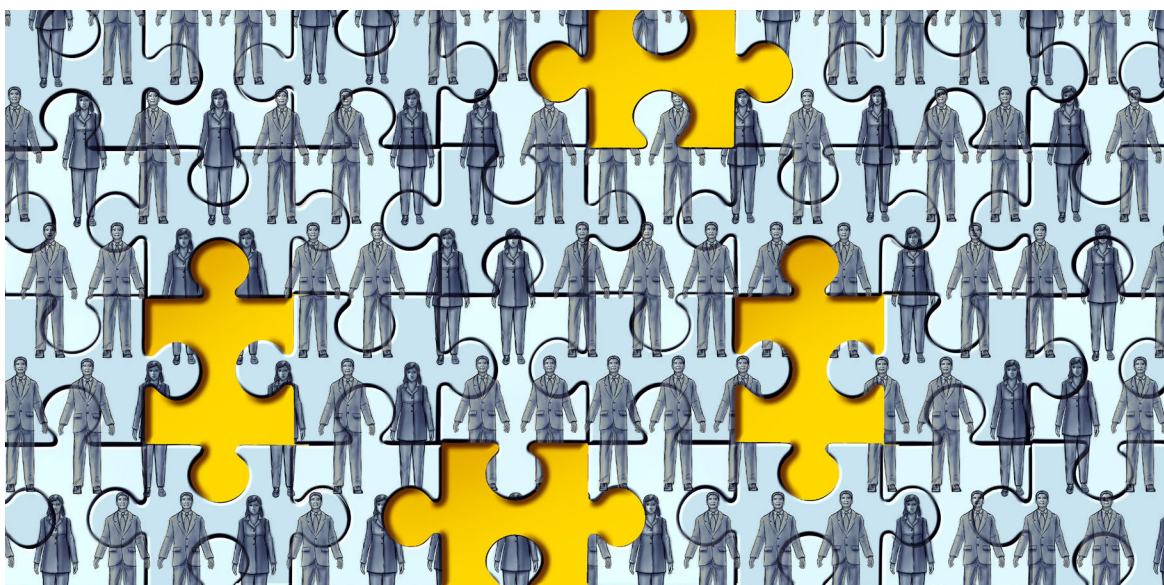


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Attracting and Employing Top-Tier Civilian Technical Talent in the Department of the Air Force

A Comparison of Six Occupations with Other Federal
Agencies and the Private Sector



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About This Report

The purpose of this report is to identify barriers related to the ability of current Department of the Air Force (DAF) hiring authorities and practices to attract and employ top-tier civilian technical talent in six occupational series (Computer Science, Operations Research, Electronics Engineer, Engineering Technician, Airfield Manager, and Nurse) and to explore alternative employment options and practices that the DAF may be able to use to better compete for that talent. For each occupational series, the report highlights key recruiting and employment challenges, the use of available hiring authorities and flexibilities, and how current DAF pay compares with pay in the sister services, other federal agencies, and the private sector. The report also describes findings from interviews with university career services offices and private-sector recruiting experts regarding the factors potential job candidates consider when making employment decisions. In addition, drawing on interviews with recruiting and hiring representatives from the sister services and other federal agencies, the report documents potential alternative employment options and practices that other federal organizations have found effective that the DAF could adopt to attract top talent. The report concludes by providing recommendations on actions the DAF can take to better compete for top-tier civilian technical talent.

The research reported here was commissioned by the Air Force Directorate of Civilian Force Management (AF/A1C) and conducted within the Workforce, Development, and Health Program of RAND Project AIR FORCE as part of a fiscal year 2021 project, “Hiring Top-Tier Civilian Talent.”

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We want to thank the participating university career services offices for their open sharing of information and insights into recruiting new graduates. We also offer special thanks to participating private-sector recruiting experts for their thoughtful input and candid discussion of the recruitment challenges evident in the current employment environment.

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Summary

Issue

As demand for technical talent is expected to increase across the U.S. workforce over the next decade, the Department of the Air Force (DAF) wants to ensure that it is competitive in attracting top-tier talent (e.g., highly skilled experts and promising new graduates) by identifying barriers related to the ability of current DAF hiring authorities and practices to attract and employ civilian talent in certain technical fields.

Approach

We examined current recruiting and hiring practices for six occupational series, which were selected for focus by the study sponsor: Computer Science, Operations Research, Electronics Engineer, Engineering Technician, Airfield Manager, and Nurse. For each occupational series, we conducted interviews with subject-matter experts and stakeholders and analyzed civilian personnel data to better understand recruiting and employment challenges, the use of available hiring authorities and flexibilities, and how current DAF pay compares with the sister services, other federal agencies, and the private sector. We also conducted interviews with select university career services offices, private-sector recruiting experts, and recruiting and hiring representatives from the sister services and other federal agencies to identify potential strategies the DAF could adopt to attract top talent.

Key Findings

- Common barriers identified by DAF representatives to recruiting and hiring top-tier talent include a small talent pool with the desired skills and credentials for some occupations, lower pay relative to the private sector, lengthy hiring timelines, challenges with hiring in remote or overseas locations, and a lack of effective marketing and recruiting at the local level.
- Although many of the occupations included in this review have direct hire authority (DHA), DAF representatives voiced concerns regarding whether DHA and its associated flexibilities were being used to the fullest extent.
- Data show inconsistent or minimal use of recruiting, relocation, and retention incentives for some occupational series.
- For several occupations, pay comparisons show that DAF pay lags behind that of the other services and certain federal government agencies. This gap is due to fewer positions in demonstration projects and alternative personnel systems that provide more flexible pay options. In addition, data show that DAF pay is often lower compared with other

services and other agencies within pay plan type—General Schedule, demonstration projects, or alternative personnel systems.

- Representatives from university career services offices and private-sector recruiting experts indicated in interviews that recruitment of top undergraduate candidates and experienced talent requires more than compensation: It demands emphasis on mission, innovation, and professional opportunities.
- These interviews, along with interviews with representatives from other federal agencies, also highlight the importance of increased marketing and branding through the use of specialized recruiters and expanded and effective use of social media and internet tools.

Recommendations

- Ensure that hiring managers are aware of and understand how to use available hiring authorities and related flexibilities.
- Review current outreach and marketing efforts to ensure that they address factors important to potential candidates, including focusing on mission, values, and opportunities for innovation and professional growth.
- Create opportunities throughout the educational life span of potential undergraduate student candidates to build familiarity with DAF and civilian job opportunities.
- Consider the increased use of specialized civilian recruiters at the Air Force Personnel Center, whose focus is on identifying applicant pools and interfacing with potential applicants, to help facilitate an enterprise-wide recruiting approach.
- Review position scope and level of work for those occupations covered under this study that had inconsistencies with sister services to determine whether positions are accurate and comparable to sister service positions.
- Assess why some positions that could be covered by alternative pay structures are not, and explore options for expanding or adopting alternative pay structures that allow for more competitive compensation through pay banding.

Occupation-Specific Recommendations

Two of the occupations we reviewed were significantly distinct from the others, and we offer two recommendations to address issues specific to these occupations:

- Explore the feasibility of creating a specific occupational series for Airfield Managers with other services, the Federal Aviation Administration, and the Office of Personnel Management to facilitate better career field management.
- Explore options for more creative recruitment of Nurses, including paths for hiring directly out of school.

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Chapter 1. Introduction

As demand for certain types of technical talent is expected to increase across the U.S. workforce over the next decade, the Department of the Air Force (DAF) wants to ensure that it is competitive (i.e., would be considered an employer of choice) in attracting and employing top-tier civilian technical talent (i.e., highly skilled experts and promising new graduates). For example, the U.S. Bureau of Labor Statistics (BLS) projects data scientists and mathematical science occupations to be among the top ten fastest growing occupations, with the employment change percentage from 2020 to 2030 estimated to be over 31 percent.¹ This growth in employment provides both the opportunity of a larger workforce from which to hire and the challenge of remaining competitive amid a growing number of private-sector employment opportunities. The competition is likely to be acutely felt by the DAF because of its size, its mission, and the range of technical talent of its employees. Recognition of this challenge and the need to look at potential personnel reforms to better recruit, train, and retain technical talent are reflected in the U.S. Department of Defense (DoD) strategy on digital modernization,² as well as the Air Force science and technology strategy for 2030 and beyond.³

A key part of the DAF's technical talent is its civilian workforce. The 2018 National Defense Strategy states that DoD must “emphasize new skills and complement our current workforce with information experts, data scientists, computer programmers, and basic science researchers and engineers—to use information, not simply manage it” as part of its strategy to build civilian workforce expertise.⁴ As of 2021, the DAF employed approximately 150,000 full-time civilian employees⁵ across roughly 600 occupations.⁶ Civilians work side by side with active-duty military members, the Air National Guard, and the Air Force Reserve and are a critical part of the overall DAF workforce in helping to support and sustain the DAF mission.⁷ However,

¹ U.S. Bureau of Labor Statistics, “Fastest Growing Occupations,” webpage, undated-a.

² U.S. Department of Defense, *DoD Digital Modernization Strategy: DoD Information Resource Management Strategic Plan FY19–23*, July 12, 2019.

³ U.S. Air Force, *Science and Technology Strategy: Strengthening USAF Science and Technology for 2030 and Beyond*, April 2019.

⁴ U.S. Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America*, 2018a, p. 8.

⁵ DCPDS data from the Air Force Personnel Center. This number represents DAF personnel who are permanent full-time employees and are U.S. citizens. The project sample we use in our occupation specific chapters is less restrictive to ensure we capture all DAF personnel in the specific occupations. It is filtered to include all full-time DAF employees who make at least minimum wage.

⁶ DCPDS data from the Air Force Personnel Center.

⁷ Air Force Civilian Service, “About,” webpage, undated.

current federal hiring practices and regulations often can constrain potential hiring and employment options that can be used for attracting and employing top-tier civilian talent. Lt Gen Brian Kelly commented that for the Air Force, “One of our biggest challenges is on the civilian side and particularly it’s on the civilian side in regard to how we remain competitive and how we remain attractive to recruit and retain civilian talent using the existing federal hiring practices and regulations.”⁸ For certain occupations, the DAF is also concerned about its ability to compete with higher pay offered in the private sector. Thus, examining current recruitment practices and available hiring authorities and other flexibilities that can be used to attract and hire candidates is critical to identifying strategies for addressing current and future competition for top-tier talent.⁹

Study Objective and Approach

In fiscal year (FY) 2021, the Air Force Directorate of Civilian Force Management (AF/A1C) asked RAND Project AIR FORCE to conduct a study to identify barriers related to the ability of current DAF hiring authorities and practices to attract and employ top-tier civilian technical talent in certain technical areas and explore alternative employment options that the DAF may be able to use to better compete for that talent. Given the large number of civilian occupations within the DAF, the first task of the study involved identifying a subset of target occupations for inclusion. To help narrow down the occupations for review, we reviewed relevant literature and publicly available data on high-demand technical fields (e.g., projected employment growth) and conducted interviews with representatives from Air Force major commands (MAJCOMs) and the U.S. Space Force regarding their current civilian hiring challenges. Using the information collected from these efforts and in consultation with the study sponsor, the following six occupations were selected for inclusion in the study (along with their Office of Personnel Management [OPM] occupational series):

1. Computer Science (1550)
2. Operations Research (1515)
3. Electronics Engineer (0855)
4. Engineering Technician (0802)
5. Airfield Manager (select positions within the Transportation Management [2150] occupational series)
6. Nurse (0610).

⁸ Quoted in Scott Maucione, “Air Force Working with OPM to Hire Civilians Faster,” *Federal News Network*, June 25, 2018.

⁹ The federal government must follow specific laws and regulations for hiring civilians. We provide an overview of these in Chapter 2.

Study Tasks

To better understand (1) potential barriers to hiring and employing top-tier talent in each occupation and (2) how to best address potential barriers, we used a mixed-methods approach that included the following study tasks:

1. A review of relevant policy and available personnel data to better understand the current civilian workforce in the targeted occupational series. See Appendix A for more detail on our quantitative data sources.
2. Interviews with MAJCOM and U.S. Space Force representatives, career field managers (CFMs), and representatives from the DAF talent acquisition team to better understand barriers to attracting and employing talent in each occupational series.¹⁰ See Appendix B for more detail on the interview methodology.
3. A review of available hiring authorities and other flexibilities and their use within the DAF for each occupational series. See Appendix C for detailed information on direct hire authorities (DHAs).
4. A statistical comparison of DAF pay with pay in the private sector and at other federal agencies. See Appendix A for more detail on data sources and the methodological approach.
5. Interviews with (1) representatives from career services offices from a select number of universities regarding the factors new graduates consider when looking for jobs and (2) private-sector recruiting representatives who have significant experience in recruiting for our target occupations regarding the factors that both new and experienced talent consider when looking for jobs. See Appendix B for more detail on identification of universities and experts for inclusion and the interview methodology.
6. Interviews with recruiting and hiring representatives from the sister services and other federal agencies that employ large percentages of civilian personnel in our target occupations to identify potential alternative employment options other federal organizations have found effective that the DAF could adopt to attract top civilian technical talent. See Appendix B for more detail on the interview methodology.

Using the findings from each of these research tasks, we then developed recommendations for actions that the DAF can consider to attract and employ top-tier civilian technical talent in the occupations included in this review.¹¹

¹⁰ Each MAJCOM and the U.S. Space Force has its own office overseeing civilian personnel programs, including the recruiting and hiring of its civilian workforce. Each occupation is also managed by a CFM and team who is responsible for civilian force development for specific occupational series. Finally, the talent acquisition team at the Air Force Personnel Center is responsible for DAF enterprise marketing, recruiting, and hiring for hard-to-fill positions. Given their different but complementary roles in the civilian recruiting and hiring process, we sought input from representatives across these three groups.

¹¹ In addition to compensation, the benefits that are offered in the federal government can be utilized to help attract candidates. In a previous report, we outlined benefits offered by the DAF and how they compare with the private sector: Ginger Groeber, Kirsten M. Keller, Philip Armour, Samantha E. DiNicola, Irina A. Chindea, Brandon Crosby, Ellen E. Tunstall, and Shreyas Bharadwaj, *Department of the Air Force Civilian Compensation and Benefits: How Five Mission Critical and Hard-to-Fill Occupations Compare to the Private Sector and Key Federal Agencies*, RAND Corporation, RR-A334-1, 2021. Therefore, we do not review the material on benefits in this report.

Structure of This Report

The remaining chapters in this report provide background information on relevant DAF civilian policies and practices and document the study findings and recommendations. Chapter 2 provides an overview of DAF hiring authorities and flexibilities used to recruit and employ civilian talent. Chapters 3–8 provide our study findings on each of the six occupational series identified for inclusion in the current study. Because some readers may not be interested in all the occupations reviewed, these chapters are organized by occupation for career managers and others interested in those career fields and can be read as stand-alone reviews of each specific occupation. In cases in which relevant information is discussed in another chapter, we refer the reader to the particular location of the relevant content. Following the reviews of specific occupational series, Chapter 9 then provides insights from interviews with three groups of experts (university career services offices, private-sector recruiting experts, and representatives from the sister services and other federal agencies) to better understand the various factors that candidates, in general, consider when looking for job opportunities, as well as potential recruiting practices that may be helpful for the DAF to consider. Finally, Chapter 10 presents the study recommendations. The report also includes several appendixes that provide more detail on the study methodology, additional background information, and findings from the pay comparisons.

Chapter 2. Department of the Air Force Hiring Authorities and Flexibilities

There are a large number of hiring authorities, compensation flexibilities, and incentives available to the DAF that can be leveraged to recruit and retain civilians into positions that may otherwise be considered hard-to-fill.¹² Positions can be identified as hard-to-fill because for one reason or another (pay, location, need for skill in other agencies or private sector, etc.) the position at a specific DAF location or throughout the DAF is difficult to fill and keep filled with qualified civilian employees. This chapter draws on previous RAND research,¹³ as well as OPM, DoD, DAF, and other federal government agency publications, to provide background information on several variants of these authorities and flexibilities. Our findings on how some of these key authorities and flexibilities are used for the specific occupations under review are presented in Chapters 3–8.

Recruiting and Hiring Civilians in the Department of the Air Force

The DAF has an enterprise recruiting strategy, with the Air Force Personnel Center (AFPC) as the focal point for recruiting and hiring new employees. The staffing specialists at AFPC work with local base personnel to fill vacancies and bring new employees into DAF positions. There is a separate civilian recruiting website branded as the Air Force Civilian Service (AFCS), which provides an overview of DAF civilian jobs and careers.¹⁴ This is a change from the past, when the only mention of civilian positions on Air Force military recruiting pages was a link that would lead to limited information on civilian jobs. The current website provides information for potential applicants on civilian careers and occupations in the Air Force. For example, one unique feature, Hot Jobs, is a map that points to job locations where DHA can be used to make appointments. By clicking on the location pinpoint, a drop-down list of the positions available appears. DHA is an authority that allows federal hiring without regard to the provisions of Title 5 of the U.S. Code (U.S.C.) Sections 3309 through 3318 (see further detail later in this chapter).

¹² The federal government must follow specific laws and regulations in hiring civilian employees, including the types of incentives that can be used.

¹³ Previous RAND research includes Groeber et al., 2021; Ginger Groeber, Paul W. Mayberry, Brandon Crosby, Mark Doboga, Samantha E. DiNicola, Caitlin Lee, and Ellen E. Tunstall, *Federal Civilian Workforce Hiring, Recruitment, and Related Compensation Practices for the Twenty-First Century: Review of Federal HR Demonstration Projects and Alternative Personnel Systems to Identify Best Practices and Lessons Learned*, RAND Corporation, RR-3168-OSD, 2020; and Molly F. McIntosh, Patricia K. Tong, Hannah Acheson-Field, Noah Johnson, Norah Griffin, and Joshua Russell-Fritch, *Monetary and Nonmonetary Compensation for High-Value U.S. Department of Defense Civilian Skill Sets*, RAND Corporation, RR-A385-1, 2020.

¹⁴ Department of the Air Force, “Air Force Civilian Service,” webpage, undated.

The DAF has also issued the *U.S. Air Force Civilian Employment Eligibility Guide*, which walks an applicant through the recruitment process.¹⁵ Consisting of 28 pages, it provides information on hiring authorities and a step-by-step process on how to apply to positions. The increased marketing and branding of the AFCS is also evident with video advertisements showing up on television and streaming services; these advertisements present a total force identity for the DAF, with civilians being mentioned as an option for serving with the department.

AFPC's talent acquisition team is the DAF's only centralized recruiting team. The team has personnel performing workforce planning, marketing, recruiting, and hiring. AFPC's talent acquisition team collaborates with CFMs and hiring managers to assist in filling DAF positions.¹⁶ Team recruiters primarily focus their assistance on hard-to-fill positions. In the past, the talent acquisition team went to recruiting events (e.g., job fairs, university hiring events) for the DAF, but since the onset of the coronavirus disease 2019 (COVID-19) pandemic, the talent acquisition team has transitioned to a virtual job fair platform. The team hosts hiring events at various bases that target different occupations. The platform offers attendees the opportunity to have conversations with talent acquisition specialists, similar to what might happen at an in-person job fair. The talent acquisition team is also employing other digital hiring efforts, such as live question-and-answer chats on Facebook. Digital events are estimated to cost one-tenth of the cost of in-person events. The cost savings has allowed the team to host multiple digital events per month, instead of one or two in-person events per year as in the past.¹⁷

Air Force Materiel Command (AFMC) employs more than 40 percent of the DAF civilian workforce. In 2018, the Assistant Secretary of the Air Force for Manpower and Reserve Affairs authorized AFMC to perform a pilot whereby it recruited for AFMC positions to test strategies to improve the DAF hiring process.¹⁸ Under the pilot, AFPC operating locations at Hill Air Force Base (AFB), Robins AFB, Tinker AFB, and Wright-Patterson AFB were realigned to AFMC to provide opportunities for AFMC to test innovative recruiting strategies.¹⁹ The AFPC talent acquisition team also partners with AFMC to improve filling hard-to-fill occupations utilizing brick-and-mortar and digital hiring event efforts. The team facilitates digital hiring events for AFMC, which include providing nationwide marketing and advertising resources to increase visibility.

¹⁵ Air Force Personnel Center, *U.S. Air Force Civilian Employment Eligibility Guide*, January 2021.

¹⁶ CFMs are responsible for assisting in the management of DAF career fields by monitoring and providing recommendations related to education, training, selection, and assignments.

¹⁷ Air Force Civilian Service Talent Acquisition Division, "Air Force Civilian Service Goes Digital, Continues to Hire," Air Force Personnel Center, January 27, 2021.

¹⁸ We were not able to obtain information on the results of this pilot effort.

¹⁹ Marisa Alia-Novobilski, "AFMC Civilian Hiring Pilot Program Targets Efficiency, Timeliness," Air Force Materiel Command Public Affairs, October 12, 2018.

Hiring Authorities

In this section, we detail the different hiring authorities available to the DAF. Although there are numerous hiring authorities available to the DAF, interviewees indicated that DAF policy, with limited exceptions, requires use of DHA if that authority exists for the targeted occupation. If it does not, the second recruitment method to use when positions are advertised is merit promotion for current DAF or government employees with a status eligibility. The third option for recruitment is open competition using the competitive examining process whereby all U.S. citizens can apply for the DAF position.

Direct Hire Authorities—DoD and OPM

DHAs are used across federal agencies, including DoD, to hire civilian employees to jobs for which there is either a severe shortage of candidates or a critical need to fill the position. DHAs differ in a number of ways, based on the agency using them, the position they are being used for, and the length of time they can be used. Some government-wide DHAs require standard public job postings (DoD DHAs are different and may not require a public job posting), though they streamline other requirements, including eliminating competitive ranking, veterans' preference, and rule of three procedures.

OPM has granted five DHAs across a variety of occupations for federal agencies to hire civilians into hard-to-fill and critical job positions. These DHAs focus on medical occupations; information technology (IT) occupations; veterinary medical officers; science, technology, engineering, and mathematics (STEM) positions; and cybersecurity positions. An overview of the occupations covered by OPM's government-wide DHAs and their associated expirations dates can be found in Table C.1 in Appendix C.

DoD also has a number of DHAs for civilian positions provided by National Defense Authorization Act (NDAA) legislation over various years. Many of these authorities are used to fill key occupations with recent graduates in a streamlined manner, reducing the hiring process timeline. Table C.2 in Appendix C outlines the different DHAs provided by NDAA legislation for FYs 2016–2021.

Importantly, the FY 2020 NDAA streamlined a large number of DHAs authorized by Section 9905 of Title 5 and consolidated several previous DHAs into one, thus suspending several individual DHAs. The consolidated DHA covers all cyber workforce positions, all STEM positions (excluding those in a Science and Technology Research Laboratory [STRL]), medical or health professionals, child care services positions, financial management and all related positions (including accounting, cost estimation, auditing, actuaries, operational research, and business administration), and a few other occupations with broader exceptions.

Merit Promotion

Merit promotion is a process whereby current federal employees, former federal employees (who have reinstatement rights), or candidates with a status eligibility, such as veterans and individuals with disabilities, can compete for a vacant federal position without having to compete with applicants from the wider U.S. population. Generally, the area of consideration for a merit promotion announcement is all eligibilities and all locations. Under merit promotion, the evaluation, referral, and selection of candidates for employment, placement, or promotion is conducted using only the candidate or employee's qualifications based on their achievements, education, and work history. However, some occupations will require a USA Hire behavioral assessment administered by OPM. In other words, "lawful political affiliation, race, color, religion, sex (including pregnancy, sexual orientation, and gender identity), national origin, age, disability, genetic information, marital status, [and] prior Equal Opportunity activity" are not factors that contribute to the candidate or employee's evaluation for a position.²⁰ Under the DAF merit promotion plan, the following categories of employees may also apply for merit promotion announcements:²¹

- "Any appropriated fund employee occupying a permanent or indefinite position in the competitive service"
- "Any employee on an Overseas Limited Appointment of indefinite duration or not to exceed five years duration because of the DoD mandatory requirement to rotate from the overseas area"
- "Any employee serving under an excepted service appointment with competitive status"
- "Any employee currently serving under a Veterans' Recruitment Appointment"
- "Any employee who is a family member and is serving under a Schedule A 213.3106(b)(6) appointment whose position is temporarily converted to the excepted service"
- "Any employee under a competitive or excepted service appointment absent to military service for 31 calendar days or more; or, serving with an international organization; or, in Leave without Pay status while in receipt of injury compensation"
- Veteran Employment Opportunities Act (VEOA) applicants
- 30 percent or more disabled veterans
- any Veterans Recruitment Eligible employees
- individuals with disabilities
- non-appropriated fund employees
- Land Management employees.

In the DAF, the merit promotion process involves the following six steps:²²

²⁰ Air Force Manual 36-203, *Staffing Civilian Positions*, Department of the Air Force, July 30, 2019, p. 16.

²¹ The first six items in this list quote Air Force Manual 36-203, 2019, pp. 19–20. The last six items are from Air Force Personnel Center, 2021.

²² Air Force Manual 36-203, 2019, p. 37.

1. Determine the applicability of competitive procedures.
2. Conduct job analysis and develop the promotion plan.
3. Refer employees who are entitled to priority consideration under competitive procedures.
4. Identify competing candidates.
5. Rank competing candidates.
6. Certify eligible candidates.

It should be noted that local collective bargaining agreements may have additional procedures with respect to the merit promotion process. These local agreements may modify the DAF process outlined above.

