

Air Command and Staff College

Air University

**IS BRINGING BACK WARRANT OFFICERS THE ANSWER?
A LOOK AT HOW THEY COULD WORK IN THE AIR FORCE CYBER
OPERATIONS CAREER FIELD**

by

Petrina A. Hanson, Major, USAF
Jason D. Niederhauser, Major, USAF
Craig S. Towlson, Major, USAF
Joseph E. Wierenga, Major, USAF

A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements for the Degree of

MASTER OF MILITARY OPERATIONAL ART AND SCIENCE

Advisor: Dr. Paul J. Springer, Ph.D.

16 March 2017

DISCLAIMER

The views expressed in this academic research paper are those of the authors and do not reflect the official policy or position of the US government, the Department of Defense, or Air University. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.



Abstract

When the United States Air Force became its own service in 1947, it inherited a cadre of warrant officers from the Army. Never being sure where they fit in or how to utilize them properly, the Air Force ultimately opted to discontinue appointments to the warrant officer grades in 1959. The debate over whether or not that was the right decision has lingered for the last six decades. Though by statute the Air Force is still authorized warrant officers, the service continues to uphold its long-held position that they are unnecessary. Perhaps it is now time for senior leaders to take another in-depth look at the issue. Re-establishing warrant officer ranks for technical career fields such as cyber operations would enable the Air Force to improve retention of highly skilled and talented individuals while reducing overall manpower spending. The Air Force has difficulty competing with the private sector and even other government agencies in hiring and retaining experts in highly technical fields. Although the creation of the “super grades,” E-8 and E-9, in 1958 were, in the opinion of Air Force senior leaders, intended to fill the technical expert and superintendent roles then held by warrant officers, the grades have become too broadly focused and administrative in nature to fulfill that intent. In contrast, the Army, Navy and Marine Corps utilize warrant officers in a multitude of capacities, especially in highly technical positions, including cyber operations. The cyber operations arena, for instance, needs highly capable, technically proficient operators who can leverage their experience to fight and win in the cyber domain. Instead of hiding behind arguments dating back over sixty years, if the Air Force took a thorough, objective look, it would find that in an era when budget constraints and retention of talented, technically-minded individuals are more critical than ever, reviving a cadre of warrant officers would be an excellent option.

Contents

DISCLAIMER.....	ii
ABSTRACT.....	iii
INTRODUCTION.....	1
CYBER ORGANIZATION AND FORCE STRUCTURE.....	4
WARRANT OFFICER BASICS.....	9
WARRANT OFFICER HISTORY.....	10
AIR FORCE WARRANT OFFICERS.....	11
ARMY WARRANT OFFICERS.....	15
NAVY WARRANT OFFICERS.....	18
MARINE CORPS WARRANT OFFICERS.....	20
ARGUMENTS SUPPORTING AIR FORCE WARRANT OFFICERS.....	22
ARGUMENTS AGAINST AIR FORCE WARRANT OFFICERS.....	27
CONCLUSION.....	32
ACRONYMNS.....	36
END NOTES.....	37
BIBLIOGRAPHY.....	42

Introduction

The debate over warrant officers (WO) in the Air Force has continued to linger for the past six decades. The arguments made in favor of reinstating the WO ranks are often quickly dismissed, while many arguments against their reinstatement are holdovers from the Air Force's infant years that can now be countered relatively easily. The Air Force remains the only Department of Defense (DoD) component whose command structure does not include WO. The initial cadre of Airmen WO was inherited by the Air Force when it became its own service in 1947. Though they had been in use by the other services for half a century or more, the Air Force, being an officer-heavy organization, decided to forego the experience and expertise WO could bring to the fight and instead opted for senior noncommissioned officers (SNCOs) to fill their roles. The Air Force is currently at a juncture where WO would improve retention of skilled and talented individuals in a number of highly technical career fields, and the reinstitution of their ranks would not only be feasible, but would reduce overall manpower spending.

This paper outlines the current situation in which the cyber operations career fields find themselves and details the force structure developed to meet both Air Force and CYBERCOM requirements, specifically delving into issues with recruitment, training and retention. An understanding of the cyber arena is necessary to see how the reinstitution of WO could improve the Air Force's overall cyber situation. Then the authors provide a brief history of WO from their humble beginnings as sailing masters to their rightful place as the consummate technical experts within the US military. The use of WO in each service is highlighted, beginning with their short tenure in the newly established Air Force. From there the primary arguments for reinstituting Air Force WO are discussed, with an emphasis on improved retention of personnel with technical skillsets, the achievement of parity among the cyber warriors contributing to the joint fight, and

the potential cost savings to be realized by the conversion of commissioned officer billets to WO billets. To ensure the discussion is not one-sided, the authors also examine the primary arguments against the reinstatement of WO, including the creation of the top two enlisted ranks rendering WO ranks unnecessary, the social concerns surrounding a rank echelon that is technically neither enlisted nor officer, and the additional administrative burden associated with a third tier of personnel.

The cyber operations world provides a fantastic example of how the WO ranks could help boost retention and ensure the United States does not lose its technological edge. Warfare within the cyber domain has become reality at a staggering pace, providing adversaries with an asymmetric advantage and leaving the US with a growing inability to keep up. Senator John McCain effectively sums up the situation, stating, "Make no mistake, we are not winning the fight in cyberspace."¹ Indeed, the sheer volume of data to safeguard illustrates the scope of the problem. Each year, three billion emails move through DoD networks yielding 16 million intrusions and 11,000 suspicious events requiring human-in-the-loop assessment.² This workload can easily overwhelm the capacity of the high-demand, low-density professionals defending the cyber domain. Coupled with offensive cyber operations, the need for experienced cyber professionals is even more acute. Additionally, the US is hampered by its degraded standing on the world academic stage. Continuing to nationally rank below average in science and mathematics, shortages of students choosing to study science, technology, engineering, and mathematics (STEM) fields mean the DoD needs to do everything it can to recruit and retain its technical professionals.³ These realities come together to produce an enterprise that is unable to keep pace with the speed of cyber.⁴

To mitigate cyber growing pains, the Air Force devised three ground-breaking initiatives to help implement and integrate cyber activities into future operations: *Task Force Cyber Secure*, *Communications Squadron Next*, and *Cyber Proving Ground*. According to Lt Gen Bill Bender, Chief of Information Dominance and Chief Information Officer, Office of the Secretary of the Air Force, *Task Force Cyber Secure* will focus on cyber mission-impacting threats and vulnerabilities, develop risk management strategies enabling aircraft to fly and win in cyber contested domains, and recommend investment priorities addressing cyber challenges.⁵ The Task Force will uncover inherent risks in the cyber domain and institute a change in the Air Force culture where all Airmen, regardless of career field or specialty, understand how cyber can impact to the service's core missions.⁶ Both the Army and Navy have similar initiatives to address these areas of concern. *Communications Squadron Next* is a vision to transform communication squadrons to meet the resiliency needs of their installation, by moving from a primary focus on information technology and the provision of communications capabilities to an emphasis on mission assurance.⁷ For example, ensuring the continued functionality and resiliency of advanced weapon systems like the F-22 and F-35 requires expertise and capability to defend against increasingly sophisticated cyberattacks. The *Cyber Proving Ground* is a collaborative concept between the acquisition and operations communities to mitigate the slow acquisition process and to more quickly incorporate innovative solutions. Working with industry and academia, the effort will rapidly assess new cyber systems or concepts from an operations perspective.⁸ As efforts within the cyber domain grow, a robust, trained cyber force will be required to execute these missions. Whether the enlisted corps, the backbone of cyberspace operations, is up to the challenge of exploiting these Air Force cyber initiatives and emerging United States Cyber Command (CYBERCOM) operations remains in question. There is no

question, though, that reinstating the WO ranks to leverage their skills and experience will help curb complex personnel problems as the Air Force operates in the evolving cyberspace domain.

Cyber Organization and Force Structure

The requirement to protect vital infrastructure and information against cyberattacks has increased dramatically in the last decade. To effectively contest these constantly evolving threats, the DoD stood up CYBERCOM in 2009. CYBERCOM is a sub-unified command subordinate to US Strategic Command, and has the mission to defend DoD networks, systems, and information against cyberattacks, defend the US and its national interests, and provide support to combatant commanders' operational and contingency plans.⁹ CYBERCOM's mission focus can be categorized into Offensive Cyber Operations (OCO), Defensive Cyber Operations (DCO) and DoD Information Network operations. To achieve these three missions, CYBERCOM has organized itself into a joint Cyber Mission Force (CMF) expected to be fully operational by 2018. The CMF comprises 6,200 joint force personnel divided into 133 individual teams. It is further broken down into National Mission Teams who are dedicated to defending the US and its interests against significant cyberattacks; Cyber Protection Teams who defend priority networks and systems against priority threats; Combat Mission Teams who provide direct support to Combatant Commands; and Support Teams who provide analytical and planning support to the National Mission Teams and Combat Mission Teams.¹⁰

Each of the DoD's service components have established respective cyber elements. The 24th Air Force (AFCYBER) is the operational warfighting organization that protects Air Force networks and provides joint force personnel to the CMF.¹¹ AFCYBER encompasses 5,400 cyber personnel consisting of 3,500 military, 800 civilian and 900 contractor employees, and it is comprised of an integrated operations center (624th OC), two wings (688th and 67th Cyberspace

Wings), and a multitude of cyber squadrons across the Air Force.¹² The Air Force contributes 39 teams to the CMF, encompassing 1,700 personnel.¹³ To field the correct mix of cyberspace professionals with the required technical aptitude and abilities to fill these joint force cyber teams, the Air Force relies on a variety of career fields. There are only two Air Force Specialty Codes (AFSC) for commissioned officers within cyberspace operations, but there are eleven different enlisted career fields in the 3D AFSC series where enlisted cyber skill progression begins. The 1B4 Cyber Warfare Operations AFSC consists of retrained Airmen (typically from the 3D AFSCs) who possess the necessary potential to excel in the fledgling cyber field.

