOWITS Federal Advisory Committee.

[v] Operational career fields for Navy officers are defined as those filling Unrestricted Line designators. Enlisted operational career fields are identified by ratings with sea shore flow (SSF) career paths that are set to the maximum sea tour lengths allowed by Navy policy and considered sea intensive, resulting in 216 months or 18 years on sea duty over a 30-year career. This also includes shore-intensive communities where enlisted Sailors do not have career paths defined by SSF but can expect to spend more than half their careers on shore duty assignments. Sources: United States Navy. (2018, March). *Women in Operational Career Fields RFI # 1* (Response to RFI 1). Written response provided for the meeting of the DACOWITS Federal Advisory Committee

as policing and medicine that involve frequent interaction with the public. Lastly, a positive diverse working environment can increase employee retention. A 2013 psychological study found that employees who feel they are working in an environment with equal access to opportunities and fair treatment are less likely to report intentions to leave the company.[13] Workplace diversity can benefit individual workers, their organizations, and society at large.

C. Comparison Between Male-Dominated Civilian Career Fields and the U.S. Military

To broaden their perspective on the high attrition rates of women in operational military career fields, DACOWITS members selected eight male-dominated civilian career fields to examine. Each of these career fields parallels military occupational specialties. Figure 2 shows the representation of women in these fields compared with the active duty population, the Guard and Reserve, and Military Service Academy students.

Figure 2. Percentage of Women in Selected Male-Dominated Civilian Career Fields Compared With the U.S. Military
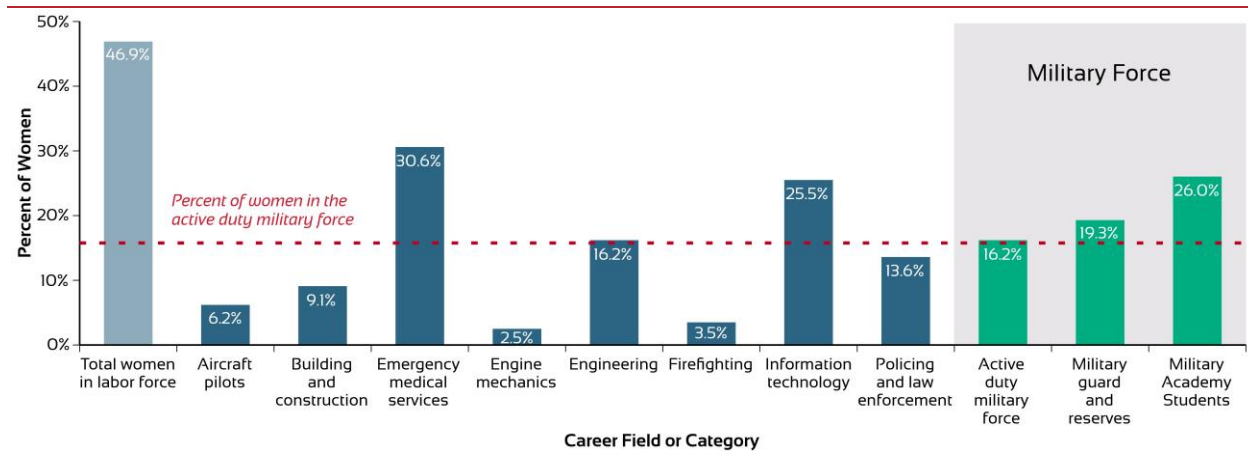
Sources: U.S. Department of Labor, Bureau of Labor Statistics (DOL BLS). (2017). Labor force statistics from the Current Population Survey. *Table 18: Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat18.htm; DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 11: Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat11.htm

Although available data on the gender distributions of specific military occupational specialties are limited, information provided by the Coast Guard Human Resources Directorate in response to a DACOWITS RFI in March 2018 showed servicewomen might be even more underrepresented than civilian women in these types of careers.[14] The data showed that as of March 2018, women made up about 7 percent of the Coast Guard's Marine Law Enforcement Specialists compared with 13.6 percent of the civilian policing and law enforcement workforce. Even more striking, women made up only 8 percent of the Coast Guard's Information Systems Technicians compared with 25.5 percent of the civilian information technology workforce.

Selection of Career Fields for In-Depth Profiles

Insight Policy Research (Insight) conducted an initial search of relevant news articles, academic literature, and government reports for each career field. Following this initial search, five of the original career fields were selected for in-depth profiling in this report: building and construction; firefighting;

policing and law enforcement; and STEM (science, technology, engineering, and mathematics) fields, including engineering and information technology.[vi] These five career fields were chosen based on (1) the amount and quality of information available and (2) the ability to ensure a diverse representation of skills and industries that parallel military occupational specialties.