Competitive Examining

There are specific processes that must be followed when recruiting applicants who are not employed by or have never worked for the federal government. Competitive examining is the traditional process by which applicants are selected for competitive service positions.²³ Title 5, Chapter I, Subchapter B, Part 332 of the U.S. Code of Federal Regulations (5 CFR 332) outlines the requirements for recruiting and selecting candidates through competitive examination, with the intent of selecting the best-qualified candidates for a given job. Outside of specific exceptions described in 5 CFR 332, applications for these jobs and examinations of applications are open to the public and are developed to avoid discrimination against any candidates for qualities unrelated to the job. Agencies employing competitive examination for their positions may use a set of eligibility and minimum qualifications that the applicant must meet to compete for the position. The applicant pool may be narrowed based on the results of the assessment if any individuals failed to meet applicable minimum score requirements. Applicants are then ranked based on a variety of agency- or hiring manager-determined factors, including proficiency levels on specific competencies or knowledge, skills, and abilities. Minimum requirements and specific quality factors are documented by human resources staff throughout the hiring process. Applicants may appeal or go through administrative review if they do not agree with the outcome and have reason to believe requirements were not applied evenly across applicants. Once the set of best-qualified applicants is determined, the hiring manager selects an applicant. This is a complicated, often lengthy, process, with many caveats, exceptions, and varying levels of assessment requirements, which can be reviewed in 5 CFR 332 or in Chapter 5 of OPM's *Delegated Examining Operations Handbook*.²⁴ OPM requires that personnel specialists who perform delegated examining as part of the competitive examining process be trained and certified following the provisions outlined in the *Delegated Examining Operations*

²³ U.S. Office of Personnel Management, "Competitive Hiring," webpage, undated.

²⁴ U.S. Office of Personnel Management, *Delegated Examining Operations Handbook: A Guide for Federal Agency Examining Offices*, June 2019.

Handbook. Guidelines specific to the DAF’s application of competitive examination can be found in Air Force Manual 36-203.²⁵

Special Hiring Authorities for Eligible Veterans

In addition to veterans’ preference in the competitive examining processes, there are several separate appointing authorities for veterans. Veterans can also be appointed under a Veterans’ Recruitment Appointment (VRA) and under authorities in the Veterans Employment Opportunity Act of 1998 and its amendments. There are also authorities for hiring veterans who are 30 percent or more disabled or who are disabled and enrolled in a U.S. Department of Veterans Affairs (VA) training program. And, agencies can use the Schedule A appointment, which is not limited to veterans, for the severely disabled to appoint disabled veterans.²⁶

Experts and Consultants

5 U.S.C. 3109 provides for the hiring of experts and consultants in the federal government. In 5 CFR 304.102, *experts* are defined as people who are “specially qualified by education and experience to perform difficult and challenging tasks in a particular field beyond the usual range of achievement of competent persons in that field.” A *consultant* is defined as “a person who can provide valuable and pertinent advice generally drawn from a high degree of broad administrative, professional, or technical knowledge or experience.” Essentially, experts or consultants can be brought into an office, agency, or organization on a short-term basis to act as a source of expertise that may not otherwise be present among the staff. This authority is particularly valuable in that agencies can hire these temporary or intermittent employees without following competitive examination, position classification, and the General Schedule (GS) pay rates. Experts and consultants can be hired on an intermittent basis or into a temporary position,²⁷ which cannot exceed two years if the work is full-time. These flexibilities may be particularly helpful in cases where specific skills are missing from the workforce and the ability to attract those with this expertise is limited by compensation differences between the federal and nonfederal sectors. Bringing experts in these areas into the open positions allows for a temporary filling of the position and may allow for the opportunity to deliver mentorship in these specific skills to the workforce.²⁸

²⁵ Air Force Manual 36-203, 2019.

²⁶ U.S. Office of Personnel Management, “Special Hiring Authorities for Veterans,” webpage, undated.

²⁷ When appointed on an intermittent basis, the expert or consultant “may be appointed under this authority without time limit or for any period determined by the agency” (5 CFR 304.103).

²⁸ U.S. Office of Personnel Management, “Expert and Consultant Pay,” webpage, undated.

Highly Qualified Experts

5 U.S.C. 9903 provides the Secretary of Defense the authority to temporarily hire nongovernment (i.e., neither civil service nor uniformed) employees as “highly qualified experts” (HQEs) without regard to any provision of this title governing the appointment of employees to positions in DoD. Appointments under this authority cannot extend beyond six years (five in the initial appointment and a one-year extension) without a break in service, and DoD cannot exceed 2,500 HQE appointments at any time. DoD instructions provide that the hiring of HQEs should “bring enlightened thinking and innovation to advance the DoD national security mission.”²⁹ The DAF is allocated 60 HQEs total, including HQE senior mentors. The DAF can hire HQEs, setting their pay between the GS-15, step 1 (or equivalent), up to the statutory limit of Level IV of the Executive Schedule. Pay can be set taking into consideration the salary paid in the labor market for comparable positions, the applicant’s skills and professional and educational accomplishments, and the complexity of the work. DAF instructions provide additional guidance for the use of HQEs. Specifically, in the DAF, initial appointments of HQEs are limited to three years but can be extended for an additional two years. The organization requesting an HQE needs approval from the Office of the Administrative Assistant to the Secretary of the Air Force. Air Force Instruction 36-901 describes other DAF-specific regulations for the hiring, performance appraisal, and compensation of HQEs.³⁰

Temporary or Term Appointments

Title 5 of the Code of Federal Regulations, and particularly 5 CFR 316, allow for a broader range of nonpermanent appointments across the civil service, specifically on a temporary (one year or less) or term (more than one year and less than four years) basis.³¹ DoD agencies have additional flexibilities: Temporary appointments may be extended up to three years, and term appointments may be extended to eight years. These appointments are typically used to address hiring in locations or types of positions where there is a critical shortage or short-term need.³² These appointments may be noncompetitive, allowing a shorter hiring process. In some cases, agencies may be authorized to convert temporary or term employees to career or career-conditional appointments.³³

²⁹ Department of Defense Instruction 1400.25, Vol. 922, *DoD Civilian Personnel Management System: Employment of Highly Qualified Experts (HQEs)*, U.S. Department of Defense, April 3, 2013, incorporating Change 1, effective January 18, 2017.

³⁰ Air Force Instruction 36-901, *Civilian Senior Executive Management*, Department of the Air Force, January 23, 2012.

³¹ U.S. Office of Personnel Management, “Competitive Hiring,” webpage, undated.

³² Groeber et al., 2020.

³³ U.S. Office of Personnel Management, “Competitive Hiring,” webpage, undated.

Temporary employees are eligible to earn annual and sick leave and are covered by Social Security and unemployment compensation, but they do not receive the other benefits provided to career civil service employees. Temporary employees can purchase health insurance from the service providers covered by the Federal Employees Health Benefits Program after they have completed one year of service; however, the employee must pay for the full cost of the health insurance, with no government contribution. These employees are generally ineligible for coverage under the Federal Employees' Group Life Insurance Program or the federal employee retirement systems.³⁴ Temporary employees may be released from employment at any time and without formal notice.

Term employees start their term in a trial period, which extends through the full first year of the appointment, during which the employee can be terminated at any time. This trial period may be waived or truncated if the term employee had previous civilian service. Like temporary employees, term employees are eligible for annual and sick leave, as well as Social Security and unemployment coverage. Unlike temporary appointments, term appointments come with eligibility for health insurance under the Federal Employees Health Benefits Program from the start.³⁵ Term employees are also eligible for retirement benefits.

Intergovernment Personnel Act Program

The Intergovernment Personnel Act (IPA) program (established in 5 CFR 334) allows agencies to temporarily bring in personnel from other government agencies, academic institutions, research laboratories, and federally funded research and development centers (FFRDCs) for hard-to-fill positions.³⁶ Similarly, federal employees can temporarily spend time working with these other organizations without losing their position or benefits from their hiring organization.³⁷ OPM outlines the following as potential objectives of such an exchange of personnel:³⁸

- strengthening the management capabilities of federal agencies, state, local and Indian tribal governments, and other eligible organizations;
- assisting the transfer and use of new technologies and approaches to solving governmental problems;
- facilitating an effective means of involving state and local officials in developing and implementing federal policies and programs; and,

³⁴ U.S. House of Representatives, *Temporary Employee Practices: How Long Does Temporary Last? Hearing Before the Subcommittee on Federal Workforce, Postal Service, and the District of Columbia*, U.S. Government Printing Office, 2010.

³⁵ 5 CFR 316; U.S. Office of Personnel Management, *Temporary Employment in the Federal Government*, September 2013.

³⁶ U.S. Office of Personnel Management, "Intergovernment Personnel Act," webpage, undated.

³⁷ U.S. Office of Personnel Management, "Intergovernment Personnel Act," webpage, undated.

³⁸ U.S. Office of Personnel Management, "Intergovernment Personnel Act," webpage, undated.

- providing program and developmental experience that will enhance the assignee's performance in his or her regular job.

DAF data show only ten completed IPAs since FY 2018 and 12 active IPAs across all of the DAF during 2021, with varying appointment lengths. Of the 12 active IPAs in 2021, four were from universities, six from national research laboratories (e.g., Massachusetts Institute of Technology's Lincoln Lab), one from an FFRDC, and one from a nonprofit research institution. Four of the positions were to fill professor positions across the DAF, and the other positions ranged from advisers to scientists. We do not have data on specific occupations.³⁹

These assignments do not require OPM approval; the agency may be reimbursed for the associated costs (pending agreement with the other organization), and these assignments do not need to be on a full-time basis. Thus, IPAs are a viable and potentially effective solution to shortages in hard-to-fill positions, and they provide a resource for bringing in new and potentially cutting-edge talent on a temporary basis.⁴⁰ OPM notes that "agencies do not take full advantage of the IPA program which, if used strategically, can help agencies meet their needs for 'hard-to-fill positions.'"⁴¹

Programs for Students and Recent Graduates

Pathways Program

The federal government uses three programs to recruit and hire students and recent graduates into federal careers: the Internship Program, the Recent Graduates Program, and the Presidential Management Fellows Program.⁴² These three programs are collectively referred to as the Pathways Program. Government agencies independently manage and administer these programs. Federal agencies benefit from a younger talent pool with recently acquired knowledge, while students and recent graduates are able to get practical experience in their fields and make money doing so.

Internship Program

Students in high school, college, and other educational institutions have the opportunity to gain experience in federal government agencies via part-time or full-time, paid internships.⁴³ The

³⁹ Data on IPAs were provided directly from the DAF.

⁴⁰ U.S. Office of Personnel Management, "Intergovernment Personnel Act," webpage, undated.

⁴¹ U.S. Office of Personnel Management, "Intergovernment Personnel Act," webpage, undated.

⁴² U.S. Office of Personnel Management, "Students & Recent Graduates," webpage, undated.

⁴³ U.S. Office of Personnel Management, "Students & Recent Graduates," webpage, undated.

Internship Program also allows for the option to convert the intern to a permanent or term position after completion of the program and their educational requirements.⁴⁴

Recent Graduates Program

The Recent Graduates Program is for those who completed their educational degrees or certificates within the past two years and are looking to develop their skills through civil service. The graduates spend a year in an agency, completing typical training for a position and working among other civilian and uniformed government employees. Like the Internship Program, the Recent Graduates Program allows agencies the option to convert those who complete the program to permanent positions.⁴⁵

Presidential Management Fellows Program

Candidates for master's and professional degrees have the opportunity to work with government leaders via the Presidential Management Fellows (PMF) Program. This program seeks to develop young professionals into potential federal government leaders through training, senior-level mentorship, career planning, and professional development opportunities. As with the other Pathways programs, those who complete the PMF Program can be converted to a permanent position, pending successful program completion and job performance.⁴⁶

SMART Scholarship

DoD offers a scholarship program for students pursuing STEM degrees with an interest in beginning a career as a civilian in DoD. This scholarship is referred to as the Science, Mathematics, and Research for Transformation, or SMART, scholarship.⁴⁷ SMART scholarships provide funding for at least one year, and up to five years, to cover the cost of degree requirements; for each year of funding, the recipient of the scholarship commits to one year of working as a civilian employee in DoD.⁴⁸ There are two types of awards: recruitment scholars and retention scholars. *Recruitment* scholars are those who are not employed in a DoD civilian position upon award of the scholarship and are required to complete summer internships and a period of employment after graduation at the DoD facility assigned as their sponsor.⁴⁹ *Retention* scholars are those who are already employed in a DoD civilian position at the time they are

⁴⁴ U.S. Office of Personnel Management, "Students & Recent Graduates," webpage, undated.

⁴⁵ U.S. Office of Personnel Management, "Students & Recent Graduates," webpage, undated.

⁴⁶ U.S. Office of Personnel Management, "Students & Recent Graduates," webpage, undated.

⁴⁷ U.S. Department of Defense, "About SMART," webpage, undated.

⁴⁸ U.S. Department of Defense, "About SMART," webpage, undated.

⁴⁹ U.S. Department of Defense, "Types of Award," webpage, undated.

awarded the scholarship and must arrange a schedule in which they will return to work during the summer and after graduation.⁵⁰

Air Force Civilian Service Programs

The AFCS offers a few unique options for students to gain experience working as a civilian in the DAF. College and graduate school students can apply for a full-time paid internship program to work alongside AFCS employees in the wage grade, administrative, professional, and technical career fields through the Air Force Premier College Intern Program (PCIP).⁵¹ The PCIP offers students 12-week summer internships, during which they can work on special projects using DAF tools and technology, all while being mentored by senior managers.⁵² Upon completion of the PCIP and their degree program, the intern is eligible for one of the DAF's formal training programs.⁵³ The AFCS also offers other paid internships and a summer hire program for temporary employment to provide more opportunities for federal service experience.⁵⁴

Compensation-Related Flexibilities

In an effort to recruit and retain a highly skilled and often highly sought-after civilian workforce, the DAF can use certain flexibilities that allow hiring managers to offer greater pay than standard pay grade-specific pay rates to attract talent to hard-to-fill positions. One such flexibility is the use of pay banding, and it is often used in demonstration projects and alternative personnel systems across DoD. Pay rates can also be supplemented based on the geographic location of the position and the standard pay rates across industries in that area to ensure competitive compensation levels for similar positions.

Pay Banding, Demonstration Projects, and Alternative Personnel Systems

An alternative to the standard GS classification and pay of civilian employees in federal agencies is pay banding, whereby multiple grades are grouped (or *banded*) together to allow for more flexibility within the band than would have been available in a specific grade. It is common for a broad range of position types and occupational series to fall under the same pay band. Pay banding was developed as a way to improve recruitment and hiring for hard-to-fill positions.

⁵⁰ U.S. Department of Defense, "Types of Award," webpage, undated.

⁵¹ Air Force Civilian Service, *Premier College Intern Program Handbook*, undated.

⁵² Air Force Civilian Service, *Premier College Intern Program Handbook*, undated.

⁵³ Air Force Civilian Service, *Premier College Intern Program Handbook*, undated.

⁵⁴ Air Force Civilian Service, "Students and Graduates," webpage, undated.

There are typically three to four levels in a pay band, far fewer than in the GS system, which results in less frequent promotions but greater increases in salary from one level to another.⁵⁵

Pay banding, along with other alternatives to the standard GS classification and pay systems, is not available to many government agencies. However, some agencies are granted the authority to establish demonstration projects, opening the door for alternative pay and personnel systems.⁵⁶ There are four such demonstration projects or alternative personnel systems used within the DAF: the Acquisition Workforce Personnel Demonstration Project (AcqDemo), the DoD STRLs, the DoD Cyber Excepted Service (CES), and the Defense Civilian Intelligence Personnel System (DCIPS).

While the GS DAF workforce is in the majority, it is also made up of a number of different systems described further in this chapter. Table 2.1 provides the number of employees in each major personnel system category and pay plan. The data indicate that, relative to the entire DAF workforce, the GG category of employees that includes both DCIPS and CES, along with the AcqDemo, makes up 5 percent of the employee population, while the Air Force Laboratory Personnel Demonstration Project (Lab Demo) is just under 1 percent of the population.

Table 2.1. DAF Full-Time Civilian Employees, by Personnel System and Pay Plan

Personnel System	Pay Plan	Number of Employees	Percentage of the DAF Workforce
DCIPS or CES	GG ^c	7,012	5%
DCIPS (Defense Intelligence Senior Executive Service)	IE	13	Less than 1%
DCIPS (Defense Intelligence Senior Level)	IP	19	Less than 1%
AcqDemo	NH, NJ, NK	6,983	5%
Lab Demo	DO, DR, DU, DX	1,104	Less than 1%
Remainder of the DAF		118,535^b	
Total		133,666^a	11.3%

SOURCE: DAF civilian personnel data files for full-time personnel, as of January 2021.

NOTES: GG = General Government; IE = Intelligence Executive; IP = Intelligence Professional; other two-letter codes in the "Pay Plan" column do not have spelled-out forms.

^a Includes some foreign personnel and personnel in other pay plans, such as physicians. This reflects only personnel who make above minimum wage, which is why the total number of employees is lower than official AFPC numbers.

^b GS-only number is 94,175, Wage Grade-only is 910.

^c DCIPS also included employees in the IA, IB, IF, and IK pay plans.

Acquisition Workforce Demonstration Project

AcqDemo represents a DoD-wide effort to improve recruitment, hiring, retention, and other incentives to attract high-quality personnel to the acquisition workforce to support the acquisition

⁵⁵ U.S. Office of Personnel Management, *Alternative Pay Progression Strategies: Broadbanding Applications*, Performance Management Practitioner Series, PMD-05, April 1996.

⁵⁶ U.S. Office of Personnel Management, 1996.

mission across the services.⁵⁷ For an agency, organization, or team to be eligible to participate in AcqDemo, at least one-third of its civil service employees must be coded as being in Defense Acquisition Workforce Improvement Act (DAWIA) positions and at least two-thirds of the civil service employees must be considered members of the acquisition workforce.⁵⁸ This demonstration project brings some flexibility to the management of personnel processes, allowing supervisors to use unique recruitment, hiring, compensation, promotion, and reward initiatives.⁵⁹ One of the key initiatives is the ability for supervisors under AcqDemo to set the pay of a civilian acquisition professional to any of a variety of specific levels within a pay band both at appointment to the position and upon future promotions.⁶⁰ This also allows employees to be compensated based on their contribution to the organization, which supervisors evaluate using the Contribution-Based Compensation and Appraisal System.⁶¹

DoD Science and Technology Reinvention Laboratories

The DoD STRLs personnel demonstration project uses similar initiatives and for a similar purpose as AcqDemo, but the STRLs are used to recruit and retain exceptional talent for the DoD's STEM career fields.⁶² More specifically, 20 STRLs across DoD are able to use authorities and flexibilities to make a career with a federal government laboratory more appealing to top talent, thus making DoD more competitive with private-sector STEM employers.⁶³

The DAF's STRL demo is managed within the Air Force Research Laboratory (AFRL) and is called Lab Demo.⁶⁴ AFRL has been using flexibilities under Lab Demo since FY 1995 as an alternative to the standard human capital policies across the rest of the DAF civilian workforce.⁶⁵ These alternatives include nontraditional authorities for position announcements, qualification determinations, direct hiring, term positions, position classifications, pay banding, and a number of other flexibilities.⁶⁶

⁵⁷ U.S. Department of Defense, "About AcqDemo," webpage, undated.

⁵⁸ U.S. Department of Defense, *DoD Civilian Acquisition Workforce Personnel Demonstration Project (AcqDemo) Operating Guide*, July 31, 2020a, p. 1.

⁵⁹ See the full set of AcqDemo initiatives at U.S. Department of Defense, "AcqDemo Initiatives," webpage, undated.

⁶⁰ U.S. Department of Defense, "AcqDemo Initiatives," webpage, undated.

⁶¹ U.S. Department of Defense, "AcqDemo Initiatives," webpage, undated.

⁶² Defense Civilian Personnel Advisory Service, "STRL," webpage, undated.

⁶³ U.S. Department of Defense, "Department of Defense Science and Technology Reinvention Laboratory Personnel Demonstration Project Program," *Federal Register*, Vol. 85, No. 235, December 7, 2020b.

⁶⁴ Department of the Air Force, "Lab Demo Information," Kirtland Air Force Base, April 19, 2007.

⁶⁵ Department of the Air Force, 2007.

⁶⁶ U.S. Department of Defense, 2020b.

DoD Cyber Excepted Service

DoD has a specific personnel management system for cyber positions that qualify as CES positions in order to recruit, employ, develop, and manage a highly skilled cyber workforce that can execute on all of the responsibilities of the U.S. Cyber Command.⁶⁷ The flexibilities available for the CES workforce include broader recruitment sourcing options, streamlined hiring, a market-based pay structure to maintain competition with the private sector, and a qualification-based promotion system (not bound by time-in-grade).⁶⁸ Hiring managers for CES positions are also authorized to use advanced in-hire rates.⁶⁹

Defense Civilian Intelligence Personnel System

DCIPS is the personnel management system for DoD's intelligence community, ensuring consistency in the management of all defense intelligence personnel and allowing for flexibilities to make it possible to recruit, hire, and retain a strong intelligence workforce.⁷⁰ Having a centralized system across the full intelligence community allows for standardized evaluations and handling of hiring, incentives, and promotions. Flexibilities that can be used for DCIPS positions are pay banding, recruiting flexibilities, and pay review and leveling.⁷¹

Locality Pay and Special Salary Rates

Locality pay refers to the process by which federal wages are determined based on pay for the nonfederal workforce in a specific geographic area, using data from BLS compensation surveys. There are 54 locality pay areas spread across the United States, with the goal of minimizing the differences in compensation between the federal and nonfederal workforce to at most 5 percent.⁷² Locality pay is adjusted annually to maintain this difference, with inputs from the Federal Salary Council on how to do so. Locality pay is added to the basic band pay of federal employees to whom pay banding applies.⁷³

OPM establishes special salary rates (SSRs) to help federal agencies recruit and retain qualified employees in certain categories of GS positions located in specific geographic areas

⁶⁷ Department of Defense Instruction 1400.25, Vol. 3001, *DoD Civilian Personnel Management System: Cyber Excepted Service (CES) Introduction*, U.S. Department of Defense, August 15, 2017.

⁶⁸ Department of Defense Instruction 1400.25, Vol. 3005, *DoD Civilian Personnel Management System: Cyber Excepted Service (CES) Employment and Placement*, U.S. Department of Defense, August 15, 2017; U.S. Department of Defense, Defense Civilian Personnel Advisory Service, *Cyber Excepted Service FAQ*, undated.

⁶⁹ Groeber et al., 2020.

⁷⁰ Defense Civilian Intelligence Personnel System, homepage, undated.

⁷¹ Groeber et al., 2020.

⁷² For more information, see U.S. Office of Personnel Management, "Use of Bureau of Labor Statistics Data for Setting General Schedule Pay," webpage, undated.

⁷³ U.S. Office of Personnel Management, "General Schedule Locality Pay Areas," *Federal Register*, Vol. 85, No. 133, July 10, 2020.

where it is typically difficult to do so. These difficulties to recruit and retain qualified civilians for particular positions in particular locations include nonfederal pay rates being higher than those in federal government, locations that are remote or isolated, and undesirable conditions related to the work involved. Agencies that wish to have SSRs granted by OPM submit their requests and all supporting evidence of the need for a SSR to be evaluated based on the length of time positions have been vacant, recruiting and hiring numbers, nature of the work, and the job market in the location. The minimum rate may not exceed 30 percent of the maximum rate, and the maximum rate may not exceed Level IV of the Executive Schedule.⁷⁴ Federal employees can receive either locality pay or an SSR, whichever results in a higher salary, but not both.

Incentives

The DAF can leverage a number of incentives to recruit and retain its civilian workforce. The “3Rs”—recruitment, retention, and relocation—are incentives that can be used in cases where the position or location are typically difficult to hire into. Student loan reimbursements, advanced annual leave, annual leave credit, and advanced in-hire rates also provide incentives to entice new employees into the civilian service, either directly out of school or from a similar position within another sector or agency.

Recruitment, Retention, and Relocation Bonuses—the 3Rs

One of the primary groupings of incentives used by federal agencies is the set that have been implemented the 3Rs. Recruitment incentives can be used by agencies for hard-to-fill positions, whereby civilians hired into the positions are provided with a cash bonus not to exceed 25 percent of their annual salary.⁷⁵ This recruitment incentive is available only to newly appointed civil service employees, meaning that the cash bonus can only be offered for an individual’s first appointment as a federal government employee or if there have been at least 90 days since the individual’s previous federal appointment.⁷⁶

Agencies may elect to use retention incentives when an employee is likely to leave their position—either to go to another federal position; in cases of a closure or relocation of the employee’s office, facility, activity, or organization; or to leave the federal service entirely—and the agency has a critical need for the specific or unique qualifications of that employee.⁷⁷ More specifically, these retention incentives are applied in cases when the employee would leave the

⁷⁴ 5 CFR 530.

⁷⁵ U.S. Office of Personnel Management, “Recruitment Incentives,” webpage, undated.

⁷⁶ U.S. Office of Personnel Management, “Recruitment Incentives,” webpage, undated.