The other DoD components have similar but different career fields, making the joint cyber world slightly disjointed. The Army, for instance, has thirty-two, the Navy has thirteen and the Marine Corps has twenty different cyber operations-related specialties spread across their respective active duty officer, warrant and enlisted cadres.¹⁴ Furthermore, DoD civilians and contractors include a mix of Information Technology Specialists, Computer Scientists, Electronics Engineers, Computer Engineers and Telecommunications Specialists.¹⁵ Within the joint force, the Air Force is the only service without cyber WO. The Army, Navy and Marine Corps have warrant officers performing cyberspace operations. These are individuals who possess a high degree of specialization that starkly contrasts the broad education and more generalized knowledge of commissioned officers. Warrant officer duties include supervising and managing the execution of cyberspace defense, intelligence, surveillance and reconnaissance, cyberspace operational preparation of the environment, and cyberspace attack actions. Army Cyber WO are specifically labeled as, “highly specialized subject-matter experts.”¹⁶ The services have different approaches to ultimately tackle the same challenges, but all except the Air

Force have WO to fill the cyber niche. Joint operations and the new Air Force cyber initiatives may require the high level of expertise and experience that only WO bring to the fight.

The DoD's transition to an operationalized cyber domain has created additional personnel requirements among all DoD service components. Traditional communications and intelligence career field specialties are being leveraged to build a cyber force in order to meet these new requirements. Recruiting, training, and retaining cyber personnel are key concerns of senior Air Force leadership. Former Air Force Chief of Staff General Mark A. Welsh III tasked the Air Force Research Institute (AFRI) in 2013 to review the training and development of the Air Force cadre of cyber professionals. Two questions they sought to answer were: "What force structure is needed to operate the Air Force's defined mission sets?" and "Should the Air Force cyber force remain a traditional force or be modeled on a nontraditional personnel structure?"¹⁷ AFRI's answers to these questions are insightful, as their highly detailed research pinpoints unique career field challenges in recruiting, training, and retaining cyber warriors. Their findings fell short, however, when they quickly dismissed the potential that a warrant officer rank structure could bring to the cyber arena. Unlike the rest of the report, AFRI did not seem to be as thorough when assessing how WO could mitigate the ongoing challenges associated with cyber professionals, and instead fell victim to the standard arguments that WO would cost the Air Force too much and/or would count against the total commissioned officer authorized end strength.

Recruitment and Training

The Air Force cyber force has recruiting challenges. The operational cyberspace structure consists primarily of enlisted 1B4 and officer 17 series AFSCs. Recruiting cyber professionals is a challenge in the rapidly growing 1B4 enlisted career field. The Air Force has implemented cyber testing to identify high-potential recruits, both within the service and among the civilian

population. Identifying the necessary talent in individuals who grasp the basic skills and have an aptitude for cyber is an essential step in ensuring low wash-out rates during initial cyber training. AFRI researchers recommended adjusting the screening tests in order to discover innovative, autodidactic team players because of their ability to do more than follow checklists, which includes thinking critically and working well on teams.¹⁸ These abilities were deemed critical for CMF personnel, who operate in the OCO/DCO mission space, rather than in the traditional communications fields that build and sustain networks. Offensive and defensive cyberspace operations require specific abilities for the protection and defense of US national security interests. The Air Force is seeking to acquire these skills from the intelligence, communications, and operations career fields, as well as the civilian workforce.

In an attempt to increase cyber awareness and recruit potential cyber warriors, the DoD and other federal agencies have created opportunities in the form of competitions and civilian community interactions. Cyber challenges like Cyber Flag at Nellis Air Force Base, Nevada, and hacking competitions, such as Digital Forensic Challenge, are effective in screening and “building the profile” of the cyber community.¹⁹ Other opportunities to attract potential cyber warriors are hacking conventions such as DEF CON, Black Hat, and CanSecWest.²⁰ The Air Force Association’s CyberPatriot is not considered a recruitment tool, but a competition for high school and middle school students to raise cyberspace awareness. The goal is to attract young students to increase their interest and awareness of the cyber domain in the hopes that they will pursue STEM-related college degree programs.

The Air Force has a long history of leading technological advances by embracing innovation and developing Airmen through technical training and operational experience. It offers several training courses to prepare the enlisted force for the challenge of cyberspace

operations. Initially, enlisted personnel begin in traditional communications career fields where they may be screened for qualification and retraining into the core 1B4 Cyber Warfare Operations career field. Capable enlisted personnel may continue to advance in the cyber operations field by attending the 24-week Intermediate Network Warfare Training course. In opting to do so, members incur an additional military service commitment.²¹ The most talented cyber warriors can expand their training even further by attending the six-month Joint Cyber Analysis Course (JCAC) at the Navy's Center for Information Dominance in Pensacola, Florida. All service components may attend, meeting requirements for a wide range of cyber operations, but it is strictly reserved for enlisted personnel with four to six years of military service who have been screened for high levels of performance and aptitude. After completing JCAC, on-the-job training with the National Security Agency is required, which can take up to one year to complete. Air Force attendees incur a three-year service commitment upon completion of their training, ensuring the service a return on its training investment.²² The cyber domain's complexity, rapidly changing technology, and emerging threats from state and non-state actors bring unique training challenges; therefore, the Air Force must ensure its cyber warriors are trained to the highest standard.

Retention and Incentives

Retaining skilled cyber technicians and operators has been a challenge for senior leaders across all components. The Marine Corps, for example, earmarked a full 16% of its fiscal year 2014 annual retention budget specifically for keeping its cyber specialists in uniform.²³ Some leaders, though, like Admiral Michael Rogers, Commander of US Cyber Command and head of the National Security Agency, submit there are non-monetary incentives that appeal to a member's sense of "ethos, patriotism, and the opportunity to do something" that industry just

cannot provide.²⁴ While this may be true, they also acknowledge that fiscal realities very often play a significant role in a member's decision to continue serving or hang up the uniform. Major General Burke "Ed" Wilson, former AFCYBER commander, relayed potential issues regarding recruiting and retaining qualified cyber operators. He mentioned that there are motivation issues concerning the pay discrepancy between "the more lucrative private sector and government as a potential competitive problem."²⁵ The demand for highly skilled cyber warriors exists both in the military and industry. For many active duty cyber professionals, when their service commitment is up, it is an easy choice to move to the private sector. Industry annual salaries can easily average \$85,000. Even the prospects of becoming a DoD civilian can be highly attractive, with a GS-13 position, for example, earning between \$75,000 and \$100,000 annually, not including other benefits of Federal government employment. Since the private sector generally pays higher, uncertainty exists as to whether or not the military can compete in retaining the necessary personnel to execute the cyber mission.²⁶ The DoD must receive a return on its investment into the extensive training of its cyber warriors. A defense manpower study conducted in March 2015 identified several Airmen that decided to separate from the Air Force because they felt their skills were not being fully utilized. Additionally, the study revealed that the primary concerns of first term enlistees were bonus or special pay, civilian job opportunities, the enlisted evaluation system, pay and allowances and promotion opportunities.²⁷ Retaining these future cyber professionals is key to building the foundation of the cyber workforce, and by implementing Air Force cyber WO, first term enlistee concerns could be addressed.

Warrant Officer Basics

The warrant officer is one of the oldest ranks used in western militaries. Historically, the WO has filled the role of technical expert—the one individual in a unit who has years of

experience and always seems to have the answer. Commanders have appreciated their counsel for centuries and relied on them to provide honest situation assessments and find solutions to their toughest problems. Sometimes called “in-betweens” or “third lieutenants,” WO rank above all enlisted members, but below traditional commissioned officers. This has led to significant friction between WO and the other ranks, not to mention morale issues. The nagging question that never seems to go away is, “Where and how do warrant officers fit in?” The services have striven to answer those questions, except the Air Force, which did away with its cadre of WO soon after becoming a separate service.

Warrant Officer History

The modern day WO can trace his or her roots back to the British Royal Navy in the thirteenth century.²⁸ The Crown awarded Royal Warrants to especially experienced sailors to distinguish them from other common sailors, yet keep them separate from the command ranks, which were normally filled by noblemen. The United States began using WO on 23 December 1775 when the purser of the USS *Andrea Doria* received a warrant.²⁹ The Navy has used the WO ranks continuously ever since. The use of WO by the Army began in 1896 with the creation of the positions of Headquarters Clerk and Pay Clerk, but they would not technically be called *warrant officers* until 1918. The National Defense Act of 1916 permitted the services to quickly expand to meet increased personnel requirements of World War I. In response, the Marine Corps established the grades of Marine Gunner and Quartermaster Clerk in 1917 to serve as technical experts.³⁰

The United States WO corps has experienced more than two centuries of growing pains as the services determined the best way to utilize and organize them. Numerous laws have been enacted to better define and normalize the WO cadre throughout the DoD. One issue stemmed

from there being different WO ranks and pay grades among the services. For instance, in 1941, the Army alone began using the rank of Warrant Officer Junior Grade. The Warrant Officer Act (WOA) of 1954 rectified this situation by standardizing the pay grade of W-1 for Warrant Officers and W-2 through W-4 for Chief Warrant Officers. The WOA also officially disbanded the Army's Mine Planter Service.³¹ Furthermore, it introduced statutory career limits and an "up or out" policy that required WO twice passed over for promotion to separate.³² Warrant officer appointment procedures were further clarified by the Defense Authorization Act of 1986, which mandated all individuals holding the ranks of Chief Warrant Officer (CW2 through CW4) be commissioned as officers, while individuals holding the rank of Warrant Officer (WO1) would continue to be appointed by their respective service Secretary. This only affected the Army, though, as the Navy and Marine Corps had already been commissioning their Chief Warrant Officers. The last major change to the WO system came in 1992 with the enacting of the Warrant Officer Management Act. This law standardized the WO promotion system, established high-year tenure requirements, and created the rank of CW5 (pay grade W-5). It further mandated a 5% cap on the total number of WO in any service holding the rank of CW5 at a given time.