[vi] Based on the results of the initial search, Insight determined there was not enough quality information available on the gender employment gap for aircraft pilots, emergency medical services, and engine mechanics to warrant further examination.

Chapter 2. Career Field Profiles

This chapter provides profiles of the following fields: building and construction, firefighting, policing and law enforcement, engineering, and information technology. The profile for each field includes an introduction, describes factors contributing to the gender gap, and identifies strategies used to recruit and retain women.

A. Profile: Building and Construction

According to the U.S. Department of Labor's Bureau of Labor Statistics (DOL BLS), "most construction laborers and helpers typically work full time and do physically demanding work. Some work at great heights or outdoors in all weather conditions. Construction laborers have one of the highest rates of injuries and illnesses of all occupations"[15] See Figure 3 for a breakdown of the gender gap in building and construction.

1. Snapshot of Women in the Field

Figure 3. Current Gender Gap in the Building and Construction Field

9% of jobs in the building and construction workforce are held by women

Examples of similar military skills and occupations:
construction engineer, electrician, plumber, carpentry and masonry specialist, concrete and asphalt equipment operator, construction mechanic, steelworker, engineering aid, civil engineer

Source: DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 18: Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat18.htm

2. Factors Contributing to the Gender Gap

The building and construction field is one of the few industries that offer high-paying opportunities and room for advancement without the requirement of a college degree.[16] The proportion of women in building and construction has changed little compared with the increases seen in other male-dominated career fields during the last several decades.[17] Construction work is stereotyped as "men's work" because of the significant physical labor involved, often in noisy or outdoor working environments. Women are usually unaware of the different opportunities available in construction because of a lack of targeted marketing and/or recruitment efforts for the variety of jobs in the industry.[18] Within the field, women have encountered structural and cultural issues that dissuade them from staying, including gender discrimination and sexual harassment. Compared with other industries, construction has had consistently higher rates of sexual harassment allegations filed with the Equal Employment Opportunity Commission.[19] Moreover, women in the industry have reported feeling that they are not given the same opportunities for advancement as their male peers.[20,21] Research suggests that work-life balance is another challenge for women in construction, particularly for women with children. The long work hours, inflexible schedules, lack of early morning childcare options, and physical nature of the work may deter women from joining the field or staying in the industry for the long term.[22]

3. Strategies for Recruitment and Retention

This section describes three strategies used to recruit and retain women in the building and construction industry:

1. **Target women through recruitment efforts and industry messages.** The male-dominated workplace and stereotype about construction as men's work often dissuades women from considering the construction industry as a viable career path for themselves. Industry leaders have successfully used targeted marketing and recruitment materials to attract more women into the construction field.[23] Recommended targeted outreach strategies include highlighting the success of women in the construction industry, featuring women in advertisement and marketing materials (including on websites), or making an explicit statement about the industry's commitment to hire qualified women. These efforts not only help women envision themselves as construction workers but also communicate the value of women within this male-dominated industry. Effective short-term recruitment efforts target groups and organizations with larger concentrations of women, and long-term plans build interest for trade careers among school-age girls.[24] The green construction industry, with jobs that focus on sustainable building and energy sources, has proven to be a promising new direction for the construction field to fill a growing need and advertise the diversity of construction opportunities to women.[25]

2. **Offer apprenticeship and training programs for women.** One of the most consistent efforts to increase the number of women in construction and building jobs is targeted training and apprenticeship programs. These programs provide women with training and skill building to start their careers in the construction industry. Nontraditional Employment for Women (NEW) is a New York City-based organization that helps women begin careers in construction, utility, and maintenance trade work. NEW not only provides skills training but also supports women's entrance into the industry in other ways; for example, it engages women in role-playing scenarios to prepare them for a male-dominated culture and helps women with children find early morning childcare options.[26,vii] Apprenticeship programs prepare women for a successful career by giving them the opportunity to learn valuable skills and build network connections in the industry.