⁷⁷ U.S. Office of Personnel Management, “Retention Incentives (Likely to Leave the Federal Service),” webpage, undated; U.S. Office of Personnel Management, “Retention Incentives (Likely to Leave for a Different Federal Position),” webpage, undated.

position if not for the bonus.⁷⁸ To use a retention bonus, the agency must establish a retention incentive plan outlining the criteria for approval, documentation to show that the employee is likely to leave the position, and the amount of the retention bonus, among other details.⁷⁹

Relocation incentives allow agencies to pay a cash incentive to new or current employees when the position requires moving to a different geographic location, and the position would be hard to fill without the incentive.⁸⁰ The relocation can be either permanent or temporary but must require that the employee establishes residence at least 50 miles from the location of the worksite where they were employed prior to the new position.⁸¹

Across all the 3R incentives, the employee and the agency enter an agreement on the terms of the incentives, including the amount and timing, the justification, and all of the criteria that must be met by the employee to remain eligible for the incentive.⁸² Within the DAF, these incentives are typically funded at the base or activity level, so funds come out of an overarching civilian personnel budget, but there are centrally funded incentives for intern programs.

Student Loan Reimbursement

Another incentive that might be helpful in recruiting applicants to a career in the federal government is to advertise the student loan repayment incentive available to agencies. Agencies manage their own loan repayment incentives and are authorized to repay up to \$10,000 per year per employee, up to a total of \$60,000 per employee over the course of their civil service career.⁸³ OPM outlines the eligibility requirements, both for the employee and type of loan, as well as a set of best practices for agencies using this incentive.⁸⁴

Advanced Annual Leave

Employees in the federal government accrue their annual leave by pay period over the course of the year. The amount accrued each pay period varies based on the length of service and the type of employee (e.g., full-time, part-time, senior-level), with the maximum for full-time

⁷⁸ U.S. Office of Personnel Management, “Retention Incentives (Likely to Leave the Federal Service),” webpage, undated; U.S. Office of Personnel Management, “Retention Incentives (Likely to Leave for a Different Federal Position),” webpage, undated.

⁷⁹ U.S. Office of Personnel Management, “Retention Incentives (Likely to Leave the Federal Service),” webpage, undated.

⁸⁰ U.S. Office of Personnel Management, “Relocation Incentives,” webpage, undated.

⁸¹ U.S. Office of Personnel Management, “Relocation Incentives,” webpage, undated.

⁸² U.S. Office of Personnel Management, “Recruitment Incentives,” webpage, undated; U.S. Office of Personnel Management, “Retention Incentives (likely to leave the federal service),” webpage, undated; U.S. Office of Personnel Management, “Retention Incentives (likely to leave for a different federal position),” webpage, undated; U.S. Office of Personnel Management, “Relocation Incentives,” webpage, undated.

⁸³ U.S. Office of Personnel Management, “Student Loan Repayment,” webpage, undated.

⁸⁴ See U.S. Office of Personnel Management, “Student Loan Repayment,” webpage, undated.

employees with at least 15 years of service being one day accrued for each pay period.⁸⁵ Employees may request an advance of their annual leave in cases where they have not yet accrued the amount of time they would like to take off.⁸⁶ The individual's agency decides whether to approve the request for advanced annual leave, and approved advanced annual leave cannot result in a greater number of days of annual leave than the individual would normally accrue in a single year.⁸⁷ Additionally, agencies are encouraged to consider three key points before approving advanced annual leave: whether there is an expectation that the employee might not return to duty after the leave period, how critical the employee's work is to the agency, and what benefits are brought to the agency by retaining the employee.⁸⁸

Annual Leave Credit

Employees who are new to federal civilian service, or who are returning after having been away from federal service, and former armed forces members can be approved to receive credit toward their "length of service" to determine their accrual rate for annual leave.⁸⁹ For example, an agency can credit a new appointee as having three years of service if they have been doing similar work for at least that amount of time prior to the civil service position to allow them to accrue their annual leave at a faster rate than they would as an employee with less than three years of service.⁹⁰ This flexibility can be used at the hiring agency's discretion as an incentive for those who have skills and experience that are critical to the position, do not have previous federal or active duty experience, and might be motivated by a faster accrual rate for annual leave.⁹¹

Superior Qualification and Special Needs Pay-Setting Authority

Agencies requiring specialized skill sets or superior qualifications for particular positions have the authority to set a compensation rate that is higher than "the minimum rate of the highest applicable rate range for the employee's position of record."⁹² The advanced in-hire rate acts as an incentive for candidates with specialized skill sets that meet the agency's needs, ideally acting as a way to increase the likelihood that the candidate will join the agency. The new appointee to

⁸⁵ U.S. Office of Personnel Management, "Annual Leave," webpage, undated.

⁸⁶ U.S. Office of Personnel Management, "Advanced Annual Leave," webpage, undated.

⁸⁷ U.S. Office of Personnel Management, "Advanced Annual Leave," webpage, undated.

⁸⁸ U.S. Office of Personnel Management, "Advanced Annual Leave," webpage, undated.

⁸⁹ U.S. Office of Personnel Management, "Annual Leave," webpage, undated.

⁹⁰ U.S. Office of Personnel Management, "Annual Leave," webpage, undated.

⁹¹ U.S. Office of Personnel Management, "Creditable Service for Annual Leave Accrual for Non-Federal Work Experience and Experience in the Uniformed Service," webpage, undated.

⁹² 5 CFR 531.212.

the position must meet one of two criteria outlined in the CFR subpart regarding this authority (5 CFR 531.212):

- “The candidate has superior qualifications” (beyond the minimum requirements) “based on the level, type, or quality” of their position-relevant skills or competencies.
- “The candidate fills a special agency need” that is “essential to accomplishing an important agency mission, goal, or program activity.”

Conclusion

The recruitment, hiring, and retention of highly skilled civilians into the DAF can be a challenge given competition from the private sector for the same pool of talent, making many positions difficult to fill within the typically strict parameters for hiring and pay-setting in the federal government. DoD and the DAF have a variety of flexibilities related to hiring and compensation, as well as incentives for new hires and those who need to be relocated. These authorities include DHA, alternative hiring options for highly skilled talent and temporary and term positions, programs for students and recent graduates, alternative personnel management systems, flexibilities around setting compensation levels, and incentives for recruitment, retention, and relocation. The use of these authorities and flexibilities may make the positions more appealing to highly skilled applicants and make the process of recruiting and hiring them more competitive. Our findings on the extent to which these hiring authorities and key incentives are used for the occupations under review in this report are described in the next several chapters.

Chapter 3. Computer Science

Overview of the Occupation

The OPM *Handbook of Occupational Groups and Families* describes the Computer Science (1550) occupational series as all positions primarily involved in

the application of, or research into, computer science methods and techniques to store, manipulate, transform or present information by means of computer systems. The primary requirements of the work are (a) professional competence in applying the theoretical foundations of computer science, including computer system architecture and system software organization, the representation and transformation of information structures, and the theoretical models for such representations and transformations; (b) specialized knowledge of the design characteristics, limitations, and potential applications of systems having the ability to transform information, and of broad areas of applications of computing which have common structures, processes, and techniques; and (c) knowledge of relevant mathematical and statistical sciences.⁹³

We note that this series falls within the broader Mathematical Sciences OPM occupational group, whereas a separate group—Information Technology—“covers two-grade interval administrative positions that manage, supervise, lead, administer, develop, deliver, and support information technology (IT) systems and services.”⁹⁴ As of January 2021, civilian personnel records indicate that there are 2,108 full-time civilian personnel in this Computer Science occupational series within the DAF. This represents roughly 22 percent of all personnel within the occupational series in the federal government, with FedScope data (see Appendix A for description of FedScope) indicating that there are 9,572 Computer Science personnel across the federal government.⁹⁵ As Table 3.1 shows, the largest concentration of Computer Science personnel within the DAF are in AFMC (84 percent). Figure 3.1 shows that personnel are most concentrated at the AFMC bases of Hill (27 percent), Robins (16 percent), and Tinker (15 percent).

⁹³ U.S. Office of Personnel Management, *Handbook of Occupational Groups and Families*, December 2018, p. 102.

⁹⁴ U.S. Office of Personnel Management, 2018, p. 123.

⁹⁵ U.S. Office of Personnel Management, “Federal Workforce Data,” webpage, March 2021. We did not have access to January FedScope data, so we used March 2021 data.

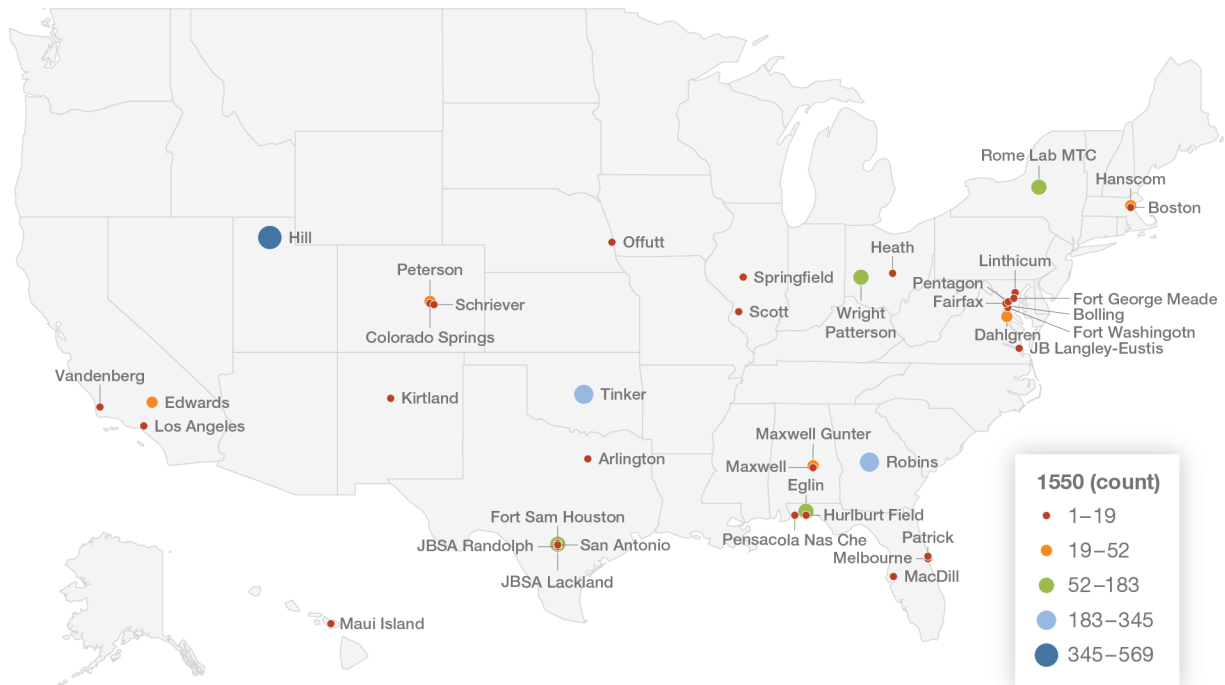
Table 3.1. DAF Computer Science Personnel, by Air Force Major Commands and Other Organizations

MAJCOMs and Other Organizations	Number of Civilian Personnel	Percentage of Total Civilian Personnel
Air Combat Command	105	5%
Air Education and Training Command	<10	<1%
AFMC	1,781	85%
Air Mobility Command	<10	<1%
Space Command	<10	<1%
U.S. Space Force	<10	<1%
Special Operations Command	<10	<1%
Other organization	205	10%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: Organizations included in the “Other organization” category include Air Force MAJCOM sub-agencies and combatant commands. Column may not total to 100 percent because of rounding.

Figure 3.1. Location of DAF Computer Science Personnel Across the United States



SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Personnel Characteristics

Consistent with OPM minimum educational requirements for a bachelor's degree for personnel in the Computer Science occupational series,⁹⁶ 65 percent of DAF personnel in this series hold a bachelor's degree, 32 percent hold a master's degree, and 2 percent hold a Ph.D. The majority of personnel are non-prior service, with only 16 percent of personnel being retired military or having prior military service. AFPC records show that 20 percent of personnel either are currently or will be eligible for retirement within the next five years. Appendix D provides more detail on the demographic characteristics of DAF Computer Science personnel.

Table 3.2 shows the distribution of DAF Computer Science personnel across pay grades. As the table shows, the plurality of Computer Science personnel hold NH-03 (AcqDemo) positions (41 percent). As noted in Chapter 2, in contrast to the traditional GS system, AcqDemo provides an alternative pay system that allows for pay banding and merit-based promotions. An additional 14 percent of personnel are under Lab Demo within AFRL (DR positions), which provides a similar pay banding system. The GS (and GG equivalent) positions make up a combined total of roughly 43 percent of all personnel in the Computer Science series.

⁹⁶ OPM basic requirements are as follows: "Bachelor's degree in computer science or bachelor's degree with 30 semester hours in a combination of mathematics, statistics, and computer science" (U.S. Office of Personnel Management, "Computer Science Series 1550," webpage, undated).

Table 3.2. DAF Computer Scientists, by Pay Grade

Pay Grade	Number of Civilian Personnel	Percentage of Total Civilian Personnel^a
GS-05	31	1%
GS-07	236	11%
GS-09	183	9%
GS-10	<10	<1%
GS-11	102	5%
GS-12	103	5%
GS-13	207	6%
GS-14	35	2%
GS-15	<10	<1%
NH-02 (GS-5-11 equiv.)	<10	<1%
NH-03 (GS-11-13 equiv.)	860	41%
NH-04 (GS-14-15 equiv.)	40	2%
DR-01 (GS-7-11 equiv.)	40	2%
DR-02 (GS-12-13 equiv.)	132	6%
DR-03 (GS-14 equiv.)	96	5%
DR-04 (GS-15 equiv.)	26	1%
Other ^a	<10	<1%
Total	2,108	100%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: GG and GS pay schedules were combined at their corresponding levels.

^a There are also a very small number of personnel who are not in one of the listed pay plans but are instead in a position as a highly qualified expert or a scientific or professional position. GG pay scale is for the DCIPS, NH pay scale is for the AcqDemo, DR pay scale is for the Lab Demo.

Barriers to Recruiting and Hiring

The Computer Science occupational series was included on both the DAF and DoD lists of mission critical occupations (MCOs) at the time of this study.⁹⁷ According to data from the BLS, employment for Computer Science and Information Research Scientists (the occupational category used by the BLS) personnel across the U.S. workforce is expected to increase by 22 percent between 2020 and 2030, while the BLS projects that the overall workforce, across all non-farm occupations in the United States, will increase by only 9 percent over the same

⁹⁷ DoD defines an MCO as “an occupation having the potential to put a strategic program or goal at risk of failure related to human capital deficiencies” (U.S. Department of Defense, *FY 2018–FY 2019 Department of Defense Civilian Human Capital Operating Plan*, June 2018b, p. C-6). See Groeber et al. (2021) for more detail on how MCOs are designated.

period.⁹⁸ This growth in employment provides both the opportunity of a larger pool of potential recruits and the challenge of remaining competitive amid a growing number of positions with private-sector competitors.

To better understand perceived challenges in recruiting and hiring top talent in the Computer Science occupational series, we held discussions with MAJCOM representatives, the career field management team, and AFPC's talent acquisition team. Key challenges raised in these interviews included the existence of a small talent pool with the desired skills and credentials, lower compensation compared with the private sector, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level.

DAF representatives reported that because of the requirements needed to work on specific DAF programs, hiring managers often have very specific skill sets and experience that they are looking for in candidates, resulting in a small talent pool that meets desired requirements. Furthermore, our interviewees told us that, in their experience, the DAF often cannot compete with the private sector in terms of compensation, particularly for moderately to highly qualified experts (we explore compensation later in this chapter). Certain locations, in particular, are more competitive for talent than others in terms of compensation, as well.

DAF representatives also raised concerns that good job candidates are lost during the often lengthy time it takes to bring a candidate on board, which could take months depending on the vetting and clearance needed for a job. In many cases, Computer Scientists may need a security clearance to work on a particular program. The security clearance process can be lengthy, and we were told that many candidates cannot wait that long to be hired. In discussions with AFMC, interviewees indicated that they are trying to leverage the PCIP to help address issues with security clearance for new graduates by having candidates who they want to become permanent employees begin the clearance process while they are interns.

Finally, DAF representatives also described a lack of effective marketing and recruiting at the local level as an additional barrier to finding top talent. In particular, there is DHA for Computer Science positions, which means that hiring managers have more flexibility in hiring talent on the spot.⁹⁹ However, interviewees said that they often find that hiring managers do not always know how to use DHA to its fullest extent. In addition, interviewees voiced concerns that there is little proactive marketing or recruiting that takes place to find candidates who are well qualified for potential on-the-spot job offers. One interviewee expressed concern that many hiring managers are still using the "post and pray" method of posting a vacancy on USAJOBS and hoping that qualified candidates apply instead of actively recruiting personnel to find top talent.

⁹⁸ U.S. Bureau of Labor Statistics, *Occupational Outlook Handbook*, September 8, 2021.

⁹⁹ DHA would not address the issue of the additional time that may be needed if a security clearance is required prior to hiring.

Use of Hiring Authorities, Special Salary Rates, and Incentives

As described in Chapter 2, the DAF has various hiring flexibilities and incentives it can use to recruit and hire new talent. To better understand what tools the DAF is using, we provide an overview of hiring authorities, special salary rates, and the use of recruitment, relocation, and retention incentives for Computer Science personnel in the sections below.

Hiring Authorities

Table 3.3 lists the most widely used original hiring authorities for DAF Computer Science personnel (i.e., used for at least 2–3 percent of the population). As the table shows, the majority of personnel have been hired using DHAs, with AcqDemo and Lab Demo having their own DHA. Less than 10 percent of personnel were originally hired using delegated examining authority. A small percentage of personnel were hired through the Pathways Program.

From these data, it appears that the DAF is using DHA to help hire Computer Science personnel, which has the associated benefit of allowing hiring managers to make on-the-spot offers to qualified candidates rather than the lengthy time for posting a vacancy and waiting for applicants to apply. It is the DAF’s practice that the hiring action may not be coded as DHA when a USAJOBS job announcement is utilized to recruit. However, a hiring action may be coded as DHA when a non-USAJOBS announcement is utilized to recruit. As noted in the previous section, however, several representatives voiced concerns that even though a new hire may be coded as a DHA, hiring managers may not actually be fully using DHA and its associated flexibilities (e.g., making on-the-spot job offers instead of going through a more bureaucratic and lengthier process). Unfortunately, to our knowledge, there are no available data to confirm or refute this concern. Future research may benefit from conducting a survey with hiring managers regarding their knowledge of and use of DHA and its associated flexibilities.

Table 3.3. Most Widely Used Original Hiring Authorities for DAF Computer Science Personnel

Original Hiring Authority	Number of Civilian Personnel	Percentage of Total Civilian Personnel
DHA (unspecified)	1,075	51%
Pub. L. 111-383 (NDAA 2011) (AcqDemo)	220	10%
Pub. L. 103-337 (NDAA 1995) (Lab Demo)	197	9%
OPM delegated examining (unspecified)	160	8%
10 U.S.C. 1601 (civilian intelligence personnel)	132	6%
5 CFR 315.713(A)(1) (conversion based on service in a Pathways Program)	54	3%

SOURCE: Defense Civilian Personnel Data System (DCPDS) data provided by AFPC.

NOTE: To ensure that we were able to identify all hiring authorities being used, this sample includes all personnel, including part-time and temporary personnel, as of January 2021. We show only the most widely used original hiring authorities (authorities used for at least 2–3 percent of the population). Four percent of personnel had unspecified hiring authorities.

Special Salary Rates

As described in Chapter 2, special salary rates often are used to help fill positions in specific occupations for which there is difficulty recruiting talent by increasing the compensation that can be offered beyond the standard pay associated with the GS pay levels. There are 12 special salary rate tables that apply to Computer Science personnel in a variety of locality pay areas in 2021.¹⁰⁰ These special salary rates cover pay grades ranging from GS-05 through GS-12. The same special salary rate tables also cover Computer Engineers (0854) and Information Technology Management (2210) personnel. As noted in Chapter 2, there are limits on special salary rates, however, such that the minimum rate cannot exceed 30 percent of maximum rate for the pay grade and the maximum rate cannot exceed Level IV of the Executive Schedule (5 U.S.C 5305[a] and 5 CFR 530.304[a]). In a previous report, we documented how these limitations can affect the ability of the DAF to pay more as GS grade levels increase.¹⁰¹

Recruitment, Relocation, and Retention (3Rs) Incentives

As described in Chapter 2, key tools the DAF has to help recruit and retain personnel are the 3R incentives. Civilian personnel data show that an increasing number of recruitment incentives have been used over the past five years to attract Computer Science personnel. In 2020, the DAF used 246 recruitment incentives, up from just 111 in 2016. When looking at civilian data on new hires into the Computer Science series in the DAF, we estimate that roughly 82 percent of personnel received recruitment incentives in 2020, compared with roughly 61 percent in 2016.¹⁰² The majority of recruitment incentives were through AFMC, where 85 percent of Computer Science personnel are employed. Only a small number of relocation incentives appear to have been used in the past five years (15 total under AFMC), however. In terms of retention incentives, over 340 were provided in 2020, whereas the data show that only six were used in all of 2016–2019. Unfortunately, we do not have data on the percentage of eligible personnel who were offered these incentives and who then chose not to take them. Data are only available on the total number of incentives provided in a particular year.

Comparison of Air Force Pay with the Private Sector and Other Federal Agencies

As noted previously, DAF representatives indicated that compensation can be a barrier to recruiting top Computer Science talent. In this section, we compare current and historical DAF pay for Computer Science personnel with civilians in this occupational series in other services

¹⁰⁰ See U.S. Office of Personnel Management, “2021 Index to Title 5 Special Rate Tables by Occupation,” webpage, undated.

¹⁰¹ See Groeber et al., 2021.

¹⁰² Percentages are based on new hire data from AFPC civilian records.

and across the federal government. We also compare private-sector, non-federal government Computer and Information Research Scientists, examining recent trends in pay for this occupation, as well as geographic and industry variation in prevailing pay rates. We conducted two types of comparisons:

1. **Workforce pay comparisons:** We rely on BLS data discussed below that provide estimates of average pay for this occupation at the U.S. workforce level, within key industries and at specific localities around key DAF installations. These data also provide estimates of the 25th percentile, median, and 75th percentile of pay at the U.S. workforce level. We compare these pay statistics with analogous DAF pay from administrative records. The comparisons are high-level and are intended to provide a general sense of prevailing pay across workforces.
2. **Employee pay comparisons:** We draw on individual-level survey and administrative data described below to study differences in pay by age and education level. Within federal employment, we conduct further comparisons of employment and pay by pay plan. These pay comparisons of similar employees across different workforces therefore provide the basis for our pay recommendations for this occupation.

The workforce comparisons provide a broad sense of prevailing pay in this occupation, while the employee-level analysis allows for comparisons of pay for similarly aged employees with similar educational attainment, illustrating how different agencies use different pay plans and flexibilities within pay plans to compensate Computer Science talent.

Workforce Pay Comparisons

To conduct comparisons to the U.S. workforce, we used BLS Occupational Employment and Wage Statistics (OEWS) data.¹⁰³ As discussed in Appendix A, these data are based on surveys of employers, with the sampling frame designed to be nationally representative of the non-self-employed, civilian workforce. Because these data are based on employer surveys, there are no statistics available by employee characteristics (e.g., age, education). Nevertheless, these BLS OEWS data illustrate prevailing patterns of pay at national and subnational levels. Our comparison occupation for measuring Computer Science pay in BLS data is the Computer and Information Research Scientists occupation, six-digit Standard Occupation Classification (SOC) code 15-1221:

Computer and Information Research Scientists: Conduct research into fundamental computer and information science as theorists, designers, or inventors. Develop solutions to problems in the field of computer hardware and software.¹⁰⁴

In May 2020, the BLS reported that 30,220 non-self-employed individuals were working in this occupation across all industries, including the federal government, with a mean annual salary

¹⁰³ U.S. Bureau of Labor Statistics, “Occupational Employment and Wage Statistics,” webpage, undated-b.

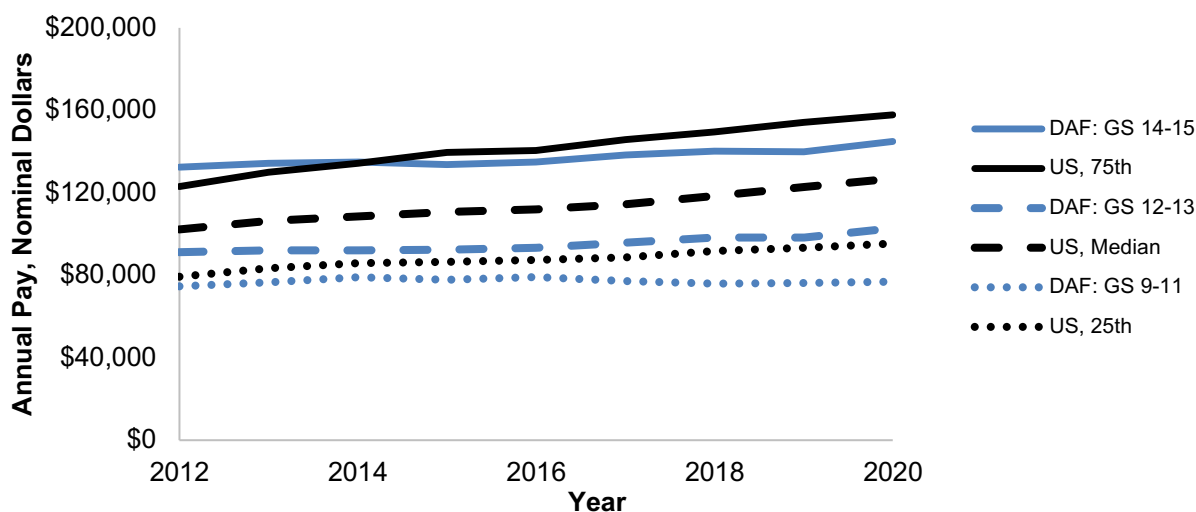
¹⁰⁴ White House, Office of Management and Budget, *Standard Occupational Classification Manual*, 2018, p. 47.

of \$130,890. These 30,220 individuals include an estimated 9,060 Computer Science civilian personnel working in the federal government.