Air Force Warrant Officers

In late 1941, just prior to the US entry into World War II, the Army established more than forty classifications to which warrant officers could be assigned as technical experts, including a number in the Army Air Forces (AAF).³³ With battles raging in both Europe and the Pacific, the AAF expanded its WO corps beyond technical experts to include a new category called flight officers. This category included pilots, bombardiers and navigators who had been denied commissions due to various circumstances.³⁴ The flight officer designation was phased out after the war. Once WWII was over and it became clear the AAF would likely become its

own service, Air University formed a committee in 1946 charged with conducting a study of WO and noncommissioned officer (NCO) career progression. The committee identified three main issues that would need to be addressed in order to successfully integrate WO into the new service. These included the need to define the role of WO, the use of the WO ranks as career incentives for enlisted members, and finally, maintaining the WO force structure would require additional personnel staff and place a greater burden on personnel managers.³⁵ While these issues were not insurmountable, they were significant, but in the end, the Air University committee recommended against eliminating the WO corps, citing two reasons. As a fledgling service, it was felt the new Air Force would need to retain the WO ranks to maintain parity with the Army. The committee also felt as long as the ranks were defined and managed properly, WO could become an integral part of the new service.³⁶ The AAF Personnel Directorate ultimately accepted the committee's recommendation and the WO ranks were retained.

When the Air Force became its own service in September 1947, it retained the 1,200 WO still serving on active duty in the AAF.³⁷ The Air Force was not really sure what to do with these personnel and tried a number of times to develop a structure that would work. For a while it was not even sure how to define the position. In 1953, the Air Force released its policy on WO, calling them, "a technical specialist with supervisory ability, who is appointed for duty in one superintendent Air Force specialty."³⁸ The policy attempted to define WO responsibilities as greater than those of NCOs, but less than and more specialized than those of commissioned officers.³⁹ To clear up any issues that could arise from WO possibly being in charge over commissioned officers, the policy stipulated that WO would only supervise other WO, enlisted members, or civilian personnel. The policy further solidified the warrant officers' standing above the enlisted force structure, but below that of the commissioned officers. Mirroring the Army, it

described the Air Force WO ranks as an incentive for superior-performing enlisted personnel. The WOA of 1954 further defined the role of WO in the Air Force by attempting to create a unified approach to the ranks among all the services.

As the Air Force was finding its way as a separate service, so too was it finding its way in regards to WO. It never considered WO part of its enlisted force structure, though the Airman Career Program identified the warrant officer (and its superintendent role) as the next step above E-7, which was technically the highest enlisted rank at the time.⁴⁰ Similarly, the Air Force never considered them part of the officer corps, either. But Congress did, and thus WO authorizations counted against the cap on officer strength mandated by the Officer Grade Limitation Act of 1954. At the time, the Air Force had approximately 4,500 WO authorizations.⁴¹ This proved a conundrum for the service, as WO were considered a logical step for *enlisted* career progression, but actually counted against *officer* end strength. At the time, the Air Force was actually making an effort to assimilate WO into its force structure and planners were looking at a total of 20,000 WO billets to fill superintendent roles and ensure opportunities for enlisted career progression.⁴² The Air Staff ultimately rejected this proposal, as to achieve the desired WO end strength would require a reduction of 15,500 authorizations for commissioned officers. In doing so, the utility of WO in the Air Force was effectively nipped in the bud before it even had a chance to blossom. By curtailing WO expansion, the Air Staff continued the enlisted promotion stagnation that WO superintendents could have alleviated and essentially preordained the addition of SNCO ranks, as at that point there was really no other option.

Technology was rapidly progressing and new information was coming available faster than any person could keep up with. The need for “technical experts” went away in favor of higher numbers of lesser-skilled Airmen working specific tasks rather than whole processes.⁴³

The new service valued the flexibility provided by a cadre of broadly trained technicians over the highly trained, more experienced—but stove piped—experts the WO corps provided. This one-two punch of officer caps and preference for flexibility all but knocked WO out of the Air Force. Their fate was sealed for good, though, when the service instituted the two new ranks of E-8, Senior Master Sergeant, and E-9, Chief Master Sergeant, following passage of the Military Pay Act in 1958.⁴⁴ Although the Act actually instituted the E-8 and E-9 ranks in *all* services, only the Air Force chose to use the new grades to replace its cadre of WO. The Air Force Personnel Directorate decided the new ranks would provide career advancement opportunities for enlisted personnel, as well as fulfill the supervisory roles currently being fulfilled by WO. It thus recommended in 1959 that WO be eliminated from the force structure.⁴⁵ As an added bonus, the new enlisted ranks would have no effect on the number of officer authorizations.

Vice Chief of Staff General Curtis LeMay, however, would not approve the Personnel Directorate's plan to phase them out completely. Keeping an eye to the future, he approved the plan only with the provision that WO ranks could be reinstituted at a later date if the needs of the Air Force so dictated.⁴⁶ Although there would be no more new WO appointed after 1959, there were still more than 3,000 of them on active duty. The Air Force was not sure what to do with them since many had been replaced in their superintendent roles by the new enlisted grades, so most were assigned to commissioned officer jobs for the duration of their careers.⁴⁷ The remaining WO were culled by forced separation, early retirements or simply faded away when they reached normal retirement. The last remaining Air Force WO on active duty retired in 1980, and the last WO in the Air Force Reserves retired in 1992.⁴⁸ Upon his retirement, he was promoted to CW5; the only Airman ever to hold that rank.

Army Warrant Officers

The Army began using warrant officers in 1896, but the official birthday of the Army WO corps is 9 July 1918. Up until then, although they wore military uniforms, Army WO were actually considered civilians. This changed when the Judge Advocate General determined that WO did indeed hold military status.⁴⁹ Following the institution of the WO ranks for the Mine Planter Service, the Warrant Officer Act of 1920 expanded the role of WO to perform other specialties such as band-leading or clerical duties, in order to create a means of rewarding members for their service during WWI.⁵⁰ No new WO outside of bandleaders or the Mine Planter Service were appointed between 1922 and 1935.⁵¹ This coincides with the overall drawdown of the US military after WWI. By 1936 the Army WO corps had diminished to roughly half its wartime strength. In that year the Army began replenishing the WO ranks, but the corps took yet another blow in 1939 when it was announced that any WO who was qualified as a pilot could garner a direct appointment as an Army Air Corps Lieutenant.⁵² During WWII, the number of WO specialties was increased to forty, and the technical competence and utility of the WO ranks was affirmed. The Army also learned that it should appoint WO based on its mission needs, rather than as a reward for past service.⁵³

In December 2016, the Army had a total of 26,578 WO serving throughout its Active, Guard, and Reserve components—accounting for nearly 3% of its total force.⁵⁴ The Army has two WO career tracks. The first consists of forty-three Military Occupational Specialties (MOS) referred to as Technical Warrant Officers, including Cyber Operations Technicians. The second track includes ten aviation-related MOS called Flight Warrant Officers.⁵⁵ This track began in 1953 when the Warrant Officer Flight Program was initiated.⁵⁶ They pilot four different helicopter airframes as well as the Army's few fixed wing aircraft. The highly specialized

helicopter aviation career field was a perfect fit for WO and allowed the Army to expand its pilot cadre without having to expand its commissioned officer corps.⁵⁷

The Army recruits and accesses its WO through two basic methods. The primary method, or midcareer-select model, involves recruiting from its enlisted ranks to fill the Technical Warrant Officer billets. Applicants must be at least the rank of Sergeant (E-5) and have at least four to six years of experience in an applicable feeder MOS.⁵⁸ Feeder MOS are those whose skillsets closely correspond to the applicable WO specialty. WO candidates must also have no more than twelve years of service when applying. The second method, or early-select model, involves recruiting civilians directly out of high school, college, or career, and only applies to Flight Warrant Officers.⁵⁹ The Army will also recruit Flight Warrant Officers out of its own enlisted ranks and even the enlisted ranks of the other services, but by expanding its applicant pool to the civilian market, the talent pool from which to choose is significantly larger and more diverse. The applicant requirements for Flight Warrant Officers are the same as for Technical Warrant Officers, except when the applicant is enlisted, there is no specific feeder MOS—all MOS may apply.

Although WO have been successfully carrying out the Army's mission since 1896, like the Air Force, the Army has had issues defining their role and determining exactly what they bring to the fight. In fact, the Army did not even publish an official definition of WO until 1957. But, the service has taken steps to ensure the WO ranks are being utilized effectively, including further integrating them into the officer corps, updating the definition and roles of WO, and developing a future WO strategy. In 2002, the Army Training and Leader Development Panel (ATLDP) conducted a study into the utilization and effectiveness of the WO corps. Its findings showed that for WO to effectively support the Army's mission, they should be completely

integrated into the officer corps, their role should be more precisely defined, and their professional development should be overhauled.⁶⁰

The Army took the ATLDP recommendations seriously. One of the first steps it took was to incorporate WO career and professional development requirements into DA Pamphlet 600-3, *Commissioned Officer Development and Career Management*. The document now encompasses all officers, commissioned *and* warrant. It even illustrates the Army's commitment to accepting WO as an integral part of its force structure by stating, "Better integration of warrant officers into the officer corps enhances the effectiveness and professionalism of warrant officers."⁶¹ The ATLDP further recommended the Army's definition of WO, in use since 1985, be updated to better encompass the responsibilities shouldered by the WO corps of today. The Army accepted this recommendation and DA 600-3 now defines a WO as, "a self-aware and adaptive technical expert, leader, trainer, and advisor. The warrant officer administers, manages, maintains, operates, and integrates Army systems and equipment. Warrant officers are innovative integrators of emerging technologies..."⁶²

The most significant aspect of the updated definition is the inclusion of the term "leader." Army WO have evolved from being master technicians to being technical experts *and* leaders. The pendulum has swung even further than the paradigm the Air Force once employed, with WO serving as superintendents, to now even filling command billets. In fact, according to the Army's Command Policy, "when assigned duties as station, unit, or detachment commander, WO are vested with all power usually exercised by other commissioned officers."⁶³ For example, Bandmasters are commanders, with full command authority, including under the Uniform Code of Military Justice. The maritime field also sees WO filling command billets. As vessel masters of various size craft ranging from landing craft up to logistics support vessels, WO carry out all

responsibilities and wield full authority as both ship's commander and detachment commander of upwards of thirty crew members.⁶⁴ These WO carry on the proud tradition of sea-going Army vessels stretching back to the days of the Mine Planter Service. Finally, to ensure its ability to meet the challenges of complex future operations, in 2016 the Army released its Warrant Officer 2025 Strategy. This document serves as a roadmap to stimulate planning and charts the course toward achieving the optimized accessions, professional military education and leader development of the Army WO cadre to ensure they are being utilized effectively and fully integrated into the force of the future.⁶⁵

Navy Warrant Officers

The Navy began using warrant officers in 1775. In 1794 legislation was passed to establish a Federal Navy and also to institute the rank of *sailing master*, later shortened to just *master*.⁶⁶ The sailing master was the senior WO on a ship, the most experienced sailor, and although not in overall command of the vessel, was responsible for day-to-day activities and navigation. The *master* designation remained in use until 1883 when the rank was assimilated into the commissioned officer corps. When the US entered WWII, the Navy had a total of eight WO specialties, and four more were added before the war's end.⁶⁷ Postwar specialization and technological advancements drove the creation of additional specialties to meet modern-day requirements.