3. **Maintain recruitment and retention programs.** A 2018 study of women in the construction industry showed that the presence of recruitment and retention programs in a company correlated with a higher percentage of women in that workplace. This research showed that targeted programs for recruiting or retaining women were effective tools to attract and keep women in male-dominated industries such as building and construction.[27]

B. Profile: Firefighting

According to DOL BLS, "When on the scenes of fires and other emergencies, [a firefighter's] work can be very dangerous. When not on the scene of an emergency, firefighters remain on call at fire stations, where they sleep, eat, and perform other duties during shifts that often last 24 hours. Many work more than 40 hours per week."[28] Firefighters may either work professionally or volunteer for a local department. As of 2015, 30 percent of firefighters were professional career firefighters. See Figure 4 for a breakdown of the gender gap in firefighting.

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vii See http://www.new-nyc.org/

1. Snapshot of Women in the Field

Figure 4. Current Gender Gap in the Firefighting Field
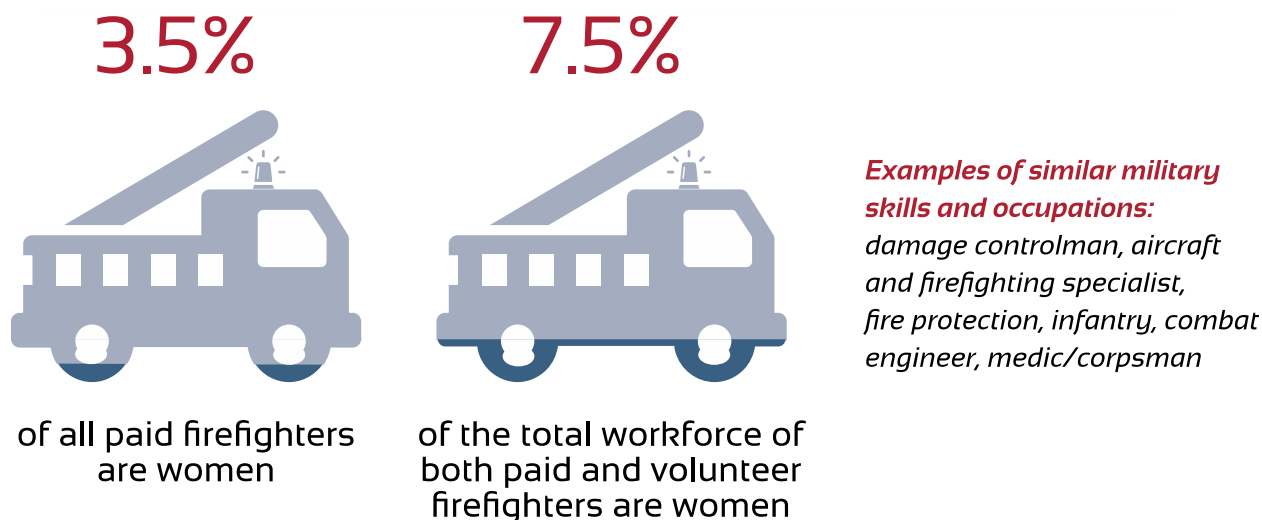
3.5%

of all paid firefighters are women

7.5%

of the total workforce of both paid and volunteer firefighters are women

Examples of similar military skills and occupations: *damage controlman, aircraft and firefighting specialist, fire protection, infantry, combat engineer, medic/corpsman*

Sources: DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 18: Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat18.htm;
DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 18: Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat18.htm; Haynes, H. J. G., & Stein, G. P. (2017). *U.S. fire department profile – 2015.* Retrieved from https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics/Fire-service/osfdprofile.pdf

2. Factors Contributing to the Gender Gap

Women may not enter the firefighting field because of perceptions of firefighting as a masculine occupation or because of barriers such as physical tests. One study that surveyed firefighting departments across the United States found that about 84 percent of men passed the physical ability exam required to become a firefighter versus only about 47 percent of women. Women's pass rate improved with physical training prior to the exam, but many women did not have access to proper physical training.[29] Women were also less likely to picture themselves as firefighters when choosing a career. Of the firefighters surveyed in this study, about 21 percent of women and about 41 percent of men knew they wanted to become firefighters from a young age.[30]