DAF Pay Lags Behind the U.S. Average for Computer Scientists

Figure 3.2 compares annual earnings at the 25th percentile, median, and 75th percentile across all of these 30,220 employees with average DAF pay (including locality pay) for Computer Science personnel in three pay grade groupings: GS-9–11, GS-12–13, and GS-14–15.¹⁰⁵ As Figure 3.2 shows, from 2012 to 2020, computer science pay in the U.S. workforce rose faster than corresponding DAF pay at all three points in the earnings distribution. Although DAF GS 9–11 pay were similar to the 25th percentile in 2012, by 2020, the 25th percentile earnings in the U.S. workforce was closer to DAF GS-12–13 pay. Although DAF GS-14–15 pay exceeded the 75th percentile of pay in the U.S. workforce in 2012, 75th percentile pay exceeded GS-14–15 pay by over \$10,000 in 2020. DAF pay thus lags behind pay in the U.S. workforce, largely because of more rapid increases in pay across the earnings distribution over the past decade.

Figure 3.2. Average Annual DAF Pay for Computer Science Personnel, by Pay Grade Versus Percentiles of Annual Pay for All Full-Time Computer and Information Research Scientists in U.S. Workforce



NOTE: “U.S.” data are percentiles from BLS full-time annual pay measures, representing all non-self-employed employees in that occupation in the United States. “DAF” data are average pay within pay grade groupings from FedScope data.

¹⁰⁵ These pay grade groupings include GS employees, GG employees at the same numerical grade, and analogous demonstration authority employee grades, namely, NH/DR-02 grouped with GS-9–11, NH/DR-03 grouped with GS-12–13, and NH/DR-04 grouped with GS-14–15.

DAF Pay Lags Behind Regional Averages Near Installations and Behind Most Industries

These national-level statistics, however, do not shed light on how competitive DAF pay is in specific localities where the DAF has a demand for Computer Scientists, nor do they show how DAF pay compares across employees' careers. To address this first point, Tables 3.3 and 3.4 provide 2020 average pay by specific industry and by localities surrounding or near the six installations with the largest fractions of DAF Computer Science employment. Because of the geographic concentration of this occupation compared with the others analyzed in this report, we also show average pay for two states—California and Washington—that together employ nearly a third of the total number of Computer and Information Research Scientists in the U.S. workforce. Although the composition of these workforces may differ along age, education, and other dimensions, these comparisons provide a high-level indication of how the DAF's average pay in a given area measures up to prevailing pay.

As shown in Table 3.4, pay varies by private industry, such that the overall average obscures substantially higher average pay in three industries: Scientific Research and Development Services, Computer Systems Design, and Software Publishers. Average pay in these industries was over \$140,000 in 2020. Pay in California and Washington also exceeded \$140,000. In contrast, average pay in Colleges, Universities, and Professional Schools was substantially lower than corresponding DAF pay, at just over \$95,000.

Table 3.4. Pay Comparisons for Computer Science Employees, by Pay Grade, Industry, and State, 2020

	Mean Annual Pay	Number of Employees
DAF: GS-9–11	\$76,702	417
DAF: GS-12–13	\$102,775	1,188
DAF: GS-14–15	\$144,831	101
Scientific Research and Development Services	\$143,400	5,440
Computer Systems Design	\$143,310	5,120
Software Publishers	\$144,210	2,760
Colleges, Universities, and Professional Schools	\$95,530	1,440
California	\$150,830	7,170
Washington	\$143,010	2,190

SOURCES: Locality and industry statistics from BLS OEWS and DAF pay from AFPC civilian data files.

As shown in Table 3.5, for Computer Scientists, pay at DAF installations tends to be similar to, if not substantially below, prevailing pay in nearby localities. For example, Eglin AFB pay was more than \$15,000 lower than pay in Florida in general. Although Hill AFB pay was more than \$5,000 higher than pay in Ogden, Computer and Information Research Scientists in Salt Lake City earned an average of \$7,000 more than Computer Scientists at Hill AFB. Computer Scientists at Joint Base San Antonio (JBSA)-Lackland earned approximately \$15,000 less than Computer and Information Research Scientists in Texas overall. DAF Computer Scientists at Rome Lab and Wright-Patterson AFB earn more than the average for some nearby localities but

less for others. These findings are in contrast to the other occupations included in this study in which DAF pay at installations that employ a large number of personnel in those occupations tends to be substantially higher than average pay for those occupations in surrounding and nearby local labor markets and states. In short, both overall and at the locality level, DAF pay for Computer Scientists lags behind prevailing pay. However, the DAF does pay more, on average, than academia.

Table 3.5. Pay Comparisons for Computer Science Employees, by Locality, 2020

	Mean Annual Pay	Number of Employees
DAF: Eglin AFB	\$104,430	171
Florida	\$119,970	1,160
DAF: Hill AFB	\$91,749	393
Ogden-Clearfield, Utah	\$86,150	580
Salt Lake City, Utah	\$98,730	100
Utah	\$90,690	760
DAF: JBSA Lackland	\$111,624	88
Texas	\$126,290	1,270
DAF: Robins AFB	\$90,442	218
Atlanta-Sandy Springs-Roswell, Georgia	\$114,540	350
Georgia	\$98,830	720
DAF: Rome Lab	\$121,213	86
Utica-Rome, New York	\$110,070	140
Syracuse, New York	\$118,640	40
New York	\$138,190	960
DAF: Wright-Patterson AFB	\$125,541	114
Dayton, Ohio	\$113,210	160
Cincinnati, Ohio-Kentucky-Indiana	\$133,530	40
Ohio	\$112,530	580

SOURCES: Locality statistics from BLS OEWS, DAF pay from AFPC files. Metropolitan statistical area (MSA)-specific estimates were not available from BLS data for MSAs near the corresponding installations in Florida or Texas.

Employee Pay Comparisons

Although the above workforce comparisons provide a sense of average pay across localities and industries, the BLS OEWS data do not allow us to account for differences in the composition of employees. For example, are Computer Scientists working for the DAF more likely to be earlier in their career than personnel in industry? If so, then comparing average pay between these two would conflate any pay differences for similar employees with pay differences due to experience level. Similar arguments apply for educational attainment if DAF Computer

Scientists are less likely to have graduate degrees. To address these differences, in this section, we make comparisons for similar employees across the DAF, the sister services, the rest of the federal government, and key private-sector industries.

We used FedScope and American Community Survey (ACS) data, as described in detail in Appendix A, to provide pay comparisons. In contrast to the BLS OEWS data, ACS is a household-based survey that elicits employees' occupation, hours worked, and earnings, as well as rich sociodemographic data.¹⁰⁶ However, ACS data come with two limitations. First, these data provide *self*-reported measures of pay in each occupation at a similar level of occupational detail as the BLS OEWS; to account for reporting issues by employees, as discussed in Appendix A, we benchmark earnings measures to analogous BLS OEWS estimates to calculate adjustment factors. Second, because FedScope data are administrative, they contain the full universe of personnel under study. ACS data, however, are based on 1:40 samples of households, and thus averages calculated using these data are subject to potential sampling error, represented by dotted lines showing 95 percent confidence intervals (i.e., the likelihood that the true population average is within these lines is 95 percent) in the figures that follow. The advantage of ACS data is in the ability to calculate average pay by employee characteristics—namely, age, educational attainment, and industry of employment.

Pay Disparities Increase with Educational Attainment

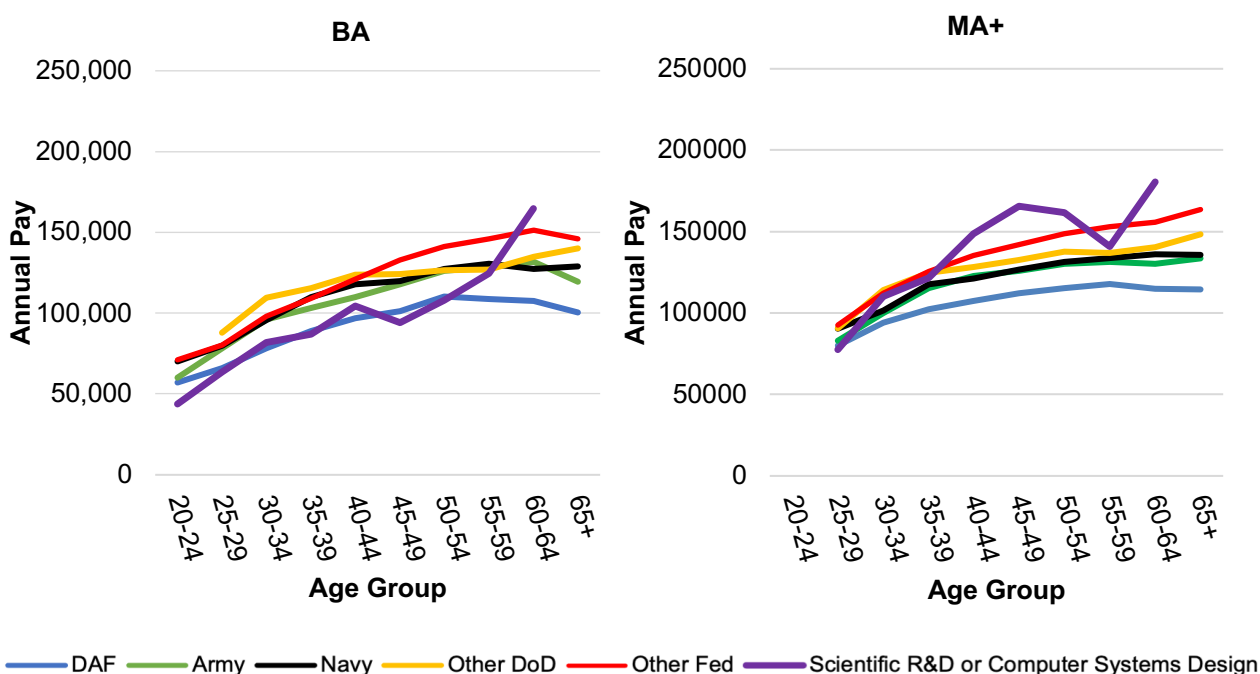
We conducted comparisons separately by educational attainment (a four-year undergraduate degree, referred to as a “BA,” or any graduate degree, referred to as “MA+”) and show average annual pay by five-year age group. We first provide these comparisons overall among the services, other DoD agencies, all other federal agencies, and the Scientific Research and Development Services and Computer Systems Design industries, which account for half of private-sector employment.

In Figure 3.3, we first examine overall pay by education and age group. We focus on pay by age within education group as a proxy for experience; because we cannot directly observe in-occupation experience in any of the available datasets, we follow a long history in labor economics, as well as recent RAND Corporation pay analyses that use age, holding education fixed, as a measure of years of potential experience.¹⁰⁷ This approach is not without its caveats: Notably, if actual experience, holding age and education fixed, varies systematically between the DAF and any comparison workforces, some fraction of the observed difference in pay could be attributable to underlying differences in experience. In Appendix E, we provide additional comparisons with services by education and length of federal service for each pay system, and we find broadly similar results.

¹⁰⁶ U.S. Census Bureau, “American Community Survey (ACS),” webpage, undated.

¹⁰⁷ Mincer, Jacob A., *Schooling, Experience, and Earnings*, NBER Books, 1974; McIntosh et al., 2020.

Figure 3.3. Average Annual Pay (\$), by Service, Agency, or Industry, Computer Science Personnel, BA and MA+, 2017–2020



NOTES: DoD, and other federal employee pay are based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors. Scientific Research and Development and Computer Systems Design Industry Computer Science employee pay calculated from ACS 2017–2019 samples, adjusted for misreporting, as described in Appendix A. Sampling variability introduces additional variation into the industry estimates; Appendix E depicts the 95% confidence intervals around these estimated series. All pay adjusted to 2020 dollars with the BLS's Consumer Price Index for All Urban Consumers Research Series (CPI-U-RS).

The first panel of Figure 3.3 shows DAF pay for Computer Scientists in five-year age groups with a four-year undergraduate, but no graduate degree, compared with the sister services, the rest of DoD, the rest of the federal government, and the largest employer of Computer Scientists in the private sector. Across the full range of ages, DAF pay is below that of the other services and the rest of the federal government. This gap in pay, averaged over the ten age groups, is just over \$15,000 between the DAF and the Army and just over \$19,000 between the DAF and the Navy.¹⁰⁸ However, DAF pay is consistently competitive with private-sector industry pay for Computer Scientists with only an undergraduate degree.

The second panel of Figure 3.3 shows pay for Computer Scientists with graduate degrees. DAF pay remains consistently the lowest among the services and federal government, and in contrast to comparisons with the undergraduate analysis, the private-sector industries under study

¹⁰⁸ Throughout this report, because there were so few personnel in these occupations in the U.S. Marine Corps, we include their personnel under the Navy.

pay significantly more than the DAF for Computer Scientists with at least a master's degree for employees in their 30s and 40s.

Lower DAF Pay Is Driven by Greater Use of Demonstration Authorities in Other Services and Alternative Personnel Systems in Other Agencies

Although these figures show differences in overall pay by education and age group, these analyses alone do not reveal why pay differs across services and the federal government. For example, are other services more likely to employ Computer Science personnel in pay plans other than the GS system? Do other services use the compensation flexibilities in other pay plans more than the DAF?

To address these questions, we conducted a series of analyses exploring the prevalence of pay plan utilization and pay within pay plans across the services and federal agencies. These analyses, which we provide more detail on in Appendix E, show three main conclusions:

- The Army and Navy are more likely than the DAF to employ Computer Science personnel in demonstration projects. Other federal agencies that employ substantial numbers of Computer Science personnel are more likely than the DAF to employ their personnel in alternative personnel systems.
- Pay in these demonstration projects and alternative personnel systems tends to exceed that of GS pay for employees of similar age and education.
- Even within pay plans, the DAF pays personnel of similar age and education less than other services or agencies. For example, the DAF currently has the largest proportion of Computer Science personnel at GS-9 or below among agencies and services employing GS Computer Science personnel.

Conclusion

The DAF has a total of 2,108 full-time civilian personnel in the Computer Science occupational series, representing roughly 22 percent of all personnel within the occupational series in the federal government. Key challenges raised by DAF representatives for recruiting and hiring talent in this series include the existence of a small talent pool with the desired skills and credentials, lower pay relative to the private sector, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level. Looking at DAF personnel data, although the data show that a majority of personnel were hired using DHAs, several representatives voiced concerns regarding whether DHA and its associated flexibilities were really being used to the fullest extent, and although an increase in recruitment incentives has been used over the past five years, only a small number of relocation incentives have been used.¹⁰⁹

In terms of compensation for DAF Computer Science personnel, there are a number of special salary rates to help increase compensation in certain localities. Close to 60 percent of

¹⁰⁹ As noted previously, we were only able to access data on the number of incentives used. We do not have data on whether more incentives were actually needed.

personnel in this series are also under demonstration projects (AcqDemo and Lab Demo), which allow for more flexible pay through pay banding. However, our pay comparisons show that the DAF's pay for Computer Scientists generally lags behind that of the other services, the rest of DoD, and the federal government more broadly, and pay for Computer Scientists with graduate degrees lags behind the private sector as well. This gap is due to lower rates of employment in demonstration authority and alternative personnel systems and lower DAF pay compared with services and other agencies within pay plan type—GS, demonstration authority, or alternative personnel systems.

Chapter 4. Operations Research

Overview of the Occupation

The OPM *Handbook of Occupational Groups and Families* describes the Operations Research (1515) occupational series as all

positions that manage, supervise, lead, or perform scientific work that involves designing, developing, and adapting mathematical, statistical, econometric, and other scientific methods and techniques. The work also involves analyzing management problems and providing advice and insight about the probable effects of alternative solutions to these problems. The primary requirement of the work is competence in the rigorous methods of scientific inquiry and analysis.¹¹⁰

As of January 2021, DAF personnel records indicate that there are 1,155 full-time civilian personnel working in the Operations Research occupational series within the DAF. This represents roughly 20 percent of all personnel within the occupational series in the federal government, with FedScope data indicating that there are 5,460 Operations Research personnel across the federal government.¹¹¹ As Table 4.1 shows, the largest concentration of Operations Research personnel within the DAF are in AFMC (49 percent). However, 36 percent of personnel are also located across other MAJCOM sub-agencies (e.g., 8 percent at Headquarters and Support Elements) and combatant commands (e.g., 8 percent at U.S. Strategic Command and 6 percent at U.S. Army Cyber Command). Figure 4.1 shows that Operations Research personnel are fairly dispersed across locations, with the highest concentrations at Wright-Patterson AFB (20 percent) and Eglin AFB (12 percent).

¹¹⁰ U.S. Office of Personnel Management, 2018, p. 100.

¹¹¹ U.S. Office of Personnel Management, 2021. We did not have access to January FedScope data, so we used March 2021 data.

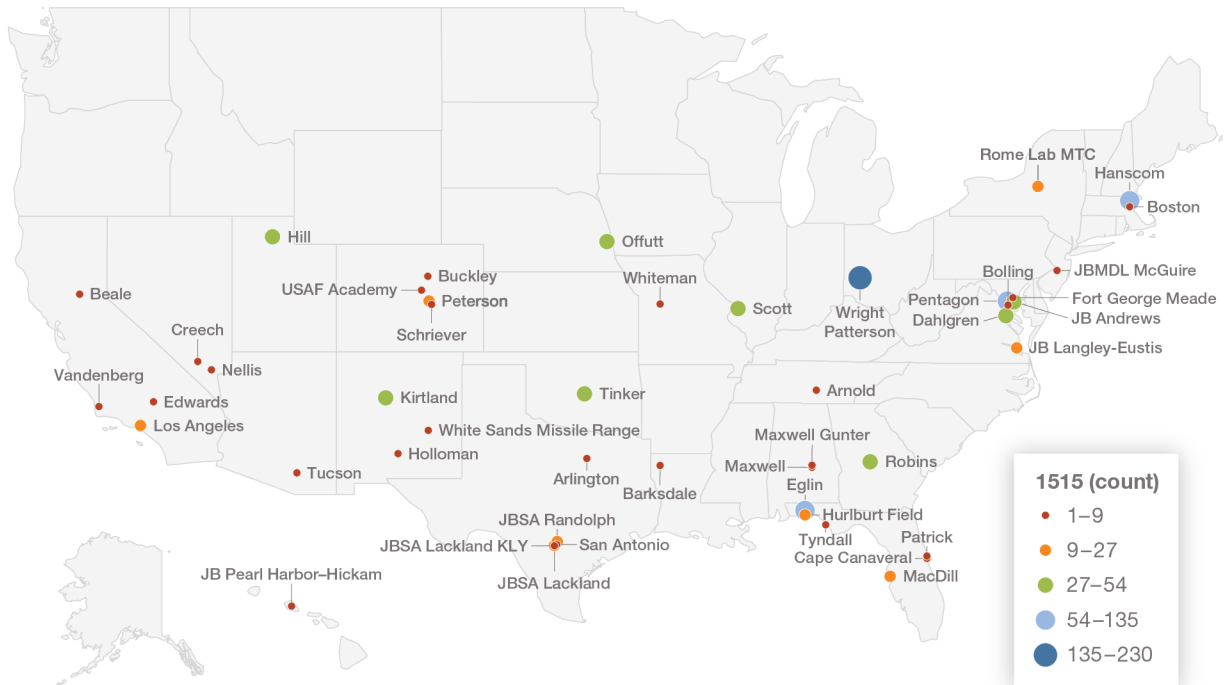
Table 4.1. Operations Research Personnel, by DAF Major Commands and Other Organizations

MAJCOMs and Other Organizations	Number of Civilian Personnel	Percentage of Total Civilian Personnel
Air Combat Command	72	6%
Air Education and Training Command	10	<1%
Air Force Global Strike Command	<10	<1%
Air Force Materiel Command	560	49%
Air Mobility Command	11	<1%
Air National Guard Units (Title 32/Title 5)	<10	<1%
Headquarters, Air Force Reserve Command	12	1%
Pacific Air Forces	<10	<1%
Space Command	<10	<1%
U.S. Space Force	39	3%
Special Operations Command	<10	<1%
U.S. Air Forces, Europe	<10	<1%
Other organization	419	36%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: Organizations included in the “Other organization” category include Air Force MAJCOM sub-agencies and combatant commands. Column may not total to 100 percent because of rounding.

Figure 4.1. Location of DAF Operations Research Analysts Across the United States



SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Personnel Characteristics

OPM educational requirements indicate that personnel in the Operations Research occupational series should hold a degree in operations research or have at least 24 semester hours in relevant subject-matter courses.¹¹² Personnel data show that 31 percent of DAF personnel in this series hold a bachelor's degree, 63 percent hold a master's degree, and 6 percent hold a Ph.D. Just over 35 percent of personnel have prior military service (15 percent are retired Air Force officers). AFPC records show that 26 percent of personnel either are currently or will be eligible for retirement within the next five years. Appendix D provides more detail on the demographic characteristics of DAF Operations Research personnel.

Table 4.2 shows the distribution of DAF Operations Research personnel across pay grades. The majority of personnel (55 percent) fall under the GS (and GG equivalent) pay system, with 39 percent of all personnel in GS-13 or higher pay grades. Thirty-two percent of personnel are under the AcqDemo pay system, which provides pay banding (NH positions), and 13 percent of personnel are under the Lab Demo pay system (DR positions).

¹¹² OPM basic requirements are as follows: “in operations research; or at least 24 semester hours in a combination of operations research, mathematics, probability, statistics, mathematical logic, science, or subject-matter courses requiring substantial competence in college-level mathematics or statistics. At least 3 of the 24 semester hours must have been in calculus” (U.S. Office of Personnel Management, “Classification & Qualifications,” webpage, undated).

Table 4.2. DAF Operations Research Personnel, by Pay Grade

Pay Grade	Number of Civilian Personnel	Percentage of Total Civilian Personnel^a
GS-07	30	3%
GS-09	34	3%
GS-10	<10	<1%
GS-11	46	4%
GS-12	69	6%
GS-13	276	24%
GS-14	141	12%
GS-15	32	3%
NH-03 (GS-11-13 equiv.)	211	18%
NH-04 (GS-14-15 equiv.)	159	14%
DR-01 (GS-7-11 equiv.)	14	1%
DR-02 GS-12-13 equiv.)	76	7%
DR-03 (GS-14 equiv.)	44	4%
DR-04 (GS-15 equiv.)	18	2%
Other ^a	<10	<1%
Total	1,155	100%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: GG pay scale is for the DCIPS, NH pay scale is for the AcqDemo, DR pay scale is for the Lab Demo. GG and GS pay schedules were combined at their corresponding levels where appropriate.

^a There are also a very small number of personnel who are not in one of the listed pay plans but are instead in a senior leader position. Column may not total to 100 percent because of rounding.

Barriers to Recruiting and Hiring

The Operations Research occupational series was included on the DAF list of MCOs at the time of this study. And, according to data from the BLS, employment of Operations Research Analysts across the U.S. workforce is expected to increase by 25 percent between 2020 and 2030.¹¹³ Thus, the DAF will face significant competition for top Operations Research talent in the future amid growing private-sector opportunities for this occupation.

To better understand perceived challenges in recruiting and hiring top Operations Researchers, we held discussions with MAJCOM representatives, the career field management team, and AFPC's talent acquisition team. Key challenges raised for this occupation were very similar to the challenges described for other STEM occupations, such as Computer Scientists. These challenges include the existence of a small talent pool with the desired skills and credentials, lower pay relative to the private sector, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level. We do not repeat these concerns in detail in this

¹¹³ U.S. Bureau of Labor Statistics, 2021.

section but instead refer the interested reader to Chapter 3 on Computer Science personnel for a more detailed review of concerns regarding recruiting and hiring STEM talent in the DAF. We do note that the majority of current DAF personnel in this occupational series hold a master's degree or higher. In the broader U.S. workforce, 679,974 of Operations Research Analysts have a bachelor's degree or lower, so the pool of potential recruits that has higher educational attainment is even smaller.

Use of Hiring Authorities, Special Salary Rates, and Incentives

As described in Chapter 2, the DAF has various hiring flexibilities and incentives it can use to recruit and hire new talent. To better understand what tools for employing talent the DAF is using and how, we provide an overview of hiring authorities, special salary rates, and the use of recruitment, relocation, and retention incentives for Operations Research personnel in the sections below.

Hiring Authorities

Table 4.3 lists the most widely used original hiring authorities for DAF Operations Research personnel (i.e., used for at least 2–3 percent of the population). As the table shows, just over 50 percent of personnel were hired using DHAs, with AcqDemo and Lab Demo having their own DHA. Less than 10 percent of personnel were hired using delegated examining authority. Fourteen percent of personnel came in through special appointing authorities for veterans. Finally, 8 percent of personnel came in as transfers from another agency. Although data indicate that DHA is being used for a large percentage of personnel, as discussed in Chapter 3, several representatives voiced concerns that although hires may be recorded as DHAs, hiring managers were not actually using DHA and its associated flexibilities to the fullest extent (e.g., going through more competitive and lengthier delegated examining processes rather than making on-the-spot job offers associated with DHA).