Three decades of tumult were in store for Navy WO following WWII. A huge number of temporary officers had been added to the Navy's rolls to meet wartime requirements and a multitude of studies attempted to reduce the confusion surrounding WO and determine the proper structure of the officer rank system to meet postwar requirements. The Smoot Board of 1951 recommended accessions of WO be ended and existing WO force structure be eliminated

through normal attrition. The Grefnell Board of 1953 then recommended minor changes to the Navy WO structure, but did not recommend eliminating them. The Williams Board of 1959 recommended the Navy follow the Air Force's lead and eliminate WO entirely while adding the E-8 and E-9 enlisted ranks.⁶⁸ As a result of the Williams Board recommendations, the number of Navy WO declined by 50% in only three years. Finally, the Settle Board of 1963 determined the drastic reduction in WO was actually detrimental to the Navy and recommended not only replenishing their ranks but also expanding their use due to the increasingly technical complexity of modern-day naval warfare.⁶⁹ Although these studies have not succeeded in removing all confusion surrounding warrant officers in the Navy, they did lead directly to their place being cemented firmly in the Navy's rank structure.

The Navy exclusively accesses its WO from among its enlisted ranks. Its WO candidates transition later in their careers than do those of the Army, having between fourteen and twenty years of service, and having achieved the rank of Chief Petty Officer or Senior Chief Petty Officer (E-7 or E-8, respectively) to ensure they have significant experience.⁷⁰ The Navy utilizes WO in twenty-seven designated career fields, including cyber operations. Like the Army, prospective WO must come from eligible feeder enlisted ratings to ensure an adequate background and experience level. There are currently 1,780 WO serving across the Navy's components—accounting for only half a percent of its total force.⁷¹ Its WO cadre may be the smallest of the three services, but like the others, these professionals play an integral role in successful operations.

As is evident by the emphasis on having attained adequate experience, the Navy continues the theme of WO serving as technical experts. It defines WO as “technical specialists who perform duties requiring extensive knowledge and skills of a specific occupational field.”⁷²

Warrant officers provide the Navy a core of technical expertise that does not diminish as they get promoted. And, like the Army, its WO can also serve as department heads, officers in charge and even executive officers and commanders.⁷³ Unlike the Army and Marines, though, the Navy does not utilize the WO-1 rank. Navy WO are accessed at the CW2 rank, unless the candidate has already achieved the rank of Master Chief Petty Officer (E-9). In that case, he or she is accessed at the CW3 rank.⁷⁴ Also, although the Warrant Officer Management Act established the CW5 rank (W-5 pay grade) in 1992, the Navy did not institute the change until 2002, and the first Navy CW4 was not promoted to CW5 until 2004.⁷⁵

In 2006, the Navy instituted a pilot program to create flying Chief Warrant Officers. At the time, the Navy was facing a shortage of flying officers and thought WO could be the answer. The goal was to create a cadre of flying specialists “unencumbered by the traditional career paths of the unrestricted line officer community.”⁷⁶ In simpler terms, this meant they were looking for pilots who would not be concerned with career broadening or command duties and could focus solely on flying. Breaking from its tradition of only accepting WO from the senior enlisted ranks, the Navy targeted enlisted members in the ranks of E-5 through E-7 to ensure they had enough career time still ahead of them to be worthwhile training as pilots. While the program continued for a number of years, it was ultimately cancelled in 2013 when the Navy reevaluated its flying officer needs and determined flying Chief Warrant Officers were not necessary.⁷⁷

Marine Corps Warrant Officers

Although warrant officers have played a critical role in the Marine Corps for a century, not much has been written about their history. As a result of the 1916 National Defense Act, in 1917 the Marine Corps established the grades of Marine Gunner and Quartermaster Clerk to serve as technical experts. A total of forty-one quartermaster clerks and forty-three Marine

Gunners were appointed from among its NCOs. Of this initial cadre, only three served throughout the war as WO, while the remainder was temporarily promoted to second lieutenant to meet the ever-present need for more officers.⁷⁸ These temporary lieutenants reverted to their previous WO ranks upon the War's end. Another WO grade, Pay Clerk, was established in 1918. The Marine Corps WO ranks stagnated after WWI until 1926 when Congress established the commissioned WO grades of Chief Marine Gunner, Chief Quartermaster Clerk and Chief Pay Clerk.⁷⁹ Additional MOS were added to the WO ranks throughout the following years and the WO corps swelled and shrank depending on wartime and peacetime requirements.

The Marine Corps currently has two WO classifications—technical WO and Marine Gunner. Technical WO refer to specialists within non-combat arms career fields, such as Cyber Network Operations Engineer. Like the Navy, WO candidates are accessed solely from its enlisted ranks. Candidates are required to have between eight and sixteen years of service and achieved the rank of Sergeant (E-5).⁸⁰ The other classification, which holds a certain historical significance within the Corps, is that of Marine Gunners. They constitute a cadre of infantry weapons specialists responsible for developing, coordinating and monitoring training programs for employment of tactical weapons. This designation has been used by the Marines on and off since 1917 and was most recently reinstated in 1988 after a sixteen-year hiatus. These WO have achieved the rank of Gunnery Sergeant (E-7) or higher, and have between sixteen and twenty-three years of service.⁸¹ Marine Gunners are commissioned at the W-2 pay grade.

The Marine Corps currently has 2,237 WO serving across its components.⁸² While their numbers account for only about 1% of the Marines' total force, WO remain an integral part of the Corps today, serving in fifty-three MOS.⁸³ As when the ranks were created, they remain the technical experts of the Corps. The Marines define a WO as “a technical officer specialist who

performs duties that require extensive knowledge, training, and experience with the employment of particular capabilities which are beyond the duties and responsibilities of senior noncommissioned officers.”⁸⁴ While specifically designated technical specialists, the Marine WO of today are being called on to fill roles traditionally considered outside their scope of responsibility or filled by commissioned officers, such as company commander, executive officer and watch officer. Like the Army, the Marines have also made great strides toward fully integrating WO into their officer corps.

Arguments Supporting Air Force Warrant Officers

As cyberspace operations continue to expand, so will the challenges facing the domain and the joint cyber force. To offset these challenges it would be prudent for the Air Force to seriously reconsider reviving the warrant officer ranks. When General LeMay agreed to disband the WO ranks in 1959, he did so only after ensuring there was a provision to bring them back in the event that they may be required for future operations. The advantages on which the Air Force can capitalize by reinstituting WO are improved retention, increased parity of expertise among services, and lowered costs (compared to commissioned officers).

Retention

Providing the best and brightest cyber Airmen a career path as a warrant officer would allow them to maintain an operational focus, hone their highly specialized, sought-after skills and entice them to reenlist rather than forcing them into administrative positions as they progress, which may lead them to separate at the end of their commitment. Anecdotal evidence suggests that keeping cyber operators in operational units, versus assigning them to nonoperational duties contributes to job satisfaction, and thus a healthy retention level. However, within the current enlisted development construct, the needs of the Air Force outweigh Airmen’s

preferences, so there is no guarantee that cyber personnel will not be transferred to other positions once trained.⁸⁵ This is especially true of both SNCOs and officers. Career broadening to further develop leaders is necessary for a diverse Air Force, but the cost of such assignments is the loss of operational expertise, which may lead Airmen to choose to leave the service in search of better opportunities elsewhere. The 2013 AFRI study tasked by General Welsh found that in a few cases, SNCOs with less than two years remaining until retirement separated from the Air Force simply because they were reassigned to duties off the CYBERCOM operations floor.⁸⁶ They chose to give up their twenty-year retirement and begin working as contractors so they could continue working in cyber operations. The fact that they were then earning a higher salary was only icing on the cake. According to a 2015 RAND study, “there is a concern that competition for highly qualified cyber warriors from industry and other federal agencies, with wages and advancement opportunities that exceed those available in the military, may draw the most highly qualified cyber warriors away from DoD.”⁸⁷ As of January 2017, the 1B4 enlisted career field was only 74 percent manned (compared to an average 84 percent across all career fields).⁸⁸ Implementing the WO ranks could entice the right Airmen to continue service by increasing their compensation and bolstering their operational promotion opportunities.

When one compares the six-figure earning potential of a cyber operator in the private sector, or even as a government civilian, to the \$62,000 to \$75,000 annual compensation of an E-5 with ten years of service *and* a Selective Reenlistment Bonus (SRB), it becomes clear that the nation’s enlisted cyber warriors are highly vulnerable to the pull of the civilian market. Warrant officer ranks would improve retention by providing members long-term career compensation predictability, rather than the random implementation of SRBs. SRBs can only be granted during specific periods of a cyber Airmen’s career, and are unpredictable, not offering

normal career pay stability. Enlisted retention decision points for 1B4s occur after five to six years in the career field and again once they are established at the twelve to thirteen year point.⁸⁹ A 2015 Air Staff A1 Directorate (Manpower, Personnel and Services) study of retention trends indicated that reenlistment goals were not met. Indeed, second, third and fourth term reenlistments ranged from 16-21% below the Air Force's goals.⁹⁰ Several Airmen stated that they would separate regardless of the patriotic fulfillment they got from serving their country because, unsurprisingly, the higher private sector income was more enticing. Additionally, SRBs may actually have little effect simply because many join the military as a stepping stone to gain valuable education, skills, and experience specifically in order to transfer to employment in the corporate world.⁹¹ Further, in a 2002 report, the Congressional Budget Office found that the pay incentives of enlistment bonuses were outweighed by those of the WO ranks.⁹² By reinstating WO, the Air Force would be able to provide members with a significant pay incentive (e.g., \$64,908 annually as a CW3 with 14 years of service vs. only \$45,012 as an E-6) to remain in uniform, without having to increase spending on additional retention initiatives, such as SRBs.