Female firefighters have often experienced negative effects as a result of the male-dominated firehouse culture, including gender discrimination and sexual harassment.[31,32,33,34,35] Female firefighters have been subject to stereotyping, hostility, and harmful "pranks" from their male colleagues, which creates a negative climate for women communally living with their male peers in the firehouse. Women have also received insufficient instruction and been subjected to hypersupervision from their superiors.[36,37,38] This differential treatment of women has limited their potential to advance within departments.[39] Both social and professional forms of gender discrimination have been more severe for African-American women than for White women.[40] African-American women have also suffered more extreme pranks from their male colleagues, who have justified this physically and mentally harmful sexual harassment as part of firehouse culture.[41] A 1995 study found that most female firefighters surveyed had experienced sexual harassment in their departments. Sexually harassed women were more likely to suffer work-related stress, fear coming to work, and use sick time to avoid work. These behaviors have continued to permeate firehouse culture.[42] In May 2018, two female battalion chiefs filed federal civil rights charges

of gender discrimination and sexual harassment against the Fairfax County Fire and Rescue Department, located in Fairfax County, Virginia. The women claimed they had been punished by the department after opposing a culture of unfair and harmful action against women. This negative climate had serious consequences; in 2016, a female firefighter in the department who had been bullied online by her male colleagues committed suicide.[43] The effects of sexual harassment have not always been so severe, but they may be linked to women avoiding and leaving the firefighting occupation, thus increasing the gender gap in the field.

3. Strategies for Recruitment and Retention

Studies conducted by experts in firefighting research suggest the following strategies would be effective in recruiting and retaining women in firefighting and similar male-dominated career fields:

1. **Target women through recruitment efforts.** Fire departments and similar industry offices may benefit from investing in the effective recruitment of women. About half of the women surveyed for one study had formed personal connections with firefighters before they decided to join a firefighting department.[44] Mobilizing personal networks of employees and retirees, conducting outreach in places where women interested in the field are likely to be found, and publicizing female role models may help recruit women into a male-dominated field such as firefighting. Women's participation in precareer volunteer firefighting and related activities may also encourage them to pursue the profession.[45]

2. **Integrate physical training in academies prior to hiring.** Department-run physical training to prepare women for the required physical firefighting ability test has increased the percentage of women who are able to pass the test and become firefighters.[46] Moreover, research has shown that the standardized Candidate Physical Ability Test (CPAT)[viii] tests women's physical readiness more fairly than many of the localized tests.[47] The United Women Firefighters, an association of female firefighters and fire officers who work for the Fire Department of New York, has partnered with the Fire Foundation, the New York Women's Foundation, and the New York Sports Club to provide CPAT training for women interested in becoming firefighters.[48]

3. **Accommodate women's needs.** Increasing responsiveness to women's needs may help retain women in male-dominated fields such as firefighting. Such strategies may include supplying uniforms and equipment that are designed for feminine frames, being vigilant of sexual harassment and controlling sexual harassment with "zero tolerance" policies, and upholding standardized and fair processes for promotion.[49,50,51] Because men and women live in the firehouse together in professional departments, it helps women if departments accommodate their physical and psychological needs by providing them access to private dormitories and restrooms and respecting their dietary preferences at mealtimes.[52] Fire departments and other industry offices may also consider addressing issues stemming from masculine cultures that are often hostile to women.[53,54]

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viii The CPAT is a standardized exam that measures firefighting candidates' ability to perform the physical tasks necessary to work as a firefighter. (Source: Firefighter Candidate Testing Center. (n.d.). Candidate physical ability test [Web page]. Retrieved from https://www.fctconline.org/cpat/)

C. Profile: Policing and Law Enforcement

According to DOL BLS, police work is "physically demanding, stressful, and dangerous. Police officers have one of the highest rates of injuries and illnesses of all occupations. Working around the clock in shifts is common."[55] See Figure 5 for a breakdown of the gender gap in policing and law enforcement.

1. Snapshot of Women in the Field

Figure 5. Current Gender Gap in the Policing and Law Enforcement Field

13.6% of all police and sheriff's patrol officers are women

Examples of similar military skills and occupations:
master at arms/military police, security forces specialist, investigator, security patrol, reconnaissance, infantry, corrective specialist, protective services

Source: DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 18: Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat18.htm

2. Factors Contributing to the Gender Gap

Male and female police officers have rated themselves equally well in job performance, which suggests they are equally capable of performing their duties.[56] In fact, one study found most female officers thought they performed their work duties as well as or better than their male colleagues.[57] However, women have also perceived differences in their roles versus those of men within police departments, differences linked to the male-dominated culture of the police force.[58] According to a historical analysis of women in police work, differences in the roles of male and female officers have often led women to hold segregated, subordinate positions that fit the cultural norms of feminine skills. Male police officers have been less likely to see their female colleagues as capable of patrol or crime-fighting work.[59] A 1999 study found that female police officers' rate of promotion was lower than that of male officers at one Midwestern police agency and that child and family obligations often prevented women from entering or completing the promotion process.[60] Women reported higher levels of job-related stress than men in a 2008 study of the Baltimore Police Department.[61] Another study found that in the police force, women faced higher levels of emotional burnout than men.[62] Despite these stressors, research suggests that female police officers do not leave the field more frequently than their male colleagues and do not attribute their career changes to stress or burnout. Women most often reported leaving the police career for personal or political reasons or to pursue another career within the criminal justice field.[63]