Table 4.3. Most Widely Used Original Hiring Authorities for DAF Operations Research Personnel

Original Hiring Authority	Number of Civilian Personnel	Percentage of Total Civilian Personnel
DHA (unspecified)	398	34%
Pub. L. 106-117 Section 511 (Special Appointing Authorities for Veterans)	163	14%
Pub. L. 111-383 (NDAA 2011) (AcqDemo)	84	7%
Pub. L. 103-337 (NDAA 1995) (Lab Demo)	90	8%
OPM delegated examining (unspecified)	77	7%
5 CFR 315.501 (transfer of career or career-conditional employee)	88	8%
10 U.S.C. 1601 (civilian intelligence personnel)	35	3%

SOURCE: DCPDS data provided by AFPC.

NOTES: To ensure that we were able to identify all potential hiring authorities being used, this sample includes all personnel, including part-time and temporary personnel as of January 2021. We show only the most widely used original hiring authorities (authorities used for at least 2–3 percent of the population). 4 percent of personnel had unspecified hiring authorities.

Special Salary Rates

As described in Chapter 2, special salary rates are often used to help fill positions in occupations for which there is difficulty recruiting talent by helping increase the compensation that can be offered beyond the standard pay associated with the GS pay levels. Operations Research personnel currently do not have any approved special salary rates.

Recruitment, Relocation, and Retention (3Rs) Incentives

Civilian personnel data show that an increasing, yet still small, number of recruitment incentives are being used to attract Operations Research Analysts. In 2020, the DAF used 26 recruitment incentives, up from just nine in 2016 (a majority through AFMC). When looking at data on civilian new hires into the Operations Research series in DAF, we estimate that only 22 percent of personnel received recruitment incentives in 2020, compared with 13 percent in 2016.¹¹⁴ Even fewer relocation incentives were provided (just three in 2020), and very few retention incentives were used over the past three years (two in 2020 and one in 2018). Again, unfortunately, we do not have data on the percentage of eligible personnel who were offered these incentives and who then chose not to take them. We were only able to obtain data on the total number of incentives used in a particular year. Given the relatively small number of incentives currently being used, this could be an area that the DAF may want to focus on, particularly as demand for this occupation increases in the future.

¹¹⁴ Percentages are based on new hire data from AFPC civilian records.

Comparison of Air Force Pay with the Private Sector and Other Federal Agencies

As noted previously, DAF representatives indicated that compensation can be a barrier to hiring top talent. In this section, we compare current and historical DAF pay for Operations Research personnel with civilians in this occupational series in other services and across the federal government. We also conduct comparisons with non-federal government Operations Research Analysts, examining recent trends in pay for this occupation, as well as geographic and industry variation in prevailing pay rates. We conducted two types of comparisons:

1. **Workforce pay comparisons:** We rely on BLS data discussed below that provide estimates of average pay for this occupation at the U.S. workforce level, within key industries and at specific localities around key DAF installations. These data also provide estimates of the 25th percentile, median, and 75th percentile of pay at the U.S. workforce level. We compare these pay statistics with analogous DAF pay from administrative records. The comparisons are high-level and are intended to provide a general sense of prevailing pay across workforces.
2. **Employee pay comparisons:** We draw on individual-level survey and administrative data described below to study differences in pay by age and education level. Within federal employment, we conduct further comparisons of employment and pay by pay plan. These pay comparisons of similar employees across different workforces therefore provide the basis for our pay recommendations for this occupation.

The workforce comparisons provide a broad sense of prevailing pay in this occupation, while the employee-level analysis allows for comparisons of pay for similarly aged employees with similar educational attainment, illustrating how different agencies use different pay plans and flexibilities within pay plans to compensate Operations Research talent.

Workforce Pay Comparisons

To conduct comparisons to the U.S. workforce, we again used BLS OEWS data. As discussed in Chapter 3 and Appendix A, these data are based on surveys of employers, preventing any analyses by employee characteristics (e.g., age, education). Nevertheless, the BLS OEWS data illustrate prevailing patterns of pay at national and subnational levels. Our comparison occupation for measuring Operations Research pay in BLS data is the Operations Research Analyst occupation, six-digit SOC code 15-2031:

Operations Research Analysts: Formulate and apply mathematical modeling and other optimizing methods to develop and interpret information that assists management with decision making, policy formulation, or other managerial functions. May collect and analyze data and develop decision support software, services, or products. May develop and supply optimal time, cost, or logistics networks for program evaluation, review, or implementation.¹¹⁵

¹¹⁵ U.S. Bureau of Labor Statistics, 2021.

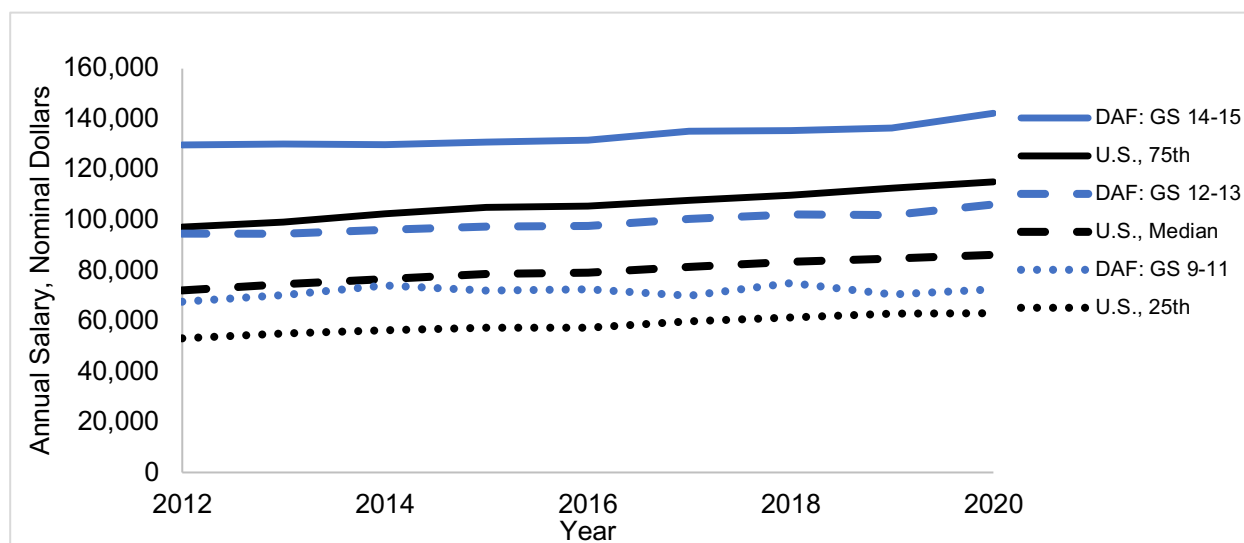
In May 2020, the BLS reported 96,220 non-self-employed individuals working in this occupation across all industries, including the federal government, with a mean annual salary of \$92,280.

DAF Pay Substantially Exceeds U.S. Average for Operations Researchers

The BLS provides occupation-specific data not just on employment and average wages, but also on annual earnings at select points in the earnings distribution. Figure 4.2 compares three of these measures—annual earnings at the 25th percentile, median, and 75th percentile—with average DAF pay (including locality pay) in three pay grade groupings: GS-9–11, GS-12–13, and GS-14–15.¹¹⁶

As Figure 4.2 shows, Operations Research pay in the U.S. workforce gradually rose from 2012 to 2020 at all three points in the earnings distribution. However, DAF pay was highly competitive throughout this period: In 2020, GS-9–11 pay exceeded the 25th percentile of pay in the broader U.S. workforce by nearly \$10,000; GS-12–13 pay exceeded median U.S. pay by \$20,000; and GS-14–15 pay exceeded the 75th percentile of pay by \$27,000. That is, pay for Operations Research personnel in the DAF has been, on average, substantially higher than pay for Operations Research employees in the U.S. workforce more broadly.

Figure 4.2. Average Annual DAF Pay for Operations Research Personnel, by Pay Grade Versus Percentiles of Annual Pay for All Full-Time Operations Research Analysts in U.S. Workforce



NOTE: “U.S.” data series corresponds to percentiles from BLS full-time annual pay measures, representing all non-self-employed employees in that occupation in the United States. “DAF” data series is from FedScope data.

¹¹⁶ These pay grade groupings include GS employees, GG employees at the same numerical grade, and analogous demonstration authority employee grades, namely, NH/DR-02 grouped with GS-9–11, NH/DR-03 grouped with GS-12–13, and NH/DR-04 grouped with GS-14–15.

DAF Pay Exceeds Regional Averages Near Installations

These national-level statistics, however, do not shed light on how competitive the DAF is in specific localities where it has a demand for Operations Research personnel, nor does it show how DAF pay compares across employees' careers. Therefore, as in the previous chapter, to address this first point, Table 4.4 provides 2020 average pay by specific industry, and Table 4.5 provides pay by localities surrounding or near the five installations with the highest fraction of DAF Operations Research personnel employment. DAF average pay exceeds the average across three industries that employ the most Operations Research Analysts: Management of Companies and Enterprises; Computer Systems Design; and Management, Scientific, and Technical Consulting Services. Pay varies across these industries, with Operation Research Analyst employees in Management, Scientific, and Technical Consulting Services earning \$5,000 less, on average, than employees in the other two private-sector industries. We also note that average pay at the DAF installations that employ the most Operations Research personnel exceeds pay in surrounding or nearby localities. In particular, Eglin AFB pay is \$20,000 to \$40,000 higher than nearby Florida localities, and Wright-Patterson AFB pay is \$20,000 to \$30,000 higher than prevailing pay in Ohio.

Table 4.4. Pay Comparisons for Operations Research Employees, by Pay Grade and Industry, 2020

	Mean Annual Pay	Number of Employees
DAF: GS-9–11	\$72,495	80
DAF: GS-12–13	\$106,158	345
DAF: GS-14–15	\$142,242	173
Management of Companies and Enterprises	\$95,780	9,930
Computer Systems Design	\$94,480	8,030
Management, Scientific, and Technical Consulting Services	\$89,350	7,990

SOURCES: Industry statistics from BLS OEWS, DAF pay from AFPC files.

Table 4.5. Pay Comparisons for Operations Research Employees, by DAF Installation and Locality, 2020

	Mean Annual Pay	Number of Employees
DAF: Hanscom AFB	\$114,107	71
Boston-Cambridge-Nashua, Massachusetts-New Hampshire	\$93,630	2,510
Massachusetts	\$92,290	2,830
DAF: Eglin AFB	\$113,433	141
Pensacola-Ferry Pass-Brent, Florida	\$70,770	60
Panama City, Florida	\$94,750	60
Florida	\$70,640	5,570
DAF: Pentagon	\$148,618	82
DAF: Dahlgren AFB	\$122,701	23
Washington-Arlington-Alexandria, D.C.-Virginia-Maryland-West Virginia	\$113,710	6,910
DAF: Wright-Patterson AFB	\$117,319	223
Dayton, Ohio	\$97,910	610
Cincinnati, Ohio-Kentucky-Indiana	\$91,690	1,170
Columbus, Ohio	\$80,770	1,410
Ohio	\$89,430	4,830

SOURCES: Locality statistics from BLS OEWS, DAF pay from AFPC files.

Employee Pay Comparisons

Although the above local comparisons indicate that the DAF pays competitively compared with nearby employers, the BLS OEWS data do not allow us to account for differences in the composition of the workforce. For example, are Operations Research employees at Eglin AFB more likely to have graduate degrees than Operations Research employees in Florida at large? If so, then comparing average pay between these two would conflate any pay disparities for similar employees with pay differences due to education. Similar questions apply to age: Are Eglin AFB Operations Research employees more likely to be mid- to late-career and hence command higher pay than Florida Operations Research employees? To account for these workforce differences, we next turn to comparisons of similar employees across employers.

In this section, we show comparisons for similar Operations Research employees across the DAF, the sister services, the rest of the federal government, and key private-sector industries. We again draw on FedScope and ACS data, introduced in Chapter 3 and described in detail in Appendix A, for the comparisons. As in the other chapters, we conduct these comparisons separately by educational attainment (BA and MA+), and we show average annual pay by five-year age group. We first provide these comparisons overall among the services, other DoD agencies, all other federal agencies, and the Professional, Scientific, and Technical Services

industry, which includes the Computer Systems Design industry and the Management, Scientific, and Technical Consulting Services industry.¹¹⁷

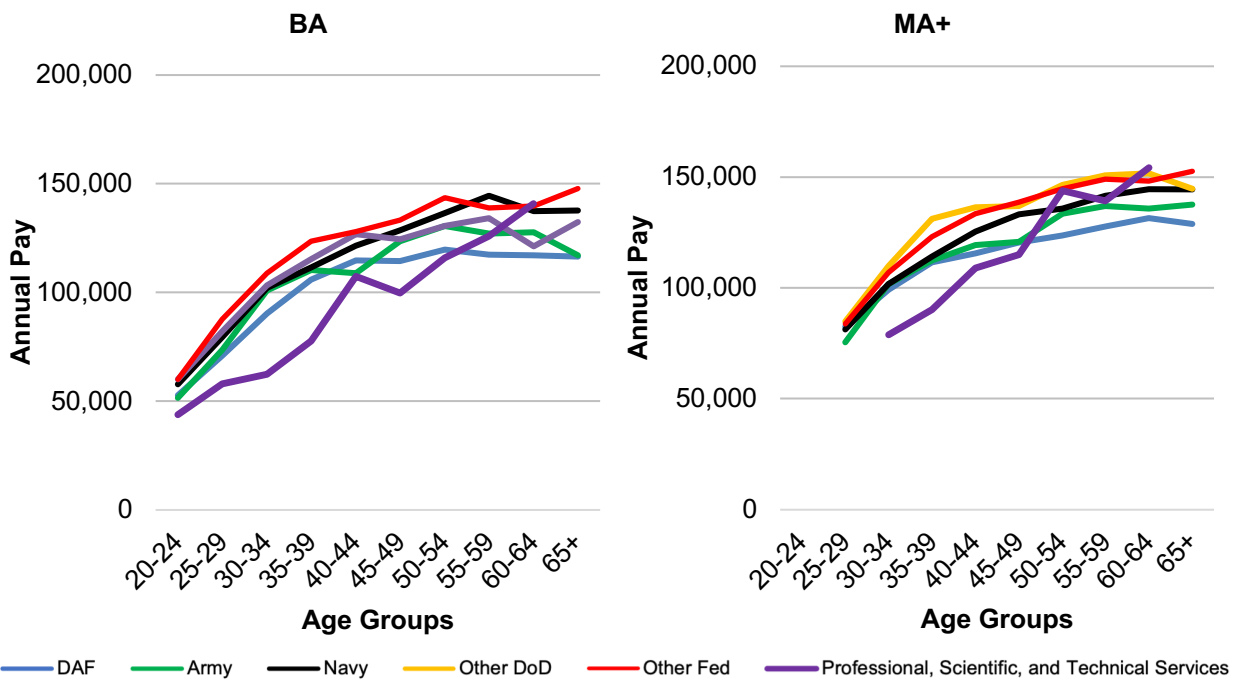
Pay Disparities Increase with Educational Attainment and Age

The first panel of Figure 4.3 shows how DAF pay for Operations Researchers of specific ages with an undergraduate but not a graduate degree compares with the sister services, other DoD agencies, the rest of the federal government, and the largest employer of these employees in the private sector. Although DAF pay is similar to Army pay at younger ages, Army pay exceeded DAF pay by at least 8 percent for five age groups under study, which tended to be among older personnel. Moreover, the Navy, other DoD agencies, and the rest of the federal government pay Operations Research personnel systematically more at all ages, with this gap particularly large for later career employees. For example, average pay for a 55–59-year-old Operations Research employee in the Navy was \$144,496, compared with just \$117,414 in the DAF. Finally, DAF pay is competitive with private industry pay for early- and mid-career employees, but industry pay meets or exceeds DAF pay for those older than 50.

Similar patterns emerge when comparing Operations Research employees with graduate degrees (the second panel of Figure 4.3). Although DAF pay is similar to the other services for employees in their 20s and early 30s, Navy and Army pay is higher than DAF pay for later-career employees. Other DoD and other federal agencies pay more than all of these services across all ages. Furthermore, the DAF has an early-career advantage compared with the private-sector industry under study, but as with Operations Researchers with undergraduate degrees, private-sector pay exceeds DAF pay for employees older than 50.

¹¹⁷ We are limited to this selection of private-sector industries because the ACS data on which we rely have a higher level of aggregation than the BLS OEWS data shown in Table 4.4.

Figure 4.3. Average Annual Pay (\$), by Service, Agency, or Industry, Operations Research Personnel, BA and MA+, 2017–2020



NOTE: DAF, Army, Navy (includes Marine Corps), other DoD, and other federal employee pay based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors. Professional, Scientific, and Technical Services industry pay is calculated from ACS 2017–2019 samples, adjusted for misreporting as described in Appendix A. Sampling variability introduces additional variation into the industry estimates; Appendix E depicts the 95% confidence intervals around these estimated series. All pay adjusted to 2020 dollars with the CPI-U-RS.

Other Services Use Demonstration Authorities to Increase Mid- and Late-Career Pay Faster Than the DAF

The above figures present overall averages across all pay plans and thus represent the combination of differences in pay for similar employees in the same hiring authorities and differences due to different use of hiring authorities. As in the previous chapter, we conducted additional analyses on the utilization of pay plans across services and federal agencies to determine the drivers of these overall differences. These analyses, which we provide more detail on in Appendix E, show the following:

- Detailed comparison by age, educational attainment, and pay plan show that DAF Operations Research personnel in pay band systems have similar pay early career but lag behind pay band personnel in other services mid- and late-career.
- The Navy is substantially more likely to employ Operations Research personnel in demonstration authorities, so the Navy pays mid- and late-career Operations Research personnel substantially more than the DAF.
- DAF Operations Research personnel in the GS system are paid similarly as in other services, but their pay lags behind other DoD agencies and the rest of the federal

government in GS pay at similar ages and educational attainment. These other agencies have substantially more Operations Research personnel in GS-14 and GS-15 positions.

- Operations Research personnel working for non-DoD federal agencies are more likely to be in alternative personnel systems and be paid more than similar employees in GS systems. The result is that Operations Research personnel working outside of the services are paid substantially more over their career than DAF personnel.

Conclusion

The DAF has a total of 1,115 full-time civilian personnel in the Operations Research occupational series, representing roughly 20 percent of all personnel within the occupational series in the federal government. Similar to the other STEM occupations included in this study, key challenges raised by DAF representatives for recruiting and hiring talent in this series include the existence of a small talent pool with the desired skills and credentials, higher pay than the private sector for early- and mid-career workers, similar or lower pay than the private sector for late-career workers, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level. Furthermore, although over 50 percent of personnel were hired using DHAs, as noted in the previous chapter, several representatives voiced concerns regarding whether DHA and its associated flexibilities were really being used to the fullest extent. In addition, only very small numbers of relocation and retention incentives have been used over the past five years.

In terms of pay for DAF Operations Researchers, less than half of personnel in this series are under demonstration projects (AcqDemo and Lab Demo), which allow for more flexible pay through pay banding. There are also no special salary rates for Operations Researchers. Our pay comparisons show that average DAF pay for Operations Researchers is broadly competitive with average pay in the U.S. workforce and in local labor markets around key DAF installations. However, Operations Research personnel working in the Navy and other non-DoD federal agencies are more likely to be in alternative or demonstration personnel systems and be paid more than similar employees in GS systems.

Chapter 5. Electronics Engineer

Overview of the Occupation

The OPM *Handbook of Occupational Groups and Families* describes the Electronics Engineer (0855) occupational series as

positions managing, supervising, leading, and/or performing professional engineering and scientific work involving electronic circuits, circuit elements, equipment, systems, and associated phenomena concerned with electromagnetic or acoustical wave energy or electrical information for purposes such as communication, computation, sensing, control, measurement, and navigation.¹¹⁸

As of January 2021, civilian personnel records indicate that there are 5,164 full-time civilian personnel in the Electronics Engineer occupational series within the DAF. This represents roughly 29 percent of all personnel within the occupational series in the federal government, with FedScope data indicating that there are 17,880 Electronics Engineers across the federal government.¹¹⁹ This study did not include personnel in the 801 General Engineer or the 0850 Electrical Engineer occupational series, who might be performing work associated with electronics engineering. As Table 5.1 shows, the majority of personnel in the Electronics Engineer occupational series are in AFMC (82 percent), with the highest concentration of positions located at the AFMC bases of Robins (20 percent), Tinker (20 percent), Wright-Patterson (17 percent), and Hill (16 percent) (see Figure 5.1).

¹¹⁸ U.S. Office of Personnel Management, 2018, p. 71.

¹¹⁹ U.S. Office of Personnel Management, 2021. We did not have access to January FedScope data, so we used March 2021 data. See Appendix E for a further breakdown of federal employment in this series across agencies.

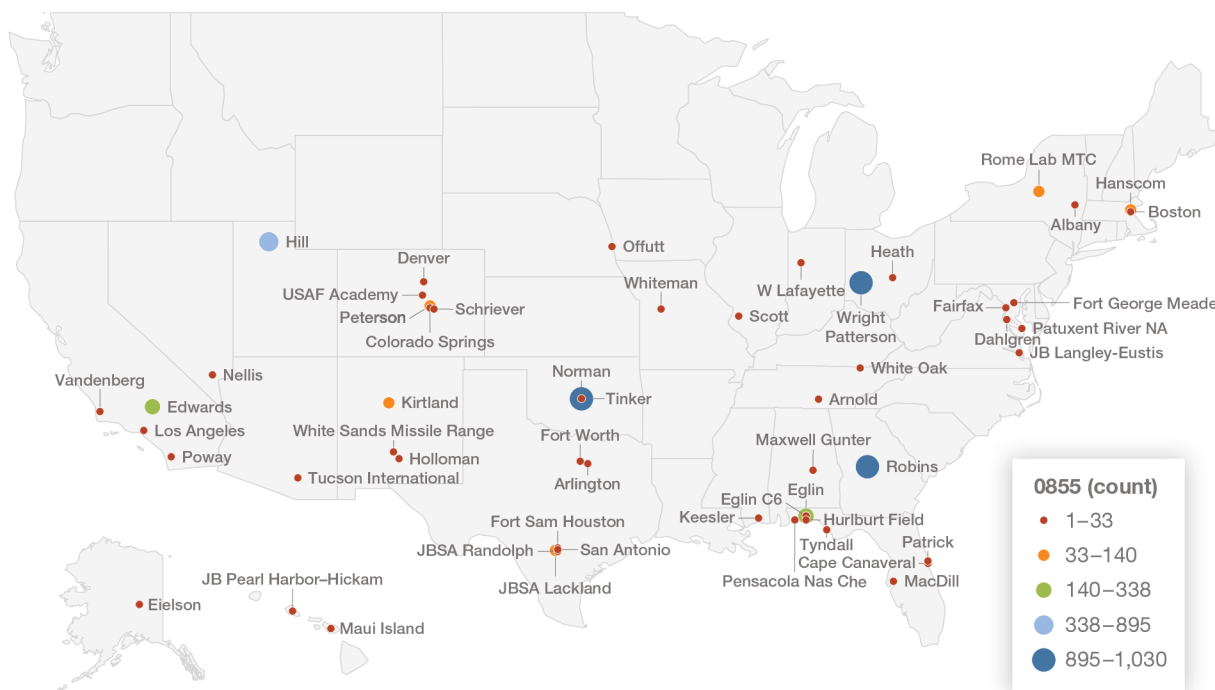
Table 5.1. DAF Electronics Engineer Personnel, by Air Force Major Commands and Other Organizations

MAJCOM and Other Organizations	Number of Civilian Personnel	Percentage of Total Civilian Personnel
Air Combat Command	374	7%
Air Education and Training Command	<10	<1%
Air Force Materiel Command	4,249	82%
Air Mobility Command	<10	<1%
Pacific Air Forces	<10	<1%
Space Command	<10	<1%
U.S. Space Force	135	3%
Special Operations Command	12	<1%
U.S. Air Forces, Europe	<10	<1%
Other organization	375	7%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: Organizations included in the "Other organization" category include Air Force MAJCOM sub-agencies and combatant commands. Column may not total to 100 percent because of rounding.

Figure 5.1. Location of DAF Electronics Engineers Across the United States



SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Personnel Characteristics

Consistent with OPM educational requirements for personnel in the Electronics Engineer occupational series,¹²⁰ 53 percent of DAF personnel hold a bachelor's degree, 42 percent hold a master's degree, and roughly 5 percent hold a Ph.D. Unlike some other civilian occupational series, the majority of personnel in this series (84 percent) do not have any prior military service. AFPC records show that 28 percent of personnel either are currently or will be eligible for retirement within the next five years. Appendix D provides more detail on the demographic characteristics of DAF Electronics Engineers.

Table 5.2 shows the distribution of DAF Electronics Engineers across pay grades. As the table shows, the largest concentration of Electronics Engineer personnel is in NH-03 (AcqDemo) positions (51 percent), with 58 percent of all personnel falling under AcqDemo. Another 12 percent of personnel are under Lab Demo. Both of these demonstration projects provide a flexible pay banding system. The GS (and GG equivalent) positions make up a combined total of only 30 percent of all personnel in the Electronics Engineer series.