Cyber Airmen live and work in a career field that lacks operational senior enlisted opportunities across the Air Force. As their training, education and expertise expand, so does their value to the service. However, career progression is hampered due to the limited number of cyber SNCO positions available. Only twenty-one E-8 and E-9 billets exist, leading to limited promotion potential and stagnation at lower ranks.⁹³ The 2013 DoD Cyberspace Workforce Strategy devised six focus areas to build and sustain a knowledgeable workforce. One area focused specifically on retaining qualified personnel by providing career progression opportunities. According to the strategy, increased retention rates can be realized if organizations are able to clearly show career progression opportunities.⁹⁴ Cyber WO billets will provide

enlisted subject matter experts with additional promotion opportunities while still allowing them to work primarily as cyber operators, versus increasingly working administrative functions which the “super grades” of E-8 and E-9 are typically assigned to perform. Warrant officer ranks will ultimately enhance Air Force cyber expertise and mitigate the looming retention problem by providing a clear career path for those who prefer the technical aspects of the job.

Parity with Other Services

In the 2013 AFRI study, both Air Force cyber officers and enlisted personnel stated that WO would provide stability, expertise, and bridge the gap between the officer and enlisted corps.⁹⁵ Yet, the Air Force remains the only service within the joint cyber realm without WO. It is essential that the Air Force retains parity among the other services in order to efficiently integrate into joint cyber operations and effectively contribute to the joint fight. For example, the Army’s Cyber Command states that their cyber warrant officers,

Give commanders the advantage in the cyberspace domain. [They] advise commanders on the availability and employment of capabilities; maintain and assist in the development of staff estimates; help to de-conflict and synchronize cyberspace operations; coordinate external support for cyber operation mission requirements; and integrate effects into the planning and targeting processes. Their primary function is to act as the subject matter expert and advisor to the commander and staff regarding the employment of offensive and defensive cyber operations.⁹⁶

This level of responsibility and required expertise is far greater than that of Army enlisted personnel. Yet, the Air Force essentially expects the same level of expertise from its disenfranchised (lower paid, with fewer advancement opportunities) enlisted cyber personnel as their Army WO brethren. This is evidenced by its enlisted Cyber Career Field and Education and Training Plan that details the lofty expectations placed on a 1B4 who,

Performs duties to develop, sustain, and enhance cyberspace capabilities to defend national interests from attack and to create effects in cyberspace to achieve national objectives. Conducts Offensive Cyberspace Operations

and Defensive Cyberspace Operations using established tactics, techniques and procedures to achieve COCOM and national objectives. Executes command and control of assigned cyberspace forces and de-conflicts cyberspace operations across the kinetic and non-kinetic spectrum. Supports cyberspace capability, development, testing and implementation. Partners with DoD, interagency and Coalition Forces to detect, deny, disrupt, deceive, and mitigate adversarial access to sovereign national cyberspace systems.⁹⁷

It becomes clear that WO would allow the Air Force to remain effective and operate efficiently in the joint realm by tendering Airmen cyber operators whose expertise, experience and rank are on par with that of the other services.

Lowered Costs/Officer End Strength

The use of warrant officers was partly eliminated due to their counting against officer end strength, which could endanger the growth of Air Force company grade officer authorizations.⁹⁸

As cyber officer authorizations grow, so does the cost of maintaining them. Cyber officers are not the solution to the cyber retention dilemma, as they are currently 93 percent manned.⁹⁹

Furthermore, cyber officers do not execute the technical aspects of the job that enlisted personnel do. When Air Force officers reach the field grade ranks (Major (O-4) through Colonel (O-6)), they take command and/or broaden their knowledge base outside their primary career field, thus losing their technical edge. The talent pool for WO will come from the enlisted force; those who desire to remain in the technical and operational aspects of cyberspace throughout their career, but also desire higher pay and greater potential for promotion.

Committing to the development of its cyber force by creating WO billets will not undermine the Air Force's ability to field officers throughout its ranks. It currently has 24,849 authorized billets in the communication and cyber career fields, with 1,911 of them allotted for commissioned officers.¹⁰⁰ Converting a hundred or more of these billets to WO surely would not degrade the officer corps, but actually reduce the long-term costs associated with commissioned

officer pay and benefits. Just looking at base pay, an O-4 with 14 years of service makes \$89,622 annually, while a CW3 with commensurate service tenure would cost the Air Force only \$64,908. This is a substantial cost savings in return for exchanging a broadly trained generalist for a recognized technical expert. The other service components manage to fund and leverage WO, which enhances retention rates, and bridges the gap between enlisted and officer expertise. By reinstating WO to serve in the cyber fight, the Air Force, too, can optimize its cyber force with improved retention and increased parity of rank and expertise with its sister services at lower personnel costs.

Arguments Against Air Force Warrant Officers

When considering reasons why returning the warrant officer ranks would be disadvantageous for the Air Force, one must look back at the rationale given by senior leaders when the service chose to discontinue the ranks in the first place, because they still ring true today. Numerous reasons led to the Air Force's decision to stop the appointment of WO in 1959, including manpower billets, the establishment of two new enlisted ranks, social concerns and administrative management. Although there are ways to manage and integrate these ranks back into the Air Force, an understanding of the challenges involved is necessary before WO would become a viable option to meet the service's 21st century requirements.

Manpower

The first issue that must be considered if the warrant officer ranks are to be reinstated is the establishment of manning positions for WO billets. The fiscal year 2017 budget maintains the active duty end strength force authorization at 317,000.¹⁰¹ In deciding to re-implement WO, the question arises as to where these positions would be taken from—the enlisted corps or the officer corps. In 2016, former Chief Master Sergeant of the Air Force (CMSAF) James Cody submitted

the issues surrounding the manpower question as a rationale for denying the return of WO. He stated, “This idea that you would get all the manpower associated with the new program, it doesn’t work that way...you’re still going to work within the end number that you have.”¹⁰² Reinstating the WO ranks would require senior leaders to determine where to pull the manpower positions from, and whether they come from the enlisted force or commissioned officer corps, the overall end strength of the Air Force would not change. But it is not just about the billets themselves; it is also about the costs associated with them. Chief Cody elaborates on this further, stating, “When we have a conversation about warrant officers, we’re talking about money. Either the Air Force would have to take some funding out of the budget for officers to cover warrant officer salaries, or the enlisted force would probably take a hit.”¹⁰³

When the Air Force opted to discontinue the WO ranks, their positions transitioned to commissioned officer billets as the WO retired or separated. This provided a gradual increase—albeit not by much—in the overall manning of the officer corps, over the three decades until the last Air Force WO retired. As they were phased out, the service utilized its remaining WO to fill company grade authorizations.¹⁰⁴ Additionally, as the WO program was being studied at USAF headquarters in 1958, the service announced the addition of the new E-8 and E-9 ranks to the enlisted corps. The creation of these two top-tier positions allowed for the existing enlisted manning to be reallocated versus adding more positions for WO which would require a reduction in commissioned officer allocations.¹⁰⁵ To this day, the Air Force has continued this preference.

New Enlisted Ranks

By discontinuing the warrant officer ranks and implementing the enlisted ranks of E-8 and E-9, Master Sergeants (E-7) and below were offered new promotion and leadership opportunities. Air Force senior leadership noted that removing the WO positions “cut out an

additional management layer and a separate personnel management system, and created increased promotion opportunities for the senior enlisted.”¹⁰⁶ The technical expertise and leadership qualities developed by the Air Force’s top enlisted grades were considered sufficient, thus eliminating the requirement for WO. Additionally, these new enlisted grades deterred E-7s from looking toward the WO ranks as a path to promotion and instead allowed them to further their career progression while staying in the enlisted ranks. A 1965 Air Command and Staff College paper found “With the new super enlisted grades...outstanding Master Sergeants were no longer eager to vie for a warrant appointment.”¹⁰⁷ In fact, enlisted members viewed WO positions as undesirable because they found the emphasis on a single career field too limiting.¹⁰⁸ One Chief Master Sergeant recalls his both positive and negative view of WO, stating “They were absolute experts in their area of endeavor. If you saw a warrant officer in the finance business, he could recite the manual to you...a walking book of knowledge, primarily because of long tenure. They had been working for 20 or 25 years in one field.”¹⁰⁹ While a WO’s *depth* of knowledge is commendable, in today’s joint force, it may be *breadth* that remains most valuable.

Today, the top three enlisted ranks are considered the Air Force’s technical experts in each of their specific career fields. This is one reason senior leaders hesitate to bring back WO. Their argument is that the service currently has a technically competent enlisted force, and the role of WO is just not needed. As discussed previously, the Air Force defined the role of WO as, “a technical specialist with supervisory ability, who is appointed for duty in one superintendent Air Force specialty.” This technical expertise is built into its lower enlisted ranks—Airman Basic through Technical Sergeant—through professional military education, career opportunities, technical training and experience. Once they reach the senior enlisted ranks, they transition from technical experts to leaders and mentors who develop the lower enlisted ranks.

Air Force Instruction 36-2618, *The Enlisted Force Structure*, defines the role of SNCOs as, “leaders, supervisors, managers, and mentors to further develop junior enlisted Airmen and NCOs under their charge to maximize their leadership abilities.”¹¹⁰ When CSAF General David Goldfein was recently asked about reintroducing a WO program during his nomination hearing, he responded, “The Air Force enlisted corps has the technological and leadership capabilities to perform at the same level of a warrant officer corps without instituting a fundamental change in our NCO development and progression.”¹¹¹ Former Secretary of the Air Force Deborah James voiced similar comments on the competency of the enlisted force, echoing no desire to return to a rank structure that includes WO. She stated, “The Air Force is not planning on bringing back warrant officers anytime soon... the cost outweighed the benefits. We would have to have career development types of programs in place, and so there just didn’t seem to be enough of an urgency or reason to do it because we have such a great enlisted force as it is.”¹¹² Air Force leaders do not see a need or desire to reinstate WO positions. In their view, the enlisted force has the capability and technical expertise to meet any and all future challenges.