3. Strategies for Recruitment and Retention

Studies conducted by experts in policing and law enforcement research suggest the following strategies would be effective in recruiting and retaining women in policing and similar male-dominated career fields:

1. **Target women through recruitment efforts.** Similar reasons often inspire both men and women to join the police force. These factors include the desire to help others, job security, and job benefits. Men and women are also both motivated by the excitement of the occupation. Drawing on all of these factors, particularly altruistic desire, may help recruit women to policing and similar fields.[64,65] It may also be beneficial to emphasize the occupational features that are known to attract women. For example, Minnesota police departments have hosted successful recruitment events targeting women. These events give women an in-depth look at all aspects of a police career and highlight useful skills that women could apply in law enforcement to encourage them to join the police force.[66]

2. **Provide women with physical training prior to physical tests.** Women may find the physical exams necessary to be hired by the police force and similar fields intimidating.[67] Rigorous training programs help women meet the requirements for these exams and may increase their ability to be hired as police officers.[68]

D. Profile: Engineering

Engineering is a diverse career field that requires a high level of technical skill and education. Engineers design products and solve problems in many different arenas, from space to biology to the environment, and adapt to advances in science, technology, and design. See Figure 6 for a breakdown of the gender gap in engineering.

Overview: Women in STEM

There is increasing attention and concern about the underrepresentation of women in STEM classrooms and career fields. During the last 20 years, billions of dollars in federal funding have been allocated to increase the number of women and girls pursuing STEM.[a] STEM fields are a growing part of the U.S. economy. Workers in these fields earn higher wages than their non-STEM counterparts.[b] Women's underrepresentation in STEM is often characterized by researchers as a "leaky pipeline."[i] Research suggests that women's interest and retention in STEM fields progressively declines in stages from K–12 education to college and graduate school and then drops further with applied jobs in the field.[c] Identified barriers to women's initial and ongoing participation in STEM careers include gender stereotypes, a male-dominated culture that product a "chilly" environment for women, the absence of women role models in the field, and a lack of early experiences with STEM education.[d]

This report focuses on two STEM career fields, engineering and information technology, for further examination of the gender employment gap, barriers to women's participation, and specific strategies for the recruitment and retention of women.

[a] Fouad, N. A., Chang, W., Wan, M., & Singh, R. (2017, June). Women's Reasons for Leaving the Engineering Field. *Frontiers in Psychology*. 8(875).
[b] Milgram, D. (2011, November). How to Recruit Women and Girls to the Science, Technology, Engineering, and Math (STEM) Classroom. *Technology and Engineering Teacher.*71(3), 4-11.
[c] Blickenstaff, J. C. (2005). Women and Science Careers: Leaky Pipeline or Gender Filter? *Gender and Education*, 17(4), 369-386.
[d] Blickenstaff, J. C. (2005). Women and Science Careers: Leaky Pipeline or Gender Filter? *Gender and Education*, 17(4), 369-386.
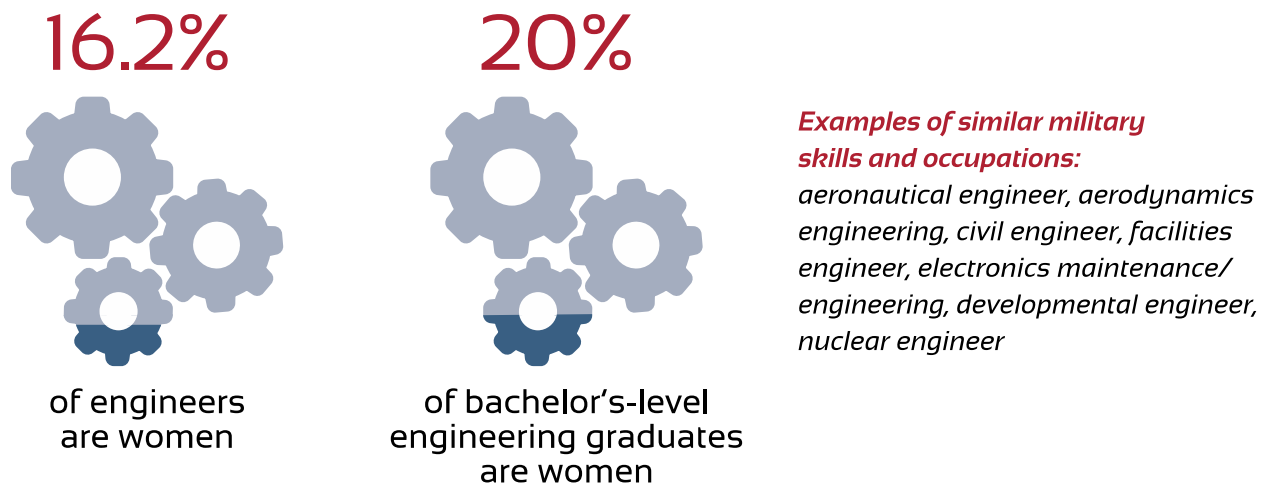
1. Snapshot of Women in the Field