¹²⁰ OPM basic requirements can be found at U.S. Office of Personnel Management, "Electronics Engineering Series, 0855: Individual Occupational Requirements," webpage, undated.

Table 5.2. DAF Electronics Engineers, by Pay Grade

Pay Grade	Number of Civilian Personnel	Percentage of Total Civilian Personnel
GS-05	17	<1%
GS-07	182	4%
GS-09	247	5%
GS-10	12	<1%
GS-11	214	4%
GS-12	122	2%
GS-13	555	11%
GS-14	160	3%
GS-15	22	<1%
NH-02 (GS-5-11 equiv.)	64	1%
NH-03 (GS-11-13 equiv.)	2,614	51%
NH-04 (GS-14-15 equiv.)	320	6%
DR-01 (GS-7-11 equiv.)	15	<1%
DR-02 GS-12-13 equiv.)	222	4%
DR-03 (GS-14 equiv.)	239	5%
DR-04 (GS-15 equiv.)	155	3%
Other ^a	<10	<1%
Total	5,164	100%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: GG pay scale is for the DCIPS, NH pay scale is for the AcqDemo, DR pay scale is for the Lab Demo. GG and GS pay schedules were combined at their corresponding levels.

^a There were also a very small number of personnel who were not under any of the listed pay plans and instead fell under senior leader or similar positions.

Barriers to Recruiting and Hiring

The Electronics Engineer occupational series was included on the DAF list of MCOs at the time of this study. Compared with the other occupational series studied, employment for Electronics Engineers is anticipated to be similar to expected growth for all occupations, with data from the BLS estimating an increase of 7 percent between 2020 and 2030 (average expected growth rate for all occupations is 8 percent).¹²¹ We heard similar concerns regarding recruiting and hiring Electronics Engineers as we did for the other STEM occupations included in this report (i.e., Computer Science and Operations Research). These challenges include a small talent pool with the desired skills and credentials, lower pay relative to the private sector, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level. We do not repeat these concerns in detail in this section but instead refer the interested reader to Chapter 3

¹²¹ U.S. Bureau of Labor Statistics, 2021.

on Computer Science employees for a more detailed review of concerns regarding recruiting and hiring STEM talent in the DAF.

Use of Hiring Authorities, Special Salary Rates, and Incentives

As described in Chapter 2, the DAF has various hiring flexibilities and incentives it can use to recruit and hire new talent. To better understand what tools the DAF is using and how the DAF is using these tools for employing talent, in the sections below, we provide an overview of hiring authorities, special salary rates, and the use of recruitment, relocation, and retention incentives for Electronics Engineer personnel.

Hiring Authorities

Table 5.3 lists the most widely used original hiring authorities for DAF Electronics Engineers (i.e., used for at least 2–3 percent of the population). As the table shows, data indicate that over 60 percent of personnel were hired using DHAs, with AcqDemo and Lab Demo having their own DHA. As we did in the other chapters, we will again note that although data show DHA being used, several representatives voiced concerns regarding whether DHA and its associated flexibilities were really being used to the fullest extent (e.g., making on-the-spot job offers instead of going through a more competitive and lengthier process). Less than 10 percent of personnel were originally hired using delegated examining authority. Compared with the other occupational series reviewed in this report, a higher percentage of personnel seems to have come through internship programs, with 8 percent of personnel hired through the Pathways Program and as conversions from the Federal Career Intern Program.

Table 5.3. Most Widely Used Original Hiring Authorities for DAF Electronics Engineer Personnel

Original Hiring Authority	Number of Civilian Personnel	Percentage of Total Civilian Personnel
DHA (unspecified)	2,091	40%
Pub. L. 111-383 (NDAA 2011) (AcqDemo)	543	10%
Pub. L. 103-337 (NDAA 1995) (Lab Demo)	529	10%
10 U.S.C. 1601 (civilian intelligence personnel)	325	6%
OPM delegated examining agreement (unspecified)	301	6%
5 CFR 315.712 (conversion based on service as a Federal Career Intern)	323	6%
5 CFR 315.713(A)(1) (conversion based on service in a Pathways Program)	109	2%

SOURCE: DCPDS data provided by AFPC.

NOTES: To ensure that we were able to identify all potential hiring authorities being used, this sample includes all personnel, including part-time and temporary personnel as of January 2021. We show only the most widely used original hiring authorities (authorities used for at least 2–3 percent of the population). 3% of personnel had unspecified hiring authorities.

Special Salary Rates

As described in Chapter 2, special salary rates are often used to help fill positions in occupations for which there is difficulty recruiting talent by helping increase the compensation that can be offered beyond the standard pay associated with the GS pay levels. Electronics Engineers have 14 special salary rate tables that apply to different locality pay areas in 2021.¹²² These special salary rates cover pay grades ranging from GS-05 through GS-15, depending on the locality area. The same special salary rate tables also cover a variety of other engineering series. As noted in Chapter 2, there are limits on special salary rates, however, such that the minimum rate cannot exceed 30 percent of the maximum rate for the pay grade and the maximum rate cannot exceed Level IV of the Executive Schedule (5 U.S.C 5305[a] and 5 CFR 530.304[a]). In a previous report,¹²³ we documented how these limitations can affect the ability of the DAF to pay more as GS grades increase.

Recruitment, Relocation, and Retention (3Rs) Incentives

Civilian personnel data show that the DAF has consistently been using recruitment incentives over the past five years, although the use of relocation incentives is much less common. For example, in 2020, 331 recruitment incentives were used, up from only 25 relocation incentives. When looking at data on civilian new hires into the Electronics Engineer series in DAF, we estimate that roughly 76 percent of personnel received recruitment incentives in 2020.¹²⁴ In terms of total retention incentives, in 2020, 560 incentives were used. Very few were used for Electronics Engineers from 2016 until 2019 (less than ten each year). Unfortunately, as noted in the previous chapter, we do not have data on the percentage of eligible personnel who were offered these incentives and who then chose not to take them. We were only able to obtain data on the total number of incentives used in a particular year.

Comparison of Air Force Pay with the Private Sector and Other Federal Agencies

In this section, we compare current and historical DAF pay for Electronics Engineer personnel with civilians in this occupational series in other services and across the federal government. We also conducted comparisons with non-federal government Electronics Engineer

¹²² See U.S. Office of Personnel Management, “2021 Index to Title 5 Special Rate Tables by Occupation,” webpage, undated.

¹²³ Groeber et al., 2021.

¹²⁴ Data on accessions are from FedScope. The accessions numbers include both new hires and transfers from other agencies, so we are only able to provide a rough estimate of the percentage who received these incentives, since not all accessions may have been eligible.

employees, examining recent trends in pay for this occupation, as well as geographic and industry variation in prevailing pay rates. We conducted two types of comparisons:

1. **Workforce pay comparisons:** We rely on BLS data that provide estimates of average pay for this occupation at the U.S. workforce level, within key industries, and at specific localities around key DAF installations. These data also provide estimates of the 25th percentile, median, and 75th percentile of pay at the U.S. workforce level. We compare these pay statistics with analogous DAF pay from administrative records. The comparisons are high-level and are intended to provide a general sense of prevailing pay across workforces.
2. **Employee pay comparisons:** We draw on individual-level survey and administrative data to study differences in pay by age and education level. Within federal employment, we conduct further comparisons of employment and pay by pay plan. These pay comparisons of similar employees across different workforces therefore provide the basis for our pay recommendations for this occupation.

The workforce comparisons provide a broad sense of prevailing pay in this occupation, while the employee-level analysis allows for comparisons of pay for similarly aged employees with similar educational attainment, illustrating how different agencies use different pay plans and flexibilities within pay plans to compensate Electronics Engineer talent.

Workforce Pay Comparisons

To conduct comparisons to the U.S. workforce, we again used BLS OEWS data. As described in more detail in Appendix A, these data are based on surveys of employers, preventing any analyses by employee characteristics. Nevertheless, the BLS OEWS data illustrate prevailing patterns of pay at national and subnational levels. Our comparison occupation for measuring Electronics Engineer pay in BLS data is the Electronics Engineer occupation, six-digit SOC code 17-2072:

Electronics Engineers, Except Computer: Research, design, develop, or test electronic components and systems for commercial, industrial, military, or scientific use employing knowledge of electronic theory and materials properties. Design electronic circuits and components for use in fields such as telecommunications, aerospace guidance and propulsion control, acoustics, or instruments and controls. Excludes “Computer Hardware Engineers” (17-2061).¹²⁵

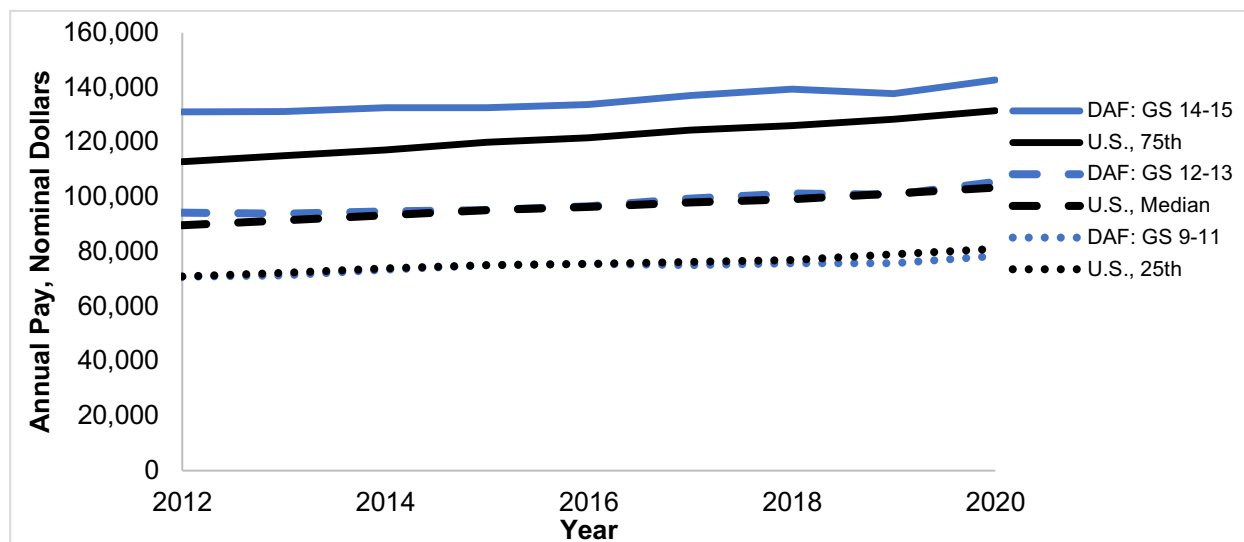
In May 2020, the BLS reported that over 122,320 non-self-employed individuals work in this occupation across all industries, including the federal government, with a mean annual salary of \$112,320.

¹²⁵ U.S. Bureau of Labor Statistics, 2021.

Pay for DAF Electronics Engineers Is Competitive with the U.S. Average

The BLS provides occupation-specific data not just on employment and average wages, but also on annual earnings at select points in the earnings distribution. Figure 5.2 compares three of these measures—annual earnings at the 25th percentile, median, and 75th percentile—with average DAF pay in three pay grade groupings: GS-9–11, GS-12–13, and GS-14–15.¹²⁶

Figure 5.2. Average Annual DAF Pay for Electronics Engineer Personnel, by Pay Grade Versus Percentiles of Annual Pay for All Full-Time Electronics Engineer Employees in U.S. Workforce



NOTE: "U.S." series corresponds to percentiles from BLS full-time annual pay measures, representing all non-self-employed employees in that occupation in the United States. "DAF" series is from FedScope data.

Figure 5.2 shows a slight trend upward in nominal pay across the distribution for the U.S. workforce, but pay for DAF Electronics Engineer personnel remains broadly competitive: GS-9–11 pay matches workforce-wide pay at the 25th percentile, GS-12–13 pay matches workforce-wide pay at the median, and GS-14–15 pay *exceeds* workforce-wide pay at the 75th percentile by at least \$10,000 for every year from 2012 to 2020.

Average DAF Pay for Electronics Engineers Is Competitive Regionally, Except in California

Although Figure 5.2 indicates that the DAF pays at or above prevailing salaries for Electronics Engineer employees at the national level, the DAF competes for talent in specific labor markets. To examine whether the DAF remains competitive relative to localities and other industries, we first identify the four private-sector industries that employed the most Electronics Engineer employees in 2020 and every DAF installation with at least 5 percent of the DAF

¹²⁶ These pay grade groupings include GS employees, GG employees at the same numerical grade, and analogous demonstration authority employee grades, namely, NH/DR-02 grouped with GS-9–11, NH/DR-03 grouped with GS-12–13, and NH/DR-04 grouped with GS-14–15.

Electronics Engineer workforce. We then compare DAF annual pay to annual pay in these industries, in the states where DAF installations are located, and in the metropolitan statistical areas (MSAs) near these installations.

We note that the BLS OEWS data do not contain statistics throughout the pay distribution at this level of geographic detail, hence we compare average pay. Furthermore, BLS OEWS data do not allow for separating federal employment out from private industry or other government employment at the state or MSA level, and hence average pay at these levels *includes* DAF Electronics Engineers who are employed in that geographic area. We nevertheless show these statistics to provide an indication of relative pay, not absolute differences. We reiterate as well that because these data are not provided at the employee level, we are unable to account for differences in education or years of experience, but these measures provide an overview of how DAF pay compares with prevailing pay for Electronics Engineer employees in each of these contexts. Tables 5.3 and 5.4 show mean annual wage and number of Electronics Engineer employees working in each industry, locality, state, or DAF installation in 2020.

As Table 5.4 shows, DAF pay compares favorably to the largest private-sector employer: the telecommunications industry. Average DAF pay for GS-9–11 pay grades was \$105,464 in 2020, whereas average pay in the telecommunications industry in 2020 was just slightly higher, at \$107,340. However, Electronics Engineer employees are paid, on average, substantially more in the semiconductor manufacturing industry and in the control instrument manufacturing industry; competing with these industries may require higher pay to recruit and retain talent.

Table 5.4. Pay Comparisons for Electronics Engineers Between the DAF and Private-Sector Industries, 2020

	Mean Annual Pay	Number of Employees
DAF: GS-9–11	\$78,416	747
DAF: GS-12–13	\$105,464	2,975
DAF: GS-14–15	\$142,699	657
Telecommunications	\$107,340	23,010
Semiconductor/Other Electronic Component Manufacturing	\$114,820	16,260
Architecture, Engineering, and Related Services	\$113,620	9,630
Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	\$122,830	7,420

SOURCES: Industry statistics from BLS OEWS, DAF pay from AFPC files.

In Table 5.5, the overall pattern shows that average Electronics Engineer pay at DAF installations tends to exceed average pay for the MSAs and states where those installations are located, indicating that at the local level, DAF pay is competitive. The one exception to this pattern is Edwards AFB; although Edwards AFB pay exceeds that of Bakersfield on average, it falls below average Electronics Engineer pay in the Los Angeles area and California at large.

Additionally, we note that DAF installations represent a substantial fraction of the local Electronics Engineer workforce in most MSAs where they are located, such as Wright-Patterson AFB, Robins AFB, and Hill AFB.

Table 5.5. Pay Comparisons for Electronics Engineers Between DAF Installations and Localities, 2020

	Mean Annual Pay	Number of Employees
DAF: Edwards AFB	\$122,963	281
Bakersfield, California	\$117,540	610
Los Angeles–Long Beach–Anaheim, California	\$124,310	5,750
California	\$128,030	22,010
DAF: Eglin AFB	\$114,827	338
Pensacola–Ferry Pass–Brent, Florida	\$94,280	130
Panama City, Florida	\$107,490	290
Florida	\$102,350	5,680
DAF: Hill AFB	\$101,840	806
Ogden–Clearfield, Utah	\$95,870	870
Salt Lake City, Utah	\$106,160	240
Utah	\$97,500	1,240
DAF: Robins AFB	\$102,976	1,008
Warner Robins, Georgia	\$97,550	1,050
Atlanta–Sandy Springs–Roswell, Georgia	\$104,430	2,780
Georgia	\$101,540	4,300
DAF: Tinker AFB	\$99,930	1,030
Oklahoma City, Oklahoma	\$95,350	1,210
Oklahoma	\$92,640	1,800
DAF: Wright-Patterson AFB	\$126,833	895
Dayton, Ohio	\$111,000	1,460
Cincinnati, Ohio–Kentucky–Indiana	\$95,580	1,100
Columbus, Ohio	\$90,160	710
Ohio	\$100,190	3,890

SOURCES: Locality statistics from BLS OEWS, DAF pay from AFPC files.

The above comparisons provide evidence that, on average, Electronics Engineer personnel working for the DAF are paid at a competitive rate, both nationally and at the installations that employ a large fraction of the DAF Electronics Engineer workforce. However, the composition of the DAF Electronics Engineer workforce may systematically differ from the broader workforce in terms of age or education; to account for differences, we next turn to comparisons of similar employees across employers.

Employee Pay Comparisons

In this section, we show comparisons for similar Electronics Engineer employees across the DAF, the sister services, other DoD agencies, the rest of the federal government, and key private-sector industries. We draw on FedScope and ACS data, introduced in Chapter 3 and described in detail Appendix A, to provide pay comparisons. As in the other chapters, we conduct these comparisons separately by educational attainment (BA or MA+) and show average annual pay by five-year age group. We first provide these comparisons overall among the services, other DoD agencies, all other federal agencies, and the telecommunications industry.¹²⁷

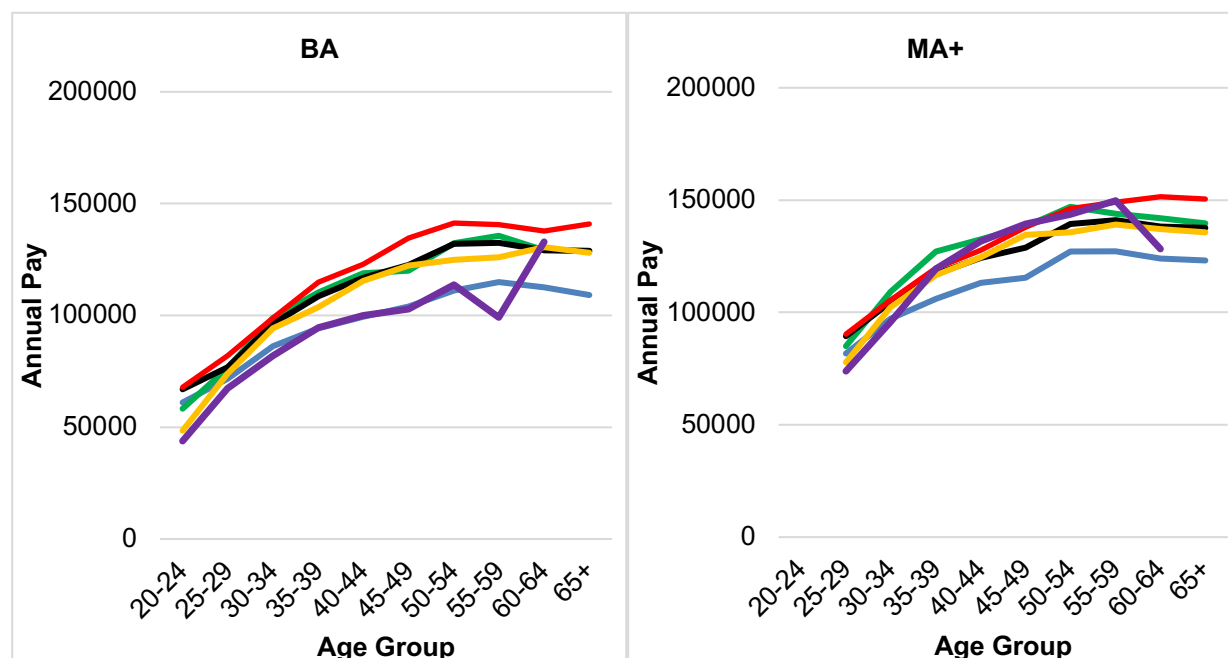
Pay Disparities Between the DAF and Other Federal Employees Increase with Educational Attainment

Figure 5.3 shows comparisons of pay by age across services and other employers for Electronics Engineer employees with an undergraduate degree but no graduate education and for Electronics Engineer employees with at least a master's degree. For Electronics Engineer employees with a bachelor's degree (the first panel of Figure 5.3), the DAF pays younger employees competitively, but DAF pay at age 30 begins to fall below that of the other services. It remains consistent with pay in the telecommunications industry across all ages, but a gap of \$20,000 to \$30,000 persists between the DAF and other federal employers. For example, for 45–49-year-olds with a bachelor's degree, average annual DAF pay was \$103,846, versus \$119,964 in the Army, \$122,582 in the Navy, \$122,358 in other DoD agencies, and \$134,636 for non-DoD federal pay. Average annual DAF pay was also slightly above telecommunications industry pay of \$102,941.

For Electronics Engineer employees with at least a master's degree (the second panel of Figure 5.3), DAF pay consistently fell short of pay for Electronics Engineer employees by other services, the federal government, and the telecommunications industry. For example, for 45–59-year-old Electronics Engineer employees with at least a master's degree, average annual DAF pay was \$115,422, compared with \$138,252 in the Army, \$128,876 in the Navy, \$134,671 in other DoD agencies, \$137,865 in non-DoD agencies, and \$139,290 in the telecommunications industry.

¹²⁷ We use ACS data to estimate average Electronics Engineer pay by age; however, the ACS groups Electrical and Electronics Engineer employees together. Fortunately, the telecommunications industry is the largest employer of Electronics Engineer employees (allowing for sufficient statistical power to estimate mean pay), and BLS OEWS data show that Electronics Engineer employees represent over 95 percent of employment for Electrical and Electronics Engineer employees in the telecommunications industry. Electrical Engineer employees represent larger fractions of the workforce in the other private-sector industries shown in Table 5.4, and thus we do not provide ACS-derived statistics of these industries in order to avoid inappropriate comparisons.

Figure 5.3. Average Annual Pay (\$), by Service, Agency, or Industry, Electronics Engineer Personnel, BA and MA+, 2017–2020



NOTE: DAF, Army, Navy (includes Marine Corps), other DoD, and other federal employee pay based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors. Telecommunications industry Electronics Engineer employee pay is calculated from ACS 2017–2019 samples, adjusted for misreporting as described in Appendix A. Sampling variability introduces additional variation into the industry estimates; Appendix E depicts the 95% confidence intervals around these estimated series. All pay adjusted to 2020 dollars with the CPI-U-RS.

Lower DAF Pay Among Services Is Due to Competitors' Greater Use of Demonstration Authorities and Alternative Personnel Systems

These comparisons raise questions as to *why* DAF pay lags behind other services for mid- and late-career Electronics Engineer employees. In particular, these estimates are averages across all pay plans, but the composition of pay plans varies by service. To address this question, we conducted a series of analyses exploring the prevalence of pay plan utilization and pay within pay plans across the services and federal agencies. These analyses, which we provide more detail on in Appendix E, show the following:

- The pay disparity is partly accounted for by greater employment of personnel in demonstration authorities and alternative personnel systems by competitors, as well as higher pay within these systems.
- The DAF also employs more Electronics Engineer personnel in lower pay grades in the GS system than other agencies, further contributing to the DAF's lagging overall pay.

Conclusion

The DAF has a total of 5,164 full-time civilian personnel in the Electronics Engineer occupational series, representing roughly 29 percent of all personnel within the occupational series in the federal government. Similar to the other STEM occupations included in this study, key challenges raised by DAF representatives for recruiting and hiring talent in this series include the existence of a small talent pool with the desired skills and credentials, lower compensation relative to the private sector, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level. Furthermore, although over 60 percent of personnel were hired using DHAs, as noted in the earlier chapters, several representatives voiced concerns regarding whether DHA and its associated flexibilities were really being used to the fullest extent. Civilian personnel data show that the DAF has been using recruitment incentives consistently over the past five years, as well as relocation incentives, although the use of relocation incentives is much less common.

In terms of pay for DAF Electronics Engineers, almost 60 percent of personnel in this series are under demonstration projects (AcqDemo and Lab Demo), which allow for more flexible pay through pay banding. There are also multiple special salary rate tables to cover a number of locality pay areas that may have more difficulty in recruiting. However, our pay comparisons show that although the DAF is competitive with the largest private industry competitor for Electronics Engineers with bachelor's degrees, DAF pay lags behind the private sector and other federal agencies for Electronics Engineers with graduate degrees. In particular, the DAF employs more personnel in lower pay grades in the GS system than other agencies and employs fewer personnel in demonstration authorities and alternative personnel systems, which tend to pay more.

Chapter 6. Engineering Technician

Overview of the Occupation

The OPM *Handbook of Occupational Groups and Families* describes the Engineering Technical (0802) occupational series as

positions that require primarily application of a practical knowledge of: (1) the methods and techniques of engineering or architecture; and (2) the construction, application, properties, operations, and limitations of engineering systems, processes, structures, machinery, devices, and materials. The positions do not require professional knowledge and abilities for full performance and therefore do not require training equivalent in type and scope to that represented by the completion of a professional curriculum leading to a bachelor's degree in engineering or architecture. Excluded from this series are positions that are specifically covered by a more specialized technical series.¹²⁸

As of January 2021, civilian personnel records indicate that there are 1,155 full-time civilian personnel in the Engineering Technical series within the DAF—roughly 8 percent of all federal personnel within the occupational series, with FedScope data indicating that a total of 15,494 Engineering Technicians work across the federal government.¹²⁹ Table 6.1 shows that the largest concentration of Engineering Technicians is in AFMC (51 percent). As Figure 6.1 illustrates, Engineering Technicians are more widely dispersed across DAF installations compared with some other occupations, with the highest concentration located at Robins AFB (11 percent).