Social Concerns

Another concern when considering the return of warrant officers is the social issues of these in-between ranks, which are not really officer but also not enlisted. In the 1950s senior enlisted members (E-7s) opted against transitioning to WO because they did not desire to return to a rank that lowered the prestige they had earned as a SNCO. One SNCO remarked, “Warrant officers often worked in an ambiguous environment in which the highest warrant officer grade (CW4) often fulfilled the duties of a commissioned major, but was subjected to the orders of the youngest second lieutenant.”¹¹³ Many enlisted Airmen had served numerous years and were highly experienced; having earned the prestige of ranks respected by both the officer and enlisted

corps alike. They did not consider transitioning into the WO ranks as favorable, despite the increase in pay.

History also shows that the confusion plaguing WO spilled over into where they fit into the Air Force in regards to housing and social integration. This confusion was illustrated in a 1955 *Air Force Times* article:

[What's] needed, in opinion of many USAF staffers, is a once-and-for-all statement on status of warrant officers. A new family allocation regulation, slated to contain one on housing has been delayed over disputes on rules for giving warrants their share of units. [The] problem is that new housing laws have earmarked so much for officers and so much for airmen housing. Now, headquarters has to decide where WO quarters will come from, the airmen allocation or the officers' or both. Meanwhile, WO rules on club membership, details, prestige and allied matters need clarification.¹¹⁴

The confusion about WO and where they fit in socially can be illustrated by yet another SNCO:

"I guess it was when housing became more visible [mid-1950s], and it was hard to figure out where this guy really fit in the picture. He had lived in officer quarters, lived in NCO quarters, and as quarters and families became important, the warrant became a handicap to the air force."¹¹⁵ Although these examples are six decades old, the issues they illustrate are issues that would need to be addressed were the Air Force to bring back WO today.

Administrative Burdens

Another challenge for Air Force warrant officers in the 1950s was the question of personnel management. Personnel management, and the inherent difficulties associated with it, should be a primary consideration when looking to return these ranks to the Air Force. The challenge of administrative management of three separate personnel categories—officer, warrant and enlisted—were time consuming. In 1963, total manning was at 3,102 WO, more than 130,000 officers and 733,000 enlisted personnel.¹¹⁶ Although the number of WO was low—only

about one third of one percent of the force—the personnel requirements including promotions, assignments, and retirements were complex. The WO promotion program alone was considered a burden in the 1950s. Title 10, United States Code, Section 559, 597, and 598 regulated the promotions for regular, reserve and temporary WO, who were eligible for either temporary or permanent promotion every year.¹¹⁷ This annual WO requirement was in addition to the existing enlisted and officer promotion cycles. To manage the personnel requirements if WO were reinstated would, at the very least, require a separate WO branch of the Air Staff A1 Directorate, separate WO regulations and policies, and a coherent philosophy on the role of WO.¹¹⁸ These provisions add an additional level of administration, requiring additional personnel to oversee the ranks, with minimal benefit—especially when one considers the modest number of WO that would actually be accessed.

Conclusion

The Air Force currently finds itself in the perfect storm where critical national security personnel requirements for next-generation constructs like the Cyber Mission Force and the Communications Squadron Next cannot be met due to shortages of technical experts. Though the service is taking steps to bolster its recruiting of the technically-minded individuals necessary to fight and win in the 21st century cyberspace domain, such as hacking competitions and STEM initiatives, it has work to do to ensure these technical experts remain in uniform once recruited. Reinstating the warrant officer ranks could be viable solution to the Air Force's retention problems. The cyber operations realm provides an example of where the service could benefit from a cadre of highly-experienced technical experts that remain focused on a single functional area throughout their entire career. Warrant officers in the cyber operations field would help alleviate the pay discrepancy that exists between enlisted members and their private sector

counterparts. Creating an echelon of professionals who earn pay and prestige higher than that of enlisted members, but are not burdened with the administrative, command, and other extra duties of commissioned officers, could entice many of the existing enlisted cyber Airmen to remain in the Air Force instead of separating after their service commitment is up. The WO ranks would provide enlisted personnel with greater promotion potential and additional career progression options, while at the same time offering them the possibility to remain focused on their craft and becoming consummate experts at what they do.

The situation in which the Air Force finds itself is a direct result of the choice it made in the late 1950s, favoring the flexibility of broadly trained SNCOs over highly trained and well-experienced WO. The WO road has not been without bumps for the other services, as their definitions and roles have constantly evolved, but unlike the Air Force, they never gave up on the idea. If the Air Force was to reinstate the WO ranks, it would be able to leverage the years of experience and lessons learned by the other services to make its own transition as smooth as possible. If the Air Force does not take action soon, it will continue to be at risk, losing its corporate knowledge and becoming increasingly vulnerable to outside threats. Many of the arguments continually voiced against the use of WO have been around since the service's infancy, but in today's world, most of the social issues can be answered relatively easily. For example, Air Force regulations fixed the housing issue by combining standards. Warrant officers now share the same base housing as company grade officers and SNCOs. The club situation has also been mitigated because by and large the enlisted and officers' clubs on Air Force bases have been collocated to be more cost effective, so there should be no question as to which establishment they can patronize.

It is true that WO would count against the Air Force's overall officer end strength, but both the President and the CSAF have pledged to grow the force, so reinstating the WO ranks would not affect current billets and manning levels, but would allow the service to retain its expertise as it grows from within. In fact, with the CSAF looking toward a total end strength of 350,000, now is the time to reinstitute WO—especially since the focus of the growth is expected to be in the cyber, maintenance, nuclear and space fields—functional areas in which WO could have a tremendous impact. With a higher end strength overall, the officer end strength will be higher, meaning the Air Force could appoint WO without worrying about a significant drop in commissioned officer authorizations. It is also true that adding a new echelon to the rank structure between enlisted members and officers would create a requirement for additional administrative overhead. But, since WO would, at least initially, constitute such a small percentage of the overall force, the overhead requirement would not be infeasible. Logic dictates that WO, accounting for 1% of the force or less, would not require anywhere near as many personnel to manage their career field as needed by the enlisted and commissioned officer corps.

The challenges that have plagued WO throughout Air Force history—manpower authorizations, social issues and personnel management—are just a few of the obstacles the service will have to overcome if the decision is made to reinstate the WO ranks. However, as CMSAF Kaleth Wright takes his position at the head of the enlisted force, opportunities to take another look at adding warrant positions are not completely out of the question. He recently told *Air Force Times* “It’s worth taking a look at reviving the warrant officer program to handle enlisted pilots, as well as other specialized fields.”¹¹⁹ This is a step in the right direction and cyber operations serves as an example that could benefit from reinstituting WO. In fact, the WO construct could very likely be used in just about any career field that places a premium on

highly-trained, highly-experienced individuals that provide continuity, technical expertise, and guidance to all levels of the force. Reincorporating WO into the Air Force will not happen overnight, but will require a concerted effort by the service's A1 Directorate and senior leaders, both enlisted and officer alike. To be effective, the WO roles will have to be clearly defined. The Air Force only has to look to its closest sister service, the Army, for inspiration. It has successfully incorporated WO into the vast majority of its career fields, and though not without trials and tribulations, has made them an integral facet of its force structure. The only thing now standing in the Air Force's way of bringing back warrant officers is the Air Force itself.



Acronyms

AFCYBER	Air Force Cyber (24th Air Force)
AFRI	Air Force Research Institute
AFSC	Air Force Specialty Code
AAF	Army Air Forces
ATLDP	Army Training and Leader Development Panel
CMSAF	Chief Master Sergeant of the Air Force
CSAF	Chief of Staff of the Air Force
CW	Chief Warrant Officer
COCOM	Combatant Command
CBO	Congressional Budget Office
CMF	Cyber Mission Force
DCO	Defensive Cyber Operations
DoD	Department of Defense
DA	Department of the Army
IT	Information Technology
JCAC	Joint Cyber Analysis Course
MOS	Military Occupational Specialties
NCO	Noncommissioned Officer
OCO	Offensive Cyber Operations
STEM	Science, Technology, Engineering, Math
SRB	Selective Reenlistment Bonus
SNCO	Senior Noncommissioned Officer
US	United States
USAF	United States Air Force
CYBERCOM	United States Cyber Command
WO	Warrant Officer
WOA	Warrant Officer Act
WWI	World War I
WWII	World War II