Figure 6. Current Gender Gap in the Engineering Field

16.2%   # 20%

Examples of similar military skills and occupations:
aeronautical engineer, aerodynamics engineering, civil engineer, facilities engineer, electronics maintenance/ engineering, developmental engineer, nuclear engineer

of engineers
are women

of bachelor's-level
engineering graduates
are women

Sources: DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 11: Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat11.htm; National Science Board. (2018). *Science and engineering indicators 2018* (NSB-2018-1). Retrieved from https://www.nsf.gov/statistics/2018/nsb20181/assets/nsb20181.pdf

2. Factors Contributing to the Gender Gap

Research suggests the underrepresentation of women in engineering begins at a young age. Women's early educational experience with math and science shapes their long-term trajectory in engineering careers. Two interconnected stereotypes that have affected women's relationship to math and science are the pervasive myths that (1) men are more successful at math and science and that (2) these careers are for men. Women have also tended to have less exposure to engineering as a viable career option, including the diversity of job opportunities and the important contributions of engineering to society.[69] In college, men have been more likely than women to pursue an engineering major even when women have comparable math and science backgrounds from high school.[70] Female engineers have often worked in environments that perpetuated gender discrimination and a culture that treated women as "second-class experts."[71,72] Women in engineering have reported feeling that they must work twice as hard to prove themselves and receive less positive recognition than their male colleagues.[73] These factors have contributed to the high attrition rate of women in the field; a 2017 study found nearly 40 percent of women in engineering careers eventually chose to leave the field. Because women are a minority in the field, and many eventually leave the profession, there are few women available to serve as mentors or role models for women engineers.[74,75] Women have also cited work-life balance as an issue in the field because of the expectation and pressure to work long hours, leaving little time for childrearing and other family responsibilities.[76]

3. Strategies for Recruitment and Retention

This section describes three strategies currently used to recruit and retain women in engineering:

▸ **Offer bonuses to employees who recruit women.** In an effort to increase diversity in the workplace, companies such as Intel, Accenture, and Microsoft began offering additional recruitment bonuses to employees who referred racial minority, women, and military veteran candidates who were hired.[77] Since Intel started using the recruitment bonuses in 2015 as part of a larger diversity campaign, it has increased the overall percentage of women in the company each successive year.[78]

▸ **Recognize and counteract gender bias in the hiring process.** There are several strategies companies have used to mitigate forms of implicit and explicit bias that can affect the hiring process. Explicit bias is the conscious attitudes and stereotypes that affect our behavior, whereas implicit bias is the subconscious beliefs that affect our understanding of others.[79] Organizations committed to increasing diversity can critically examine their interviewing processes to see if any questions or tasks unintentionally benefit male candidates over female candidates. For example, Etsy realized that some of its interview prompts for engineers, including "Quick, prove to me how smart you are," favored stereotypical male responses by prioritizing individual ego and traditional intellect over teamwork and creative thinking. Etsy changed its interview protocol because of its commitment to hire more women engineers.[80]

▸ **Provide scholarships for women to attend targeted training programs.** Another strategy that has proven successful for recruiting women in the engineering field is to provide scholarships and grants for training programs that target women. Etsy's Hacker School is open to both men and women but is designed for women to obtain hands-on experience with software engineering and expand their programming skills. Etsy has continued to expand its scholarship program to support more and more women attending the school. The investment in bringing in junior engineers has paid off for Etsy, and its diversification efforts have also begun to attract more senior women engineers; in 2 years, the number of women engineers at the company increased by 500 percent.[81,82]