¹²⁸ U.S. Office of Personnel Management, 2018, p. 67.

¹²⁹ U.S. Office of Personnel Management, 2021. We did not have access to January FedScope data, so we used March 2021 data.

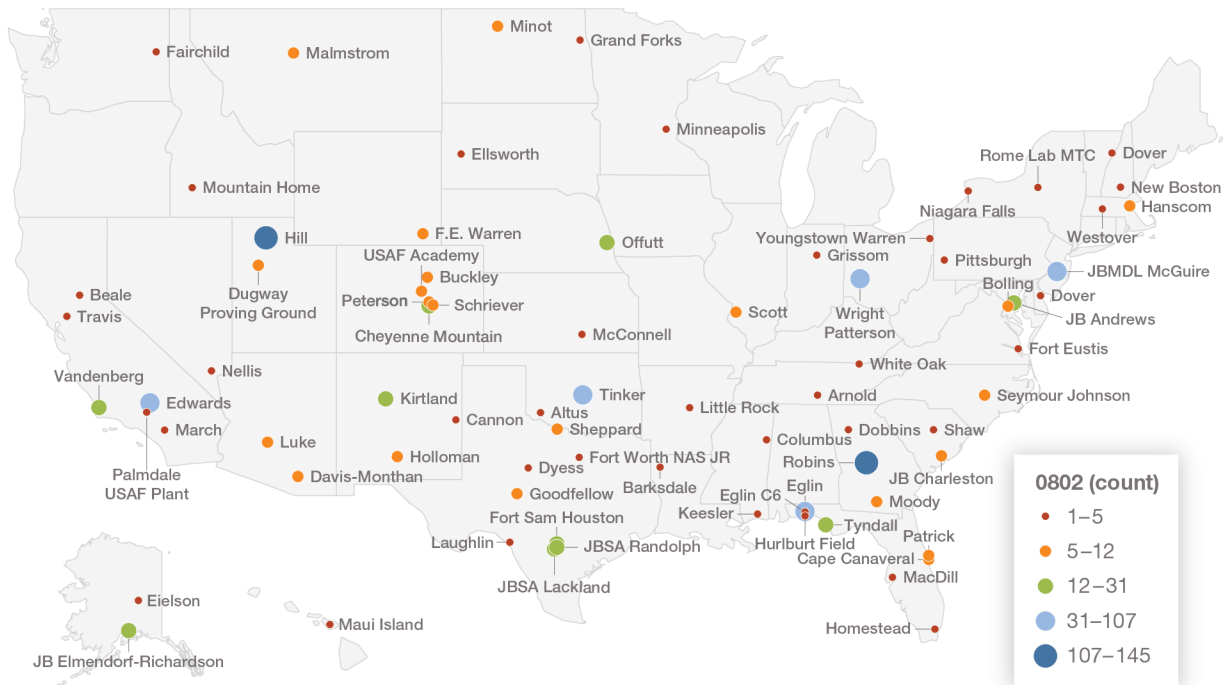
Table 6.1. Engineering Technicians, by Air Force Major Commands and Other Organizations

MAJCOM and Other Organizations	Number of Civilian Personnel	Percentage of Total Civilian Personnel
Air Combat Command	83	7%
Air Education and Training Command	105	9%
Air Force Global Strike Command	33	3%
Air Force Materiel Command	587	51%
Air Mobility Command	83	7%
Air National Guard Units (Title 32/Title 5)	<10	<1%
Headquarters, Air Force Reserve Command	37	3%
Pacific Air Forces	97	8%
U.S. Space Force	79	7%
Special Operations Command	<10	<1%
U.S. Air Forces, Europe	<10	<1%
Other organization	42	4%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: Organizations included in the “Other organization” category include Air Force MAJCOM sub-agencies and combatant commands. Column may not total to 100 percent because of rounding.

Figure 6.1. Location of DAF Engineering Technicians Across the United States



SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Personnel Characteristics

OPM educational requirements for personnel in the Engineering Technical series vary from requiring only some postsecondary education to a bachelor's degree, depending on the pay grade associated with the position.¹³⁰ In the DAF, roughly 46 percent of personnel in this series hold a high school diploma or have some college education but no degree, 33 percent hold an associate's degree or bachelor's degree, and 21 percent hold a master's degree; less than 1 percent of personnel in this series hold a Ph.D. Roughly 58 percent of personnel are retired from the military or are prior service, with the majority of prior service personnel coming from the enlisted force. AFPC records show that 38 percent of personnel either are currently or will be eligible for retirement within the next five years. Appendix D provides more detail on the demographic characteristics of DAF Engineering Technicians.

Table 6.2 shows the distribution of DAF Engineering Technicians across pay grades. As the table shows, the vast majority of Engineering Technicians fall under the GS (and GG equivalent) pay system (87 percent), with the highest concentration of all Engineering Technicians in the GS-11 pay grade (51 percent). Only 7 percent of personnel fall under the AcqDemo pay system (NJ positions), and less than 1 percent of personnel are part of the Technician Career Path, under AFRL's Lab Demo personnel system (DX positions).

¹³⁰ OPM basic requirements can be seen in more detail at U.S. Office of Personnel Management, "Engineering Technical Series, 0802: Individual Occupational Requirements," webpage, undated.

Table 6.2. DAF Engineering Technicians, by Pay Grade

Pay Grade	Number of Civilian Personnel	Percentage of Total Civilian Personnel^a
GS-05	<10	<1%
GS-06	<10	<1%
GS-07	13	1%
GS-08	<10	<1%
GS-09	189	16%
GS-10	19	2%
GS-11	588	51%
GS-12	176	15%
GS-13	<10	<1%
DX-03 (GS-8-10 equiv.)	<10	<1%
DX-04 (GS-11-12 equiv.)	<10	<1%
NJ-02 (GS-5-8 equiv.)	12	1%
NJ-03 (GS-9-11 equiv.)	41	4%
NJ-04 (GS-12-13 equiv.)	31	3%
Other ^a	<10	<1%
Total	1,155	100%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: GG pay scale is for the DCIPS, NJ pay scale is for the AcqDemo, DX pay scale is for the Lab Demo. GG and GS pay schedules were combined at their corresponding levels.

^a There are also a very small number of personnel who do not fall under these pay plans and are included in a specialized pay system.

Barriers to Recruiting and Hiring

At the time of this study, we did not hear specific concerns from MAJCOM representatives and career field managers regarding hiring and employing Engineering Technicians. Unlike most of the other occupational series in this report, almost all of the current personnel in the Engineering Technical series are prior military service, so some of the potential barriers for other occupational series when recruiting civilians, such as a lack of awareness of potential civilian opportunities and understanding of DAF culture and mission, are not recruiting concerns. Projected employment growth from the BLS varies depending on the type of Engineering Technician but ranges from less than to in line with average growth expected for all occupations.¹³¹ However, following guidance from our project sponsor and with the goal of ensuring that the DAF is able to hire and employ top talent from across the spectrum, especially in the future, we included Engineering Technicians as one of the occupational series in our review.

¹³¹ U.S. Bureau of Labor Statistics, 2021.

Use of Hiring Authorities, Special Salary Rates, and Incentives

As described in Chapter 2, the DAF has various hiring flexibilities and incentives it can use to recruit and hire new talent. To better understand what and how the DAF is using these tools for employing talent, in the sections below, we provide an overview of hiring authorities, special salary rates, and the use of recruitment, relocation, and retention incentives for personnel in the Engineering Technician occupational series.

Hiring Authorities

Table 6.3. lists the most widely used original hiring authorities for DAF Engineering Technicians (i.e., used for at least 2–3 percent of the population). Unlike many of the other occupations included in this study, only 5 percent of Engineering Technicians were hired using DHA. Twenty-five percent of personnel were hired using delegated examining authority. Consistent with the large number of veterans in this series, 18 percent were hired under special appointing authorities for veterans, and 6 percent were hired under transitional or veteran’s recruitment appointments. Six percent were transfers from other agencies. Another small portion of appointments came from students completing approved career-related work-study programs who were allowed to be appointed to career or career conditional positions in the competitive service and promotion of non–U.S. citizens serving overseas.

Table 6.3. Most Widely Used Original Hiring Authorities for DAF Engineering Technicians

Original Hiring Authority	Number of Civilian Personnel	Percentage of Total Civilian Personnel
OPM delegated examining agreement (unspecified)	305	25%
Pub. L. 106-117 Section 511 (Special Appointing Authorities for Veterans)	221	18%
5 CFR 315.501 (transfer of career or career-conditional employees)	75	6%
5 CFR 315.705 (employees serving under transitional or veterans recruitment appointments)	71	6%
DHA (unspecified)	66	5%
Executive Order 12015 (students completing approved career-related work-study programs)	55	4%
5 CFR 8.3 (promotion of a non–U.S. citizen serving overseas)	49	4%

SOURCE: DCPDS data provided by AFPC.

NOTES: To ensure that we were able to identify all potential hiring authorities being used, this sample includes all personnel, including part-time and temporary personnel as of January 2021. We show only the most widely used original hiring authorities (authorities used for at least 2–3 percent of the population). 14% of personnel had unspecified hiring authorities.

Special Salary Rates

As described in Chapter 2, special salary rates are often used to help fill positions in occupations for which there is difficulty recruiting talent by helping increase the compensation that can be offered beyond the standard pay associated with the GS pay levels. Engineering Technicians have nine special salary rate tables that apply to different locality pay areas in 2021.¹³² These special salary rates cover pay grades ranging from GS-05 through GS-15. The same special salary rate tables also cover a variety of other engineering occupations. The locality areas covered by these special salary rates tend to be for more remote locations, such as North Dakota, Montana, and Alaska. This is consistent with general concerns we heard about being able to recruit civilian personnel in general in some of the more remote locations. As noted in Chapter 2, there are limits on special salary rates, however, such that the minimum rate cannot exceed 30 percent of maximum rate for the pay grade and the maximum rate cannot exceed Level IV of the Executive Schedule (5 U.S.C 5305[a] and 5 CFR 530.304[a]). In a previous report,¹³³ we documented how these limitations can affect the ability of the DAF to pay more as GS grades increase.

Recruitment, Relocation, and Retention (3Rs) Incentives

Civilian personnel data show that the use of recruitment, relocation, and retention incentives is much less common for Engineering Technicians than for the other occupations reviewed for this study. Only one recruitment incentive was used in each of the past five years, and only two relocation incentives were used in the past five years, both in 2019. Finally, only seven retention incentives were used in the past five years, with five of those used in 2020. This may reflect a lack of needing to use these incentives for recruitment given that DAF representatives indicated these positions were not currently hard to fill.

Comparison of Air Force Pay with the Private Sector and Other Federal Agencies

In this section, we compare current and historical DAF pay for Engineering Technician personnel with civilians in this occupational series in other services, the rest of DoD, and across the federal government. We also conduct comparisons with non-federal government employees classified as engineering technicians (specifically, aerospace engineering technicians and electrical or electronics engineering technicians) or as computer network support specialists. We focus on these detailed occupations per guidance from the sponsor; however, separate analyses

¹³² See U.S. Office of Personnel Management, “2021 Index to Title 5 Special Rate Tables by Occupation,” webpage, undated.

¹³³ Groeber et al., 2021.

for these occupations are not available for comparisons with other federal agencies given data limitations. We conduct two types of comparisons:

1. **Workforce pay comparisons:** We rely on BLS data that provide estimates of average pay for this occupation at the U.S. workforce level, within key industries, and at specific localities around key DAF installations. These data also provide estimates of the 25th percentile, median, and 75th percentile of pay at the U.S. workforce level. We compare these pay statistics with analogous DAF pay from administrative records. The comparisons are high-level and are intended to provide a general sense of prevailing pay across workforces.
2. **Employee pay comparisons:** We draw on individual-level survey and administrative data to study differences in pay by age and education level. Within federal employment, we conduct further comparisons of employment and pay by pay plan. These pay comparisons of similar employees across different workforces therefore provide the basis for our pay recommendations for this occupation.

The workforce comparisons provide a broad sense of prevailing pay in this occupation, while the employee-level analysis allows for comparisons of pay for similarly aged employees with similar educational attainment, illustrating how different agencies differently compensate Engineer Technicians.

Workforce Pay Comparisons

To conduct comparisons to the U.S. workforce, we again used BLS OEWS data. As discussed in Chapter 3 and Appendix A, these data are based on surveys of employers, preventing any analyses by employee characteristics. Nevertheless, these BLS OEWS data illustrate prevailing patterns of pay at national and subnational levels. We first provide comparisons for the broad occupation category of “Engineering Technicians, Except Drafters,” SOC code 17-3020, which includes

Aerospace, civil, electrical/electronic, electro-mechanical, environmental, industrial, mechanical, surveying/mapping, and calibration engineering technicians.¹³⁴

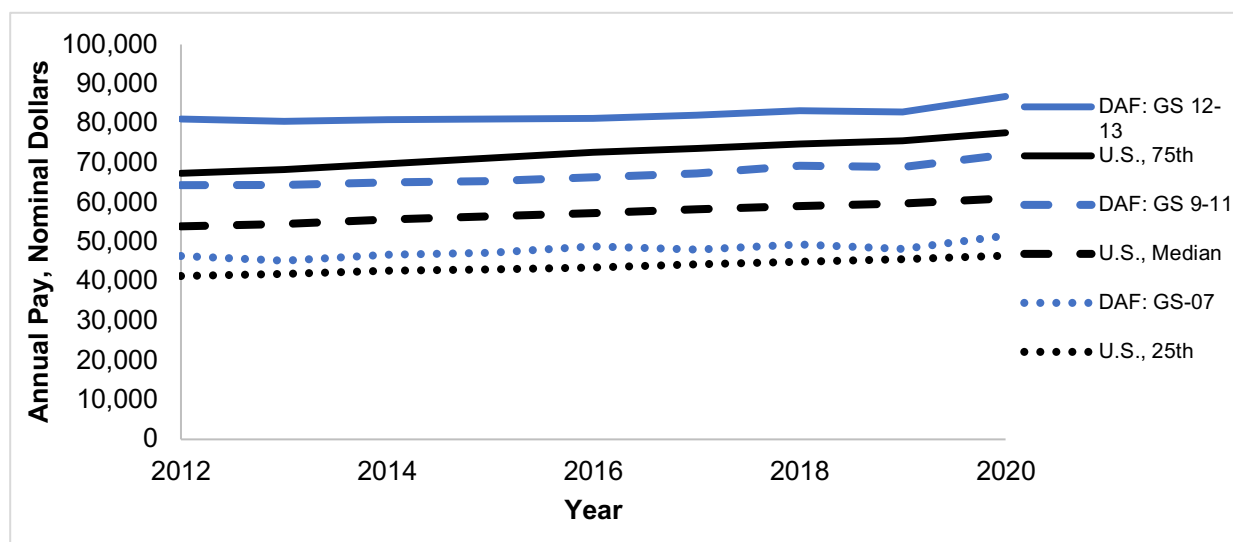
In May 2020, the BLS reported over 419,620 non-self-employed individuals work in this occupation across all industries and the federal government, with a mean annual salary of \$63,740.

Pay for DAF Engineering Technicians Is Competitive with the Broader U.S. Workforce

The BLS provides occupation-specific data not just on employment and average wages, but also on annual earnings at select points in the earnings distribution. Figure 6.2 compares three of these measures—annual earnings at the 25th percentile, median, and 75th percentile—with average DAF pay in three pay grade groupings: GS-07, GS-9–11, and GS-12–13.

¹³⁴ U.S. Bureau of Labor Statistics, 2021.

Figure 6.2. Average Annual DAF Pay for Engineering Technicians, by Pay Grade Versus Percentiles of Annual Pay for All Full-Time Engineering Technicians in U.S. Workforce



NOTE: “U.S.” series corresponds to percentiles from BLS full-time annual pay measures, representing all non-self-employed employees in that occupation in the United States. “DAF” series is from FedScope data.

Figure 6.2 shows that DAF pay for Engineering Technicians is broadly competitive with pay in the U.S. workforce from 2012 to 2020. In 2020, DAF pay for GS-07 Engineering Technicians averaged just over \$51,000, compared with \$46,500 for the 25th percentile of the U.S. pay distribution. This difference was even wider higher up in the pay distribution: GS-9–11 DAF Engineering Technicians were paid, on average, \$72,075, whereas median pay was \$61,000. GS-12–13 DAF Engineering Technicians were paid nearly \$87,000, compared to \$77,610 for the 75th percentile of the U.S. pay distribution for this occupation.

However, “Engineering Technicians” is a broad category in the BLS OEWS data. In consultation with the sponsor, we identified three detailed occupations that reflect particular DAF recruitment goals, two of which are more detailed occupations within 17-3020 relevant to DAF’s demands; a third detailed occupation outside the BLS’s Engineering Technicians category that nevertheless is related to the specific skills for DAF Engineering Technicians:

Electrical and Electronic Engineering Technologists and Technicians (SOC Code 17-3023): Apply electrical and electronic theory and related knowledge, usually under the direction of engineering staff, to design, build, repair, adjust, and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering staff in making engineering design decisions.¹³⁵

Aerospace Engineering and Operations Technologists and Technicians (SOC Code 17-3021): Operate, install, adjust, and maintain integrated computer/communications systems, consoles, simulators, and other data

¹³⁵ White House, Office of Budget and Management, 2018, p. 59.

acquisition, test, and measurement instruments and equipment, which are used to launch, track, position, and evaluate air and space vehicles. May record and interpret test data.¹³⁶

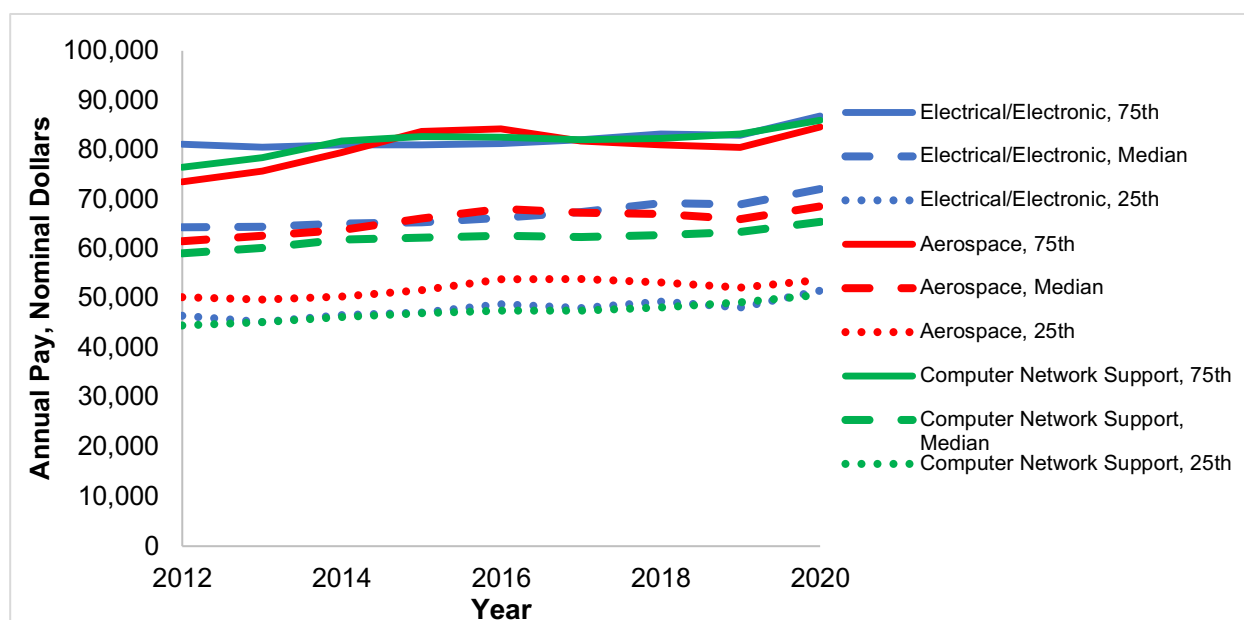
Computer Network Support Specialists (SOC Code 15-1231): Analyze, test, troubleshoot, and evaluate existing network systems, such as local area networks (LAN), wide area networks (WAN), cloud networks, servers, and other data communications networks. Perform network maintenance to ensure networks operate correctly with minimal interruption.¹³⁷

Other chapters focused on a specific detailed occupation; because of the broader nature of the Engineering Technician occupation, we provide additional information on prevailing pay for these three specialties within this broad occupational category. Figure 6.3 provides statistics on 25th percentile, median, and 75th percentile pay for these three specialties. Each of these occupations receives higher pay at each of these points in the pay distribution than the broader Engineering Technician occupational category from Figure 6.2. The 75th percentile of pay for this broader category was \$77,610 in 2020, whereas 75th percentile pay was as high as \$86,796 in 2020 for Electrical and Electronics Engineering Technicians. Median pay ranged from \$65,450 for Computer Network Support Specialists to \$72,072 for Electrical and Electronics Engineering Technicians, in contrast to median pay for the broader category of \$61,000. In short, these specialties are paid more in the U.S. workforce than the broader category of Engineering Technician.

¹³⁶ White House, Office of Budget and Management, 2018, p. 59.

¹³⁷ White House, Office of Budget and Management, 2018, p. 47.

Figure 6.3. Average Annual Pay for U.S. Workforce, by Type of Engineering Technician, 2012–2020



NOTE: Pay series corresponds to percentiles from BLS full-time annual pay measures, representing all non-self-employed employees in that occupation in the United States.

DAF Pay Is Broadly Competitive with Engineering Technician Pay Across Four Industries

We note that these national-level statistics do not shed light on potential pay differences by industry. In Table 6.4, we provide comparisons between average pay for DAF Engineering Technician personnel and for the industries that account for the greatest share of employment of each of the detailed occupations described above.¹³⁸ On average, the DAF is broadly competitive with these other industries. Mean GS-9 pay exceeds overall average pay for the top four industries (Computer Systems Design and Related Services, Aerospace Product and Parts Manufacturing, Computer Network Support, and Telecommunications) that employ Electrical/Electronics Engineering Technicians, with Computer Systems Design and Related Services paying the most, on average. DAF GS-9 average pay also exceeds average pay in Aerospace Engineering Technicians' largest industries of employment, although the difference is narrower than for the Electrical/Electronics Engineering Technicians and narrowest for Aerospace Engineering Technicians working in Aerospace Product and Parts Manufacturing. Finally, Computer Network Support Specialists are paid more, on average, than the other

¹³⁸ Unlike the other chapters, we do not present locality specific comparisons for Engineering Technicians. OPM series and occupational titles do not allow us to narrow down our comparisons to which *type* of engineering tech is at each installation, and because our analyses show that the more specific types of technicians have pay in the BLS data that differs from the broader group, any differences in pay by locality could be because of actual pay differences for similar types of techs, or because the types of techs at each installation/locality differ.

occupations, with employees in the Telecommunications industry being paid more than the average DAF GS-9 pay.

Table 6.4. Pay Comparisons for Engineering Technicians and Computer Network Support, by Pay Grade, Industry, and Type of Technician, 2020

	Mean Annual Pay	Number of Employees
DAF Engineering Technicians		
GS-7	\$51,567	16
GS-9	\$72,075	816
GS-11–12	\$86,796	187
Electrical and Electronics Engineering Technicians		
Architectural, Engineering, and Related Services	\$64,980	15,830
Semiconductor and Other Electronic Component Manufacturing	\$64,470	12,110
Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	\$64,740	7,620
Computer Systems Design and Related Services	\$67,560	5,660
Aerospace Engineering Technicians		
Aerospace Product and Parts Manufacturing	\$70,820	4,220
Architectural, Engineering, and Related Services	\$67,990	2,580
Scientific Research and Development Services	\$68,360	1,400
Computer Systems Design and Related Services	\$70,760	1,110
Computer Network Support Specialists		
Computer Systems Design and Related Services	\$72,260	38,920
Telecommunications	\$77,510	22,360
Management of Companies and Enterprises	\$71,510	10,900

SOURCES: Industry statistics from BLS OEWS and DAF pay from AFPC civilian data files.

Employee Pay Comparisons

As discussed in previous chapters, the above comparisons do not take into account employee differences that may affect pay. Differences may arise solely because of differences in the experience or educational attainment of Engineering Technician personnel across federal agencies and the private sector. For example, if the DAF Engineering Technician workforce is older, on average, than in the private sector, we may expect their pay to be higher because of their greater experience. However, pay differences may also arise because of differences in pay structures themselves, such as the use of demonstration authorities or alternative personnel systems, for otherwise similar employees. In the next section, we compare pay for Engineering Technician employees at similar ages with similar educational attainment across the DAF, the other services, other federal agencies, and the private sector.