Notes

1. Phillip Swarts, "The Digital War: Air Force Leaders Say They Want More Airmen with Cyber Experience." *Air Force Times* 76 no. 15, (12 October 2015) 14.
2. Mark Pomerleau, "Air Force's Cyber Boss: Military Needs to Innovate at 'Cyber Speed,'" *Defense Systems*, 25 April 2016, <https://defensesystems.com/articles/2016/04/25/air-forces-cyber-wilson-innovation-speed.aspx>.
3. Department of Defense, *Cyber Operations Personnel Report*, Washington, DC: Office of the Under Secretary of Defense for Personnel and Readiness, April 2011, 7.
4. Mark Pomerleau, "Air Force's Cyber Boss," 1.
5. Mark Pomerleau, "Air Force Launches New Task Force to Focus on Cyber Threats," *Defense Systems*, 1 April 2015, <https://defensesystems.com/articles/2015/04/01/air-force-task-force-cyber-secure.aspx>.
6. Ibid.
7. Ibid.
8. Ibid.
9. Department of Defense, *The Department of Defense Cyber Strategy*, "Special Report: Cyber Strategy," https://www.defense.gov/News/Special-Reports/0415_Cyber-Strategy.
10. Ibid.
11. 24th Air Force, "24th Air Force – AFCYBER," <http://www.24af.af.mil/About-Us/Fact-Sheets/Display/Article/458567/24th-air-force-afcyber>.
12. Ibid.
13. Mark Pomerleau, "Air Force Bolsters its Cyber Ranks by 40 Percent," *Defense Systems*, 4 January 2016, <https://defensesystems.com/articles/2016/01/04/air-force-boosts-cyber-ranks.aspx>.
14. Department of Defense, Office of the Under Secretary of Defense for Personnel and Readiness, *Cyber Operations Personnel Report*, April 2011, 61-64.
15. Ibid, 29.
16. U.S. Army Cyber Command, "The Facts: Cyber Army Warrant Officer Careers", 2 March 2016, <http://www.arcyber.army.mil>.
17. Panayotis A. Yannakogeorgos and John P. Geis, *The Human Side of Cyber Conflict*, (Maxwell AFB, AL: Air University Press, 2016), xi.
18. Ibid, xii-xiii.
19. Jennifer J. Li and Lindsay Daugherty, *Training Cyber Warriors: What Can Be Learned from Defense Language Training*, RAND Report RR-476 (Santa Monica, CA: RAND, 2015), 19.
20. Yannakogeorgos and Geis, *The Human Side*, 61.
21. Li and Daugherty, *Training Cyber Warriors*, 17.
22. Ibid, 16-17.
23. Sandra Jontz, "U.S. Military Cyber Commands Sweeten Bonuses, Deals to Retain Cyberwarriors." *Signal*, 5 March 2015, <http://www.afcea.org/content/?q=Article-us-military-cyber-commands-sweeten-bonuses-deals-retain-cyberwarriors>.
24. Ibid.
25. Mark Pomerleau, "Air Force's Cyber Boss."
26. Li and Daugherty, *Training Cyber Warriors*, 16.
27. William E. Parker IV, *Cyber Workforce Retention*, (Maxwell AFB, AL: Air University Press, 2016), 22.
28. David R. Welsh, *Warrant: The Legacy of Leadership as a Warrant Officer* (Nashville, TN: Turner Publishing Company, 2006), 6.

29. Warrant Officer Historical Foundation, History of Army Warrant Officers, https://warrantofficerhistory.org/Hist_of_Army_WO.htm
30. 1st Battalion 4th Marines Association (1st and 3rd Divisions) Warrant Officer History, http://1stbn4thmarines.net/other-things-interest/warrant_officer_history.htm
31. Warrant Officer Historical Foundation.
32. Warrant Officer Act of 1954, H.R. 6374, 83rd Cong., 2nd sess., (29 May 1954), 157-168.
33. Mark R. Grandstaff, "Neither Fish nor Fowl: The Demise of the USAF's Warrant Officer Program," *Air Power History* 42 no. 1 (Spring 1995), 42.
34. Ibid.
35. Ibid., 44.
36. Ibid.
37. Bruce D. Callander, "The In-Betweeners," *Air Force Magazine* 74 no. 11 (November 1991), 71.
38. Department of the Air Force, *AFR 36-72, Officer Personnel: Air Force Warrant Officer Utilization Policy*, 2 June 1953.
39. Bruce D. Callander, "The In-Betweeners," 71.
40. Mark R. Grandstaff, *Foundations of the Force: An Air Force Enlisted Personnel Policy 1907-1956* (Bolling AFB, DC: Air Force History Support Office, 1997), 143.
41. David R. Welsh, *Warrant*, 24.
42. Mark R. Grandstaff, *Foundations of the Force*, 144.
43. Mark R. Grandstaff, "Neither Fish nor Fowl," 46.
44. Bruce D. Callander, "The In-Betweeners," 71.
45. Mark R. Grandstaff, "Neither Fish nor Fowl," 49.
46. Ibid.
47. Bruce D. Callander, "The In-Betweeners," 72.
48. David R. Welsh, *Warrant*, 24.
49. Ibid., 6.
50. Department of the Army, *Army Training and Leader Development Panel Phase III Warrant Officer Study Final Report*, 18 July 2002, 1.
51. David R. Welsh, *Warrant*, 8.
52. Ibid.
53. *Army Training and Leader Development Panel*, 1.
54. Defense Manpower Data Center, December 2016 Military Personnel Report, https://www.dmdc.osd.mil/appj/dwp/dwp_reports.jsp
55. U.S. Army Careers & Jobs: Technical Warrant Officer, <http://www.goarmy.com/careers-and-jobs/current-and-prior-service/advance-your-career/warrant-officer/technical-warrant-officers.html>
56. David R. Welsh, *Warrant*, 9.
57. Bruce D. Callander, "The In-Betweeners," 71.
58. *Army Training and Leader Development Panel*, 9.
59. Ibid.
60. Ibid., 1.
61. Department of the Army, *DA Pamphlet 600-3 Commissioned Officer Professional Development and Career Management*, 3 December 2014, 1.
62. Ibid., 19.

63. Department of the Army, *Army Regulation 600-20 Army Command Policy*, 6 November 2014, 25.
64. Dennis Steele, "The U.S. Army Warrant Officer Corps: Still a Work in Progress," *Army* 62 no. 7 (July 2012), 40.
65. Department of the Army, *The Army Warrant Officer 2025 Strategy*, 2016, 10.
66. Naval History and Heritage Command, History of Warrant Officers in the US Navy, <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/w/naval-traditions-names-of-rank/history-of-warrant-officers-in-the-us-navy.html>
67. Ibid.
68. Christopher Briem, "The Navy Needs More Warrant Officers," *U.S. Naval Institute Proceedings* 129 no. 9 (September 2003), 88.
69. Ibid.
70. Department of the Navy, *Limited Duty Officer (LDO) and Chief Warrant Officer (CWO) Recruit Your Relief Brief*, 21 September 2015.
71. Defense Manpower Data Center
72. Department of the Navy, Office of the Chief of Naval Operations, *OPNAV INSTRUCTION 1420.1b Enlisted to Officer Commissioning Programs Application Administrative Manual*, 14 December 2009, 1-7 (13).
73. Navy Personnel Command, Limited Duty Officers and Chief Warrant Officers, http://www.public.navy.mil/bupers-npc/officer/communitymanagers/ldo_cwo/Pages/default.aspx
74. *LDO and CWO Recruit Your Relief Brief*.
75. Warrant Officer Historical Foundation, Warrant Officer Histories of Other Services, http://www.warrantofficerhistory.org/WO_Prog_Other_Svc.htm
76. Ibid.
77. Department of the Navy, *NAVADMIN 192/13 Termination of Navy's Flying Chief Warrant Officer "Pilot" Program and Transition of Affected Aviators*, August 2013, 1.
78. 1st Battalion 4th Marines Association
79. Ibid.
80. Department of the Navy, Office of the Secretary, *SECNAV INSTRUCTION 1412.9b Marine Corps Limited Duty Officer and Warrant Officer Programs, Promotions, and Continuation Procedures*, 7 February 2006, 5.
81. Ibid., 19.
82. Defense Manpower Data Center
83. Department of the Navy, Headquarters US Marine Corps, *Marine Corps Order 1200.17E Military Occupational Specialties Manual*, 8 August 2013.
84. *SECNAV INSTRUCTION 1412.9b*, 2.
85. Ibid., 65.
86. Ibid., 65.
87. Li and Daugherty, *Training Cyber Warriors*, 21.

88. Chief Robert J. Agard, Air Force 1B Career Field Manager, USAF SAF-CIO A6, Pentagon, to the authors, e-mail, subject: ACSC Research – Cyber Career Fields, 15 March 2017. Due to the timeline and scope for this research project, an official survey to examine SNCO retention if warrant officers ranks were an option, was not conducted. However one of the authors, Maj Craig Towlson, an 11-year Technical Sergeant, would have considered the path of warrant officer in order to stay within the technical aspects of his Air Force Meteorology career field, rather than accepting a commission. Having worked directly with Army warrant officers for five years, and knowing Airmen who chose to leave the USAF to pursue the Army warrant officer path, Maj Towlson firmly believes that many of the Air Force’s talented enlisted Airmen would elect the warrant officer path, rather than separating or crossing over to another service.
89. William E. Parker IV, *Cyber Workforce Retention*, 19.
90. Ibid.
91. Li and Daugherty, *Training Cyber Warriors*, 56-57.
92. Congress of the United States, Congressional Budget Office, *The Warrant Officer Ranks: Adding Flexibility to Military Personnel Management*, February 2002, 59-60.
93. Agard to the authors, e-mail.
94. Department of Defense, *Department of Defense Cyberspace Workforce Strategy*, 4 December 2013, 13.
95. Yannakogeorgos and Geis, *The Human Side*, 71.
96. U.S. Army Cyber Command, “The Facts: Cyber Army Warrant Officer Careers”, 2 March 2016, <http://www.arcyber.army.mil>.
97. Department of the Air Force, *Career Field Education Training Plan 1B4X1 Parts I and II*, 1 November 2014, 13.
98. Yannakogeorgos and Geis, *The Human Side*, 72.
99. Agard to the authors, e-mail.
100. Ibid.
101. "AF Officials Announce FY 2017 Budget Force Structure Changes," U.S. Air Force, 12 February 2016, accessed 7 March 2017, <http://www.af.mil/News/ArticleDisplay/tabid/223/Article/655595/af-officials-announce-fy-2017-budget-force-structure-changes.aspx>.
102. Air Force Times, "Chief Cody Shoots Down Idea Revive Warrant Officers," accessed 3 March 2017, <https://www.airforcetimes.com/story/military/2016/05/24/chief-cody-shoots-down-idea-revive-warrant-officers/84866526/>.
103. Ibid.
104. Billy Neal, “An Investigation of the Reasons for Discontinuing the USAF Warrant Officer Program and Its Effect on the Air Force Personnel Grade Structure” (Maxwell AFB, AL: Air Command and Staff College, 1965), 16.
105. Ibid.
106. David R. Welsh, *Warrant*, 9.
107. Billy Neal, “Reasons for Discontinuing,” 15.
108. Mark R. Grandstaff, “Neither Fish nor Fowl,” 43.
109. Ibid., 43.
110. Department of the Air Force, *Air Force Instruction 36-2618 Enlisted Force Structure*, 27 February 2009, 4.
111. Air Force Times, "Enlisted Drone Pilots Won't Become Warrant Officers But They May Fly Rreapers," Air Force Times, accessed 7 March 2017, <https://www.airforcetimes.com/story/>

military/2016/08/08/enlisted-drone-pilots-wont-become-warrant-officers-but-they-may-fly-reapers/88290782/.