▸ **Maintain family-friendly workplaces to support work-life balance.** Research has shown that women want to work for companies that have family-friendly policies in place.[83] More generous leave policies, flexible scheduling, remote work options, and flex family care spending are benefits that can improve work-life balance for every employee, not just women.[84,85,86] An organization's policies must be combined with a culture that normalizes the use of such benefits; otherwise, women may continue to be penalized for using these options.[87]
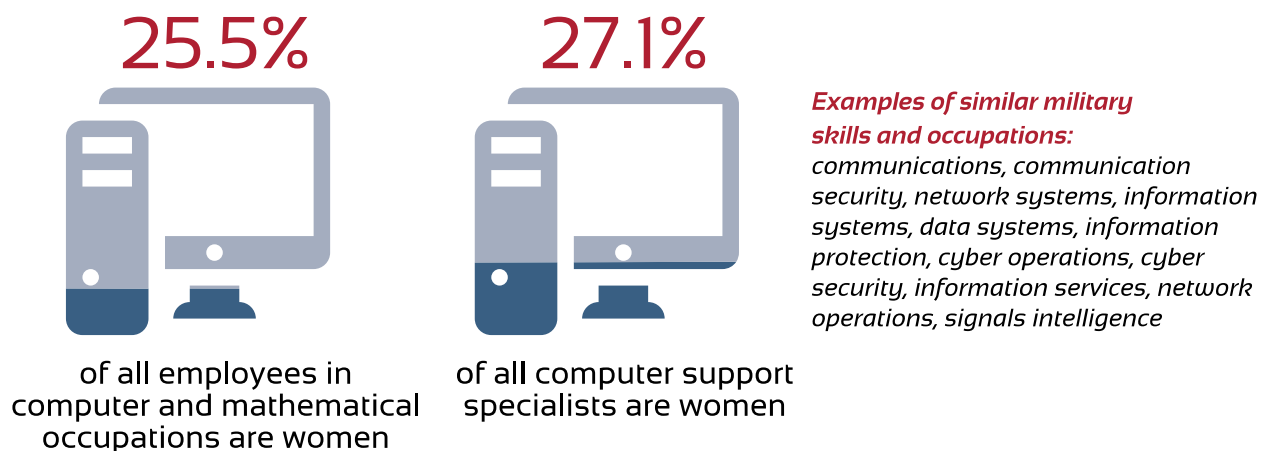
E. Profile: Information Technology

According to DOL BLS, information technology and computer-related fields—which include occupations such as computer and information research scientists, computer network architects, computer programmers, computer support specialists, computer systems analysts, database administrators, information security analysts, network and computer systems administrators, software developers, and web developers—have been growing in recent years, and the field is projected to grow 13 percent from 2016 to 2026, faster than the average for all occupations.[88] Although the percentage of female computer science graduate students has increased over time, the percentage of women majoring in computer science in undergraduate programs has declined in recent years. Both percentages have remained much lower than those for men, and students of color have been even more likely to be

underrepresented. Once employed, women in computer science-related fields have tended to earn less than men.[89] See Figure 7 for a breakdown of the gender gap in information technology.

1. Snapshot of Women in the Field

Figure 7. Current Gender Gap in the Information Technology Field

25.5%

of all employees in computer and mathematical occupations are women

27.1%

of all computer support specialists are women

Examples of similar military skills and occupations: communications, communication security, network systems, information systems, data systems, information protection, cyber operations, cyber security, information services, network operations, signals intelligence

Source: DOL BLS. (2017). Labor force statistics from the Current Population Survey. *Table 18: Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.* Retrieved from https://www.bls.gov/cps/cpsaat18.htm

2. Factors Contributing to the Gender Gap

Research has shown that women are less likely to have interest in the information technology field starting from a young age, when computer-related careers are depicted as men's fields.[90] This disinterest may continue into college. Once in college, many women show a lack of interest in the computer-related courses necessary to pursue a career in information technology.[91] Most attrition from the information technology field occurs when women begin to pursue computer science and then change majors partway through their undergraduate studies. After being immersed in this male-dominated field, young women's interest and confidence begin to wane in response to a narrative that their male peers are more suited and prepared for computer-related careers.[92]

3. Strategies for Recruitment and Retention

Studies conducted by experts in research on computer-related career fields suggest the following strategies would be effective in recruiting and retaining women in information technology and in similar male-dominated career fields:

1. **Attract women starting from a young age.** Parents and teachers may be able to encourage girls to pursue an interest in computer studies by exposing them to role models in technology fields, giving them access to age-appropriate technology activities, enrolling them in summer programs, emphasizing the social impact of technology, and dismissing stereotypes that information technology careers are men's work. The dissemination of information by organizations that influence girls—for example, the Girl Scouts—and partnerships between university computer science departments and local schools may also attract women to technology fields.[93] The organization Girls Who Code provides free coding education for girls in elementary, middle, and high schools across the country. Between 2012 and 2018, nearly 90,000 girls enrolled in Girls Who Code programs. Program graduates are connected to professional development and jobs opportunities in technology-related fields and are 15 times more likely than other young women to major in computer science or related fields in college.[94]

2. **Encourage women to pursue degrees in the field.** To enter information technology fields, women need access to quality education in computer studies. Postsecondary education institutions can attract and retain female students by offering multiple entry points into computer science studies. These entry points accommodate students' prior experience levels and make the study of computers more accessible for young women who may not have as much precollege experience as their male peers.[95] It is also helpful for college computer science departments to offer third- and fourth-year students access to the major.[96] College computer science departments can attract women by offering interdisciplinary courses that emphasize the social contexts of technology and redesigning introductory courses to include areas of interest common to women.[97,98] Assigning students in introductory courses to program in teams decreases women's isolation by encouraging connections with other students.[99] Departments can also retain female students by training faculty to encourage women to continue taking computer science courses and supporting strong, collaborative relationships among students and between students and faculty.[100,101] These strategies to recruit and retain female students can be employed by Military Service Academies and postsecondary institutions with military tracks and training programs.

3. **Recruit and retain female faculty in the field.** Because young women benefit from female role models, it is helpful for academic institutions to recruit and retain female faculty. To this end, computer science departments may consider training faculty search committees on best practices in diverse hiring, proactively identifying and building relationships with female candidates, supporting women's partners in finding jobs, adopting parent-friendly work practices, and supporting new faculty's adjustment to the institution.[102] Similar strategies can be used to recruit and retain female military instructors.

4. **Adopt diversity hiring practices.** Companies in the information technology field and similar male-dominated fields may consider training senior management on how to reduce unconscious bias in the hiring process and recruiting candidates with a wide variety of backgrounds.[103]

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5. **Provide professional support and equal opportunities.** Offering mentoring programs and access to professional support networks, providing women with equal access to promotions, and correcting gender differences in pay may help retain women in information technology and similar male-dominated fields.[104] It may also be beneficial to help women manage the stress that comes from having a demanding job along with family obligations and financial pressures.[105]

Chapter 3. Conclusions

O verall, the extant literature suggests that women employed in male-dominated career fields face common challenges. Before entering these fields, women may see the occupations within them as "men's work" and may not consider entering the fields. When women decide they want to enter physically demanding fields such as firefighting and law enforcement, stringent physical requirements may prevent them from being hired. Upon entering these male-dominated fields, many women experience negative effects stemming from the masculine cultures of these occupations, including gender discrimination and sexual harassment. The issues women face may act as barriers in their promotion and continuation within their chosen careers.

Leaders of some male-dominated civilian fields have begun to take steps to reduce women's barriers to entry and success. Targeted recruitment efforts have attracted women to these fields. Company- or department-sponsored physical training prior to entrance exams has increased women's ability to enter physically demanding careers, and increased access to science and technology education starting from a young age has increased women's ability to enter STEM-focused careers. Certain fields have also begun to adopt diversity hiring and promotion practices to reduce gender bias in hiring and promoting women. To retain women, these male-dominated fields have increased their responsiveness to women's needs in a variety of ways, including connecting women to mentorship and professional support opportunities, creating physical space for women to have privacy, and promoting family-friendly work environments that enable work-life balance. It is possible that these career fields may have looked to the military when designing practices to recruit and retain women.

The military has made significant progress in addressing many of the issues that women face in male-dominated fields. Still, military recruitment and retention data suggest there is room for improvement. Although the military already employs some targeted marketing and recruitment efforts, implements some family-friendly policies, and encourages some female-targeted mentoring, DACOWITS has put forth some recent recommendations for further progress in these areas.[106,107] Moreover, there is little evidence of comprehensive female-targeted training or apprenticeship programs to prepare women for entering the military. However, the results of this literature review suggest that such practices may serve to increase the representation of women in the military generally and in operational career fields specifically.

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