112. Ibid.

113. Mark R. Grandstaff, "Neither Fish nor Fowl," 43.

114. Billy Neal, "Reasons for Discontinuing," 13.

115. Mark R. Grandstaff, "Neither Fish nor Fowl," 43.

116. Billy Neal, "Reasons for Discontinuing," 9.

117. Ibid., 11.

118. Mark R. Grandstaff, "Neither Fish nor Fowl," 44.

119. Air Force Times, "Your New Chief Master Sergeant of the Air Force Talks Promotions, Enlisted Pilots, Dwell Time and More," accessed 7 March 2017, <https://www.airforcetimes.com/articles/your-new-chief-master-sergeant-of-the-air-force-talks-promotions-enlisted-pilots-dwell-time-and-more>.



Bibliography

- 1st Battalion 4th Marines Association (1st and 3rd Divisions) Warrant Officer History. http://1stbn4thmarines.net/other-things-interest/warrant_officer_history.htm (accessed 17 January, 2017).
- 24th Air Force. "24th Air Force – AFCYBER Factsheet." <http://www.24af.af.mil/About-Us/Fact-Sheets/Display/Article/458567/24th-air-force-afcyber>.
- "AF Officials Announce FY 2017 Budget Force Structure Changes." U.S. Air Force. 12 February, 2016. <http://www.af.mil/News/ArticleDisplay/tabid/223/Article/655595/af-officials-announce-fy-2017-budget-force-structure-changes.aspx>.
- Air Force Times. "Chief Cody Shoots Down Idea to Revive Warrant Officers." <https://www.airforcetimes.com/story/military/2016/05/24/chief-cody-shoots-down-idea-revive-warrant-officers/84866526/> (accessed 7 March 2017).
- Air Force Times. "Enlisted Drone Pilots Won't Become Warrant Officers But They May Fly Reapers." <https://www.airforcetimes.com/story/military/2016/08/08/enlisted-drone-pilots-wont-become-warrant-officers-but-they-may-fly-reapers/88290782/> (accessed 7 March 2017).
- Air Force Times. "Your New Chief Master Sergeant of the Air Force Talks Promotions, Enlisted Pilots, Dwell Time and More." <https://www.airforcetimes.com/articles/your-new-chief-master-sergeant-of-the-air-force-talks-promotions-enlisted-pilots-dwell-time-and-more>. (accessed 7 March 2017).
- Briem, Christopher. "The Navy Needs More Warrant Officers." U.S. Naval Institute Proceedings 129 no. 9 (Sep 2003): 88-89.
- Callander, Bruce D. "The In-Betweeners." *Air Force Magazine* 74 no. 11 (Nov 1991): 70-73.
- Defense Manpower Data Center, December 2016 Military Personnel Report, https://www.dmdc.osd.mil/appj/dwp/dwp_reports.jsp (accessed 20 February, 2017).
- Grandstaff, Mark R. *Foundations of the Force: An Air Force Enlisted Personnel Policy 1907-1956*. Bolling AFB, DC: Air Force History Support Office, 1997.
- Grandstaff, Mark R. "Neither Fish Nor Fowl: The Demise of the USAF's Warrant Officer Program." *Air Power History* 42, no 1 (Spring 1995): 40-51.
- Jontz, Sandra. "U.S. Military Cyber Commands Sweeten Bonuses, Deals to Retain Cyberwarriors." *Signal*, 5 March 2015. <http://www.afcea.org/content/?q=Article-us-military-cyber-commands-sweeten-bonuses-deals-retain-cyberwarriors>.
- Li, Jennifer J. and Lindsay Daugherty, "Training Cyber Warriors: What Can Be Learned from Defense Language Training." Santa Monica, CA: RAND Corporation, 2015.

Naval History and Heritage Command, History of Warrant Officers in the US Navy. <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/w/naval-traditions-names-of-rank/history-of-warrant-officers-in-the-us-navy.html> (accessed 13 February, 2017).

Navy Personnel Command, Limited Duty Officers and Chief Warrant Officers. http://www.public.navy.mil/bupers-npc/officer/communitymanagers/ldo_cwo/Pages/default.aspx (accessed 13 February, 2016).

Neal, Billy, "An Investigation of the Reasons for Discontinuing the USAF Warrant Officer Program and its effect on the Air Force Personnel Grade Structure." Maxwell AFB, AL: Air Command and Staff College, 1 April 1965.

Parker, William E. IV, *Cyber Workforce Retention*. Maxwell AFB, AL: Air University Press, 2016.

Pomerleau, Mark. "Air Force Bolsters its Cyber Ranks by 40 Percent," *Defense Systems*, 4 January 2016. <https://defensesystems.com/articles/2016/01/04/air-force-boosts-cyber-ranks.aspx>.

Pomerleau, Mark. "Air Force's Cyber Boss: Military Needs to Innovate at 'Cyber Speed.'" *Defense Systems*, 25 April 2016, <https://defensesystems.com/articles/2016/04/25/air-forces-cyber-wilson-innovation-speed.aspx>.

Pomerleau, Mark. "Air Force Launches New Task Force to Focus on Cyber Threats," *Defense Systems*, 1 April 2015. <https://defensesystems.com/articles/2015/04/01/air-force-task-force-cyber-secure.aspx>.

Steele, Dennis. "The U.S. Army Warrant Officer Corps: Still a Work in Progress." *Army* 62 no. 7 (July 2012): 39-41.

Swarts, Phillip. "The Digital War: Air Force Leaders Say They Want More Airmen with Cyber Experience." *Air Force Times* 76 no. 15 (12 October 2015): 14-15.

U.S. Army Careers & Jobs: Technical Warrant Officer. <http://www.goarmy.com/careers-and-jobs/current-and-prior-service/advance-your-career/warrant-officer/technical-warrant-officers.html> (accessed 23 October, 2016).

U.S. Army Cyber Command. "The Facts: Cyber Army Warrant Officer Careers." <http://www.arcyber.army.mil> (accessed 2 March, 2016).

U.S. Army Cyber Command. "The Facts: Cyber Enlisted Soldier Careers." 2 March 2016. <http://www.arcyber.army.mil> (accessed 2 March, 2016).

U.S. Congress, Congressional Budget Office. *The Warrant Officer Ranks: Adding Flexibility to Military Personnel Management*. Washington, DC: Congress of the United States, 2002.

U.S. Department of the Air Force. *Air Force Instruction 36-2618, Enlisted Force Structure*. Washington, DC: Department of the Air Force, 27 February 2009.

U.S. Department of the Air Force. *Career Field Education Training Plan 1B4X1 Parts I and II*, Washington, DC: Headquarters U.S. Air Force, 1 November 2014.

U.S. Department of the Air Force. *Officer Personnel: Air Force Warrant Officer Utilization Policy*. AFR 36-72. Washington, DC: Department of the Air Force, 2 June, 1953.

U.S. Department of the Army. *Army Command Policy*. Army Regulation 600-20. Washington, DC: Headquarters U.S. Army, 6 November 2014.

U.S. Department of the Army. *Commissioned Officer Professional Development and Career Management*. DA Pamphlet 600-3. Washington, DC: Headquarters U.S. Army, 1 February, 2010.

U.S. Department of the Army. *The Army Training and Leader Development Panel Phase III – Warrant Officer Study*. Fort Leavenworth, KS: Department of the Army, July 2002.

U.S. Department of the Army. *The Army Warrant Officer 2025 Strategy*. Washington, DC: Headquarters U.S. Army, 2016.

U.S. Department of Defense. *Cyber Operations Personnel Report*. Washington, DC: Office of the Under Secretary of Defense for Personnel and Readiness, April 2011.

U.S. Department of Defense. *Department of Defense Cyberspace Workforce Strategy*. Washington, DC: Office of the Secretary of Defense, 4 December 2013.

U.S. Department of Defense. “Special Report: Cyber Strategy.”
https://www.defense.gov/News/Special-Reports/0415_Cyber-Strategy.

U.S. Department of the Navy. *Limited Duty Officer (LDO) and Chief Warrant Officer (CWO) Recruit Your Relief Brief*. Washington, DC: Headquarters U.S. Navy, 21 September 2015.

U.S. Department of the Navy. *NAVADMIN 192/13 Termination of Navy’s Flying Chief Warrant Officer “Pilot” Program and Transition of Affected Aviators*. Washington, DC: Headquarters U.S. Navy, August 2013.

U.S. Department of the Navy, Headquarters US Marine Corps. *Marine Corps Order 1200.17E Military Occupational Specialties Manual*. Washington, DC: Headquarters U.S. Marine Corps, 8 August 2013.

U.S. Department of the Navy. Office of the Chief of Naval Operations, *OPNAV INSTRUCTION 1420.1b Enlisted to Officer Commissioning Programs Application Administrative Manual*. Washington, DC: Headquarters U.S. Navy, 14 December 2009.

U.S. Department of the Navy. Office of the Secretary, *SECNAV INSTRUCTION 1412.9b Marine Corps Limited Duty Officer and Warrant Officer Programs, Promotions, and Continuation Procedures*. Washington, DC: Headquarters U.S. Navy, 7 February 2006.

Warrant Officer Act of 1954. H.R. 6374, 83rd Cong., 2nd sess., 29 May 1954.

Warrant Officer Historical Foundation, History of Army Warrant Officers.
https://warrantofficerhistory.org/Hist_of_Army_WO.htm (accessed 2 January, 2017).

Warrant Officer Historical Foundation, Warrant Officer Histories of Other Services.
http://www.warrantofficerhistory.org//WO_Prog_Other_Svc.htm (accessed 2 February, 2017).

Welsh, David R. *Warrant: The Legacy of Leadership as a Warrant Officer*. Nashville, TN: Turner Publishing Company, 2006.

Yannakogeorgos, Panayotis A. and John P. Geis, *The Human Side of Cyber Conflict*, Maxwell AFB, AL: Air University Press, 2016.