First, we examine differences in pay by age and education for this occupation between the DAF and the private sector. In contrast to the above analyses, we rely on ACS data that allow us to observe these employee-level characteristics and adjust self-reported earnings using the data and methodology discussed in Appendix A. However, the ACS groups all Engineering Technicians, with the exception of Electrical/Electronics Engineering Technicians. Furthermore, our educational categories differ in this chapter, since 79 percent of DAF Engineering Technicians and 82–84 percent of private sector Engineering Technicians have less than a four-year undergraduate degree. We therefore present comparisons of Engineering Technicians with this level of educational attainment (referred to as “Less Than BA”) and those with a four-year undergraduate degree (referred to as “BA”). We do not compare those with graduate-level degrees since they account for a small fraction of the Engineering Technician workforce (i.e., less than 3 percent of the private sector and less than 5 percent of the DAF workforce).

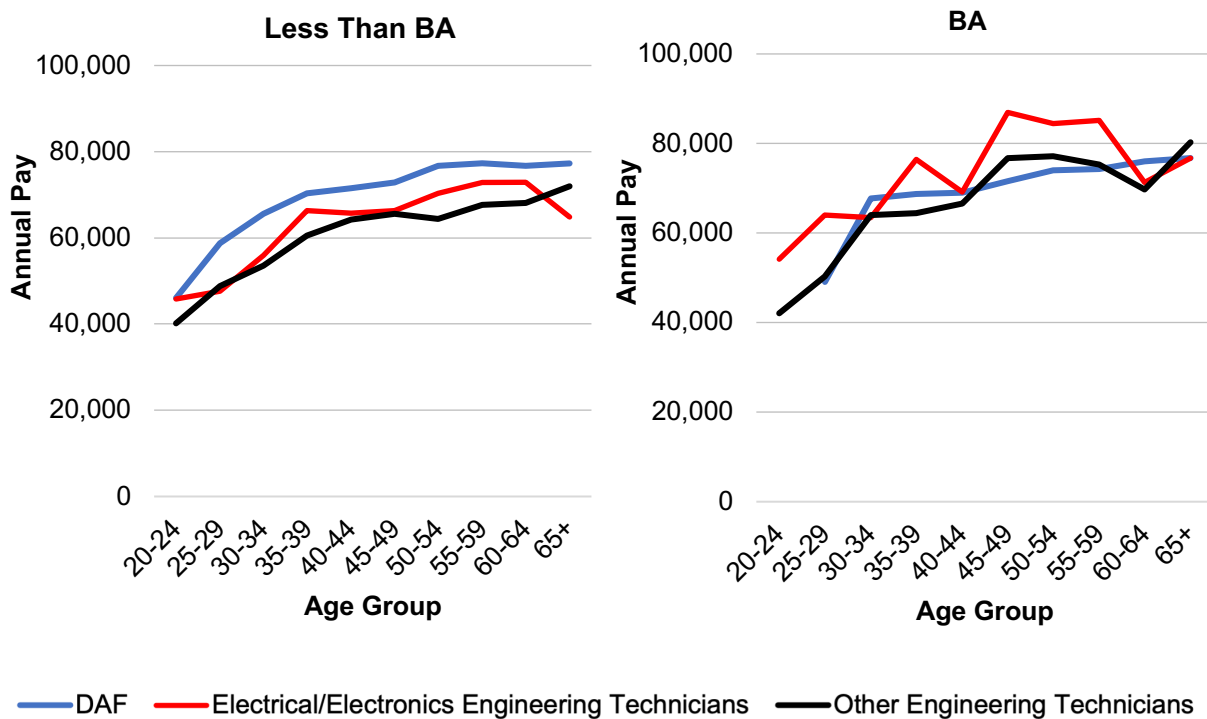
The DAF Pays More Than the Private Sector for Less Educated Personnel and Pays Less for Personnel with a BA

Figure 6.4 presents age-specific average pay for DAF Engineering Technicians, private-sector Electrical/Electronics Engineering Technicians, and private-sector Engineering Technicians of other specialties (“Other Engineering Technicians”) by education. The first panel of the figures shows all with less than a BA. DAF pay for this occupational series is highly competitive. The DAF statistically significantly exceeds the private sector in pay across the majority of age groups under study; although the DAF only matches average private-sector pay for Electrical/Electronics Engineering Technicians in their early 20s, average pay is over \$12,000 higher per year for Other Engineering Technicians in their early 50s.

The second panel of Figure 6.4 presents these comparisons for Engineering Technicians with BAs. Here, DAF pay tends to lag behind that of the private sector, in particular, for Electrical/Electronics Engineering Technicians in their late 40s and 50s, although these differences are only marginally statistically significant. This pattern is consistent with the broader pay advantage that federal employment has over private-sector employment for those with less educational attainment and the disadvantage for those with more educational attainment.¹³⁹ Therefore, the DAF may face challenges with regard to pay for recruiting Engineering Technicians with college degrees.

¹³⁹ Congressional Budget Office, *Comparing the Compensation of Federal and Private-Sector Employees, 2011 to 2015*, April 2017.

Figure 6.4. Average Annual Pay (\$), DAF Versus Private Sector, Engineering Technicians, by Education



SOURCES: Pay for the DAF calculated from FedScope data; private-sector Engineering Technician pay from the ACS.

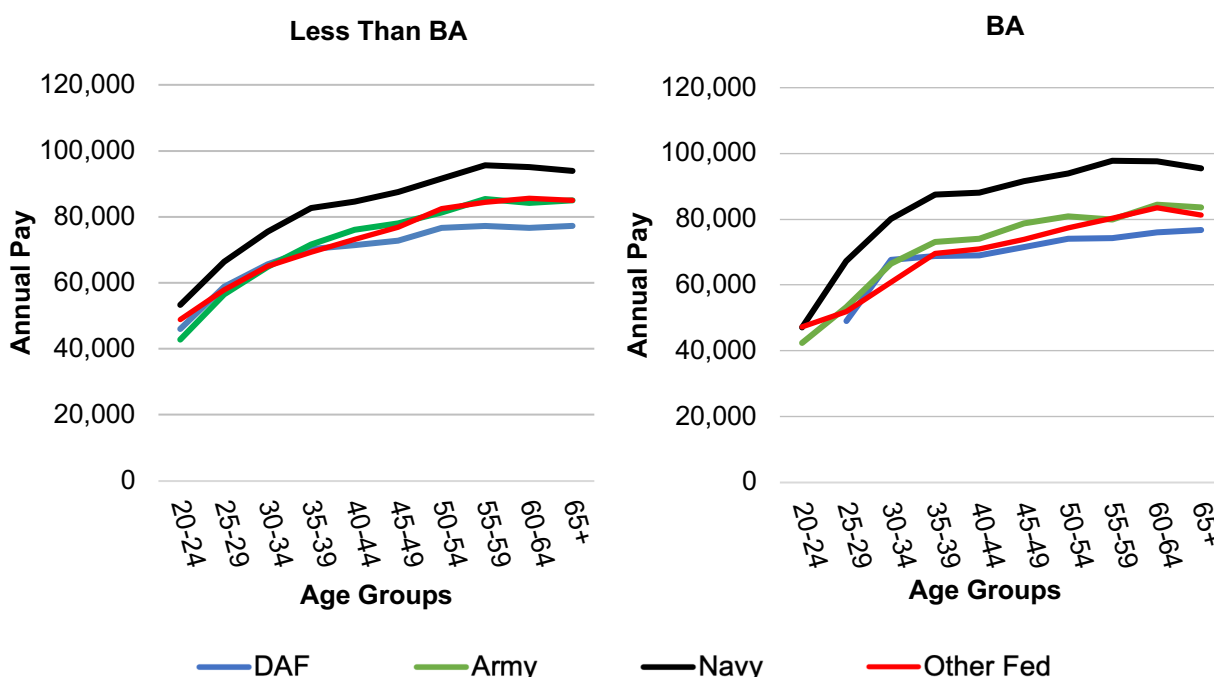
NOTE: Sampling variability introduces additional variation into the ACS estimates; Appendix E depicts the 95% confidence intervals around these estimated series.

The Pay Gap Between the DAF and Other Services/Agencies Is Due to Differences in Use of Demonstration Authorities and Fewer High-Pay Grade GS Personnel

The two panels of Figure 6.5 present parallel analyses that draw on FedScope data to compare pay by age and education within the federal government. We observe a similar pattern as in the previous chapters: DAF pay at younger ages is broadly competitive with the rest of DoD and the federal government, with the exception of the Navy. But at older ages, DAF pay lags behind the rest and falls substantially behind Navy pay. This pattern holds across both those with and without a four-year undergraduate degree.

Additional analyses, shown in Appendix E, indicate that these pay differences are driven by differences in the use of demonstration authorities across services, which provide a more flexible pay band structure (see discussion in Chapter 2). Namely, the Navy is substantially more likely to use these authorities than the other services, and the DAF is the least likely to use these authorities. Because pay in these authorities exceeds that of GS pay and pay within these pay bands is even higher in the Navy than in the DAF, especially at older ages, there is the resulting overall difference in pay observed across these figures.

Figure 6.5. Average Annual Pay (\$), by Service, or Agency, Engineering Technician Personnel, Less Than BA or BA, 2017–2020



SOURCE: Pay for the DAF and other services calculated from FedScope data.

Conclusion

The DAF has a total of 1,155 full-time civilian personnel in the Engineering Technical occupational series, representing roughly 8 percent of all personnel within the occupational series in the federal government. The majority of current DAF Engineering Technicians are prior or retired military and tend to be older, with roughly 51 percent of personnel above the age of 55. Close to 90 percent of Engineering Technicians in DAF fall under the traditional GS system. Although we did not hear specific concerns regarding hiring and employing Engineering Technicians at the time of this study, following guidance from our project sponsor and with the goal of ensuring that the DAF is able to hire and employ top technical talent from across the spectrum, especially in the future, we included Engineering Technicians as one of the occupational series in our review.

DAF Engineering Technicians have multiple special salary rate tables that cover a number of more remote locality pay areas, but very few recruiting, relocation, and retention incentives have been used over the past five years. Our pay comparisons show that the DAF is broadly competitive with the private sector in Engineering Technician pay but lags behind the Navy at all ages examined and lags behind the Army and the rest of the federal government when looking at

older employees; this is largely due to greater use of demonstration projects and alternative personnel systems and fewer high-pay grade GS personnel in the DAF.

Chapter 7. Airfield Manager

Overview of the Occupation

Airfield Managers do not have their own occupational series. Instead, they fall under the Transportations Operations (2150) occupational series. The Airfield Manager role is defined as follows:

The AFM [Airfield Manager] is responsible for the overall management of AM [Airfield Management] facilities and services to provide a safe, efficient, and effective airfield environment for aircraft operations. The AFM also provides direct supervision and management of all personnel working in AM. Certain situations (e.g., exercises, nuclear weapons or aircraft movements.) require the AFM to be designated as a trusted agent.¹⁴⁰

As of January 2021, there were 52 Airfield Manager positions across the DAF.¹⁴¹ Given the nature of the position, Airfield Manager is not a common position in the rest of the federal government, with the exception of the DoD sister services. According to data from the Defense Manpower Data Center (DMDC), as of 2020, there were 42 civilians employed in Airfield Manager-type positions in the Army and 24 in the Department of the Navy.¹⁴²

In the DAF, the largest concentration of Airfield Managers is in Air Mobility Command. Airfield Managers are also found in Air Combat Command, Air Education and Training Command, Air Force Global Strike Command, Air Force Reserve Command, Air National Guard, Pacific Air Forces, and the U.S. Space Force. However, the number within these commands is less than ten positions each.¹⁴³ Given the nature of the responsibilities of an Airfield Manager, these positions are only at locations with an airfield, and most locations only have one or two civilian Airfield Manager positions. Thus, Airfield Managers are spread across DAF locations.

¹⁴⁰ Air Force Manual 13-204, 2020, p. 10.

¹⁴¹ Because Airfield Managers do not have a specific occupational series, the career field manager reached out to individual MAJCOMS in DAF to request data on civilian Airfield Manager positions for our study. The numbers represented in this chapter are based on the data provided by the career field management team.

¹⁴² Based on input from the DAF career field manager, we used the following duty titles to use as comparisons for the DoD sister services: Airfield Managers, Supervisory Airfield Managers, and Supervisory Airfield Operations Managers in the Army and Airfield Managers and Supervisory Airfield Management Specialists in the Navy.

¹⁴³ We do not provide a similar table as in other chapters given that all MAJCOMS, with the exception of Air Mobility Command, have fewer than ten positions.

*Personnel Characteristics*¹⁴⁴

Although there is no academic educational requirement for the Airfield Manager position, roughly 31 percent of personnel in Airfield Manager positions hold a terminal high school degree, 21 percent have some college or an associate's degree, and 48 percent have a bachelor's degree or master's degree. Roughly 98 percent of personnel are retired military or prior military service (79 percent are retired Air Force enlisted members). The high number of veterans in these positions is due to the training and experience requirements associated with the position, making the best candidates prior military service members who already served in a similar position. Forty-seven percent of personnel are above the age of 55.¹⁴⁵ Appendix D provides more detail on the demographic characteristics of DAF Airfield Managers.

In terms of pay grade, unlike some of the other occupations included in this report, almost all Airfield Managers are in GS-11 or GS-12 positions, with the majority (70 percent) in GS-12 positions. Less than 20 percent of Airfield Managers are under the AcqDemo pay system in NH-03 positions.

Barriers to Recruiting and Hiring

At the time of this study, the overall Transportations Operations (2150) occupational series that Airfield Managers are under was not included in the DAF's list of mission critical occupations. However, given their critical role in Airfield Management for DAF and the technical expertise and training required for the Airfield Manager position, this is an occupation the DAF wants to monitor. In addition, Airfield Manager was noted as a challenging position to recruit for certain MAJCOMs (e.g., Air Force Reserve Command and Pacific Air Forces) and in certain locations. For example, representatives indicated that remote locations or locations with a higher cost of living can be unattractive to candidates. We note that this is similar to concerns for other occupations as well, indicating that there are more challenges for recruiting to certain locations, regardless of the occupation.

In addition to challenges related to specific locations, we were told that not having a specific occupational series for Airfield Managers can be difficult because the Transportation Operations (2150) series is very broad. According to the OPM *Handbook of Occupational Groups and Families* (p. 120), the Transportation Operations series covers "all classes of positions the duties of which are to administer, supervise, or perform work involving the planning, directing, or operation of rail, motor, air, or water transportation systems and services, including positions

¹⁴⁴ Data in this section are based on 43 personnel in Airfield Manager positions in the DAF civilian personnel data files; we had missing data for nine additional personnel, with the majority of those missing in the Air National Guard.

¹⁴⁵ Because there is not a specific occupational series for Airfield Managers, we do not have specific data on retirement eligibility. However, AFPC records show that of personnel in the 2150 occupational series overall, 49 percent either are currently or will be eligible for retirement within the next five years.

involving responsibility for operations of both transportation service and terminal facilities.” According to stakeholders we interviewed, this leads to nonstandardized titles, position descriptions, and vacancy announcements, which can confuse potential candidates. And this lack of standardization can result in candidates being referred to the position without proper Airfield Manager experience. For example, DAF policy requires that all Airfield Managers complete formal Airfield Manager School. Some candidates may have completed the course while on active duty and have the required expertise and experience. However, in other cases, we were told that candidates who do not have the required experience can be referred but are required to complete the course before they can fill the position (currently, candidates who do not have experience are required to complete the course within one year of their date of hire). This greatly extends the timeline to fill the position, and, in some cases, candidates have failed to complete the course, resulting in their termination and a position remaining unfilled. Specific minimum qualifications and training requirements for the position can be found in Air Force Manual 13-204, Volume 2, *Airfield Management*, July 22, 2020.

DAF representatives also mentioned concerns regarding compensation for this position, noting that they compete for talent with the DoD sister services, which have somewhat different requirements and responsibilities and can be of a higher grade compared to the DAF. We explore these compensation-related concerns later in the chapter.

Use of Hiring Authorities, Special Salary Rates, and Incentives

As described in Chapter 2, the DAF has various hiring flexibilities and incentives it can use to recruit and hire new talent. To better understand what tools the DAF is using and how the DAF is using these tools for employing talent, in the sections below, we provide an overview of hiring authorities, special salary rates, and the use of recruitment, relocation, and retention incentives for Airfield Managers.

Hiring Authorities

Unlike some of the other occupations in this report, Airfield Managers do not have DHA. With the large percentage of veterans in these positions, the vast majority of personnel have been appointed under various appointing authorities for veterans, with over 60 percent of personnel appointed through Pub. L. 106-117 Section 511 (Special Appointing Authorities for Veterans). All other appointing authorities were used for less than 10 percent of personnel in these positions (i.e., for only one to three positions total). Other appointment authorities used include delegated examining authority, reinstatement to a competitive service position for someone who was

previously employed under career or career conditional appointment (5 CFR 315.401), and transfer of career or career-conditional employees (5 CFR 315.501).¹⁴⁶

Special Salary Rates

As described in Chapter 2, special salary rates are often used to help fill positions in occupations for which there is difficulty recruiting talent by helping increase the compensation that can be offered beyond the standard pay associated with the GS pay levels. There are no special salary rate tables for personnel in the Transportations Operations (2150) occupational series that DAF Airfield Managers fall under.

Recruitment, Relocation, and Retention (3Rs) Incentives

As described in Chapter 2, one of the key tools the DAF has to help recruit and retain personnel are the 3R incentives. These are typically funded at the base or activity level, so funds come out of an overarching civilian personnel budget. Civilian personnel data show no recruitment, relocation, or retention incentives were used over the past five years for Airfield Managers.

Comparison of Air Force Pay with the Private Sector and Other Federal Agencies

In this section, we compare current and historical DAF pay for Airfield Managers with pay for similar positions in the sister services. We also conducted comparisons with non-federal government employees classified as Airfield Operations Specialists. We conducted two types of comparisons:

1. **Workforce pay comparisons:** We rely on BLS data that provide estimates of average pay for this occupation at the U.S. workforce level and within key industries. These data also provide estimates of the 25th percentile, median, and 75th percentile of pay at the U.S. workforce level. We compare these pay statistics with analogous DAF pay from administrative records.
2. **Employee pay comparisons:** Due to data limitations discussed below, our employee pay comparisons are limited to comparisons across DoD sister services.

We note that the results included in this section should be interpreted with some caution, however. The responsibilities of DAF Airfield Managers do not necessarily map directly onto the responsibilities of those in the sister services or occupations in the broader U.S. workforce. Instead, the below comparisons are intended to provide some initial insight into general pay comparisons. The workforce comparisons provide a broad sense of prevailing pay in this

¹⁴⁶ DCPDS data provided by AFPC. Data are based on 43 personnel in Airfield Manager positions in DAF civilian personnel data files; we had missing data for nine additional personnel, with the majority of those missing in the Air National Guard.

occupation, while the employee-level analysis allows for comparisons of pay for similarly aged employees with similar educational attainment, illustrating how the DAF compares to other services in compensating Airfield Managers.

Workforce Pay Comparisons

As with the other occupations included in this study, DAF representatives noted concerns regarding the competitiveness of compensation for Airfield Managers. However, pay comparisons for this occupation are more difficult than the others studied in this report. First, the OPM occupational series for this occupation includes other occupations that we do not include in our comparisons, rendering the FedScope data that we used widely in other chapters of this report inappropriate for similar analyses for this occupation. We therefore focus our analysis on two data sources: DMDC data, drawing on position titles to narrow comparisons across services within this occupational series, and BLS OEWS data on “Airfield Operations Specialists,” under SOC code 53-2022, described as follows:

Ensure the safe takeoff and landing of commercial and military aircraft. Duties include coordination between air-traffic control and maintenance personnel, dispatching, using airfield landing and navigational aids, implementing airfield safety procedures, monitoring and maintaining flight records, and applying knowledge of weather information.¹⁴⁷

As noted above, we acknowledge that these are not perfect comparisons, however, as the actual duties are not standardized by position title across DoD. Therefore, we suggest some caution when interpreting these results, given that the duties and qualifications across services may differ.

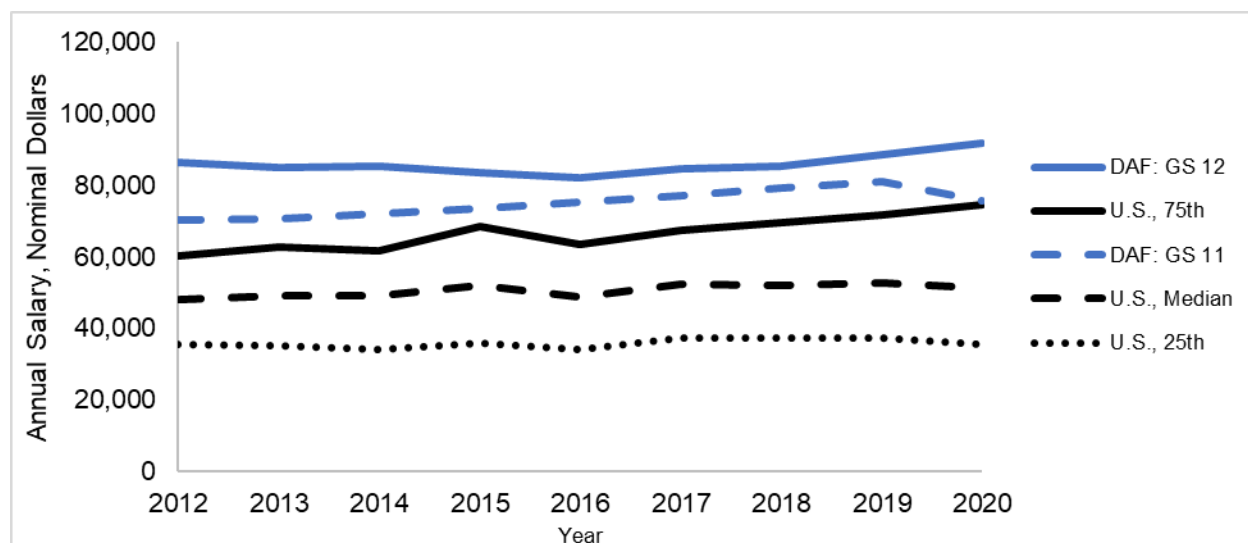
In addition, Airfield Manager is a small occupation, with just 10,590 civilian employees across the private sector and all of government in the BLS’s 2020 OEWS data, which includes both managers and non-managerial operations specialists. As a result, this occupation is aggregated with other occupations in the ACS, preventing the use of that dataset for conducting analogous comparisons as in other chapters of this report and for examining employee-level characteristics of this occupation in the U.S. workforce. The small workforce in this occupation also prevents detailed geographic analyses with the BLS OEWS data, since MSA-level statistics are not reported for confidentiality concerns when so few Airfield Operations Specialists (the SOC code for this occupation) are employed in a given area. Nevertheless, to the extent possible, we provide comparisons of DAF pay with U.S. workforce pay and with pay in specific industries and localities available from BLS OEWS data.

¹⁴⁷ U.S. Bureau of Labor Statistics, 2021.

The DAF Pays Airfield Managers Substantially More Than Airfield Operations Specialists, Nationally

Figure 7.1 shows pay comparisons between Airfield Manager personnel in the DAF and Airfield Operations Specialists in the U.S. workforce at different places in the pay distribution. Compared with U.S. workforce Airfield Operations Specialist pay, the DAF pays its Airfield Manager personnel substantially more. In 2020, GS-11 pay for Airfield Managers in the DAF averaged nearly \$76,000, compared with the U.S. median of just over \$51,000. Similarly sized differences prevailed between GS-12 Airfield Managers and Airfield Operations Specialists at the 75th percentile of U.S. pay. Although these differences could be due to underlying differences in the characteristics of these workforces (e.g., an older, more experienced DAF workforce), further workforce comparisons below also suggest that the job requirements and skill content of workers in this BLS occupation may not be directly comparable to DAF Airfield Manager personnel.

Figure 7.1. Average Annual DAF Pay for Airfield Manager Personnel, by Pay Grade Versus Percentiles of Annual Pay for All Full-Time Airfield Operations Specialists in U.S. Workforce



NOTE: "U.S." series corresponds to percentiles from BLS full-time annual pay measures, representing all non-self-employed employees in that occupation in the United States. "DAF" series is from FedScope data.

The DAF Pays Significantly More Than Industry Averages

Table 7.1 further compares DAF Airfield Manager personnel pay in 2020 by pay grade with pay for Airfield Operations Specialists by industry. The data reveal a similar pattern as in Figure 7.1: DAF pay for Airfield Manager personnel substantially exceeds average pay in industry. In particular, DAF pay for Airfield Managers is higher than average pay across all four industries that represent the largest employers of Airfield Operations Specialists, with Scheduled Air Transportation paying its Airfield Operations Specialists the most.

Table 7.1. Pay Comparisons for Airfield Managers and Airfield Operations Specialists, by Pay Grade and Industry, 2020

	Mean Annual Pay	Number of Employees
DAF: GS-11	\$75,685	<10
DAF: GS-12	\$91,644	32
Local Government	\$55,350	2,810
Support Activities for Air Transportation	\$49,250	2,520
Scheduled Air Transportation	\$60,650	2,390
Nonscheduled Air Transportation	\$56,170	920

SOURCES: Industry statistics from BLS OEWS, DAF pay from AFPC files.

As noted previously, the Airfield Operations Specialist code is not a perfect match to DAF Airfield Managers, and these substantial differences likely reflect that the responsibilities are qualitatively distinct from Airfield Operations Specialists, with DAF Airfield Managers having more managerial duties, which is why their pay is significantly higher. However, we note that, to the extent that there is overlap of knowledge, skills, and abilities between Airfield Manager personnel and Airfield Operations Specialists, the latter are paid substantially less and represent a potential pool for recruiting and training.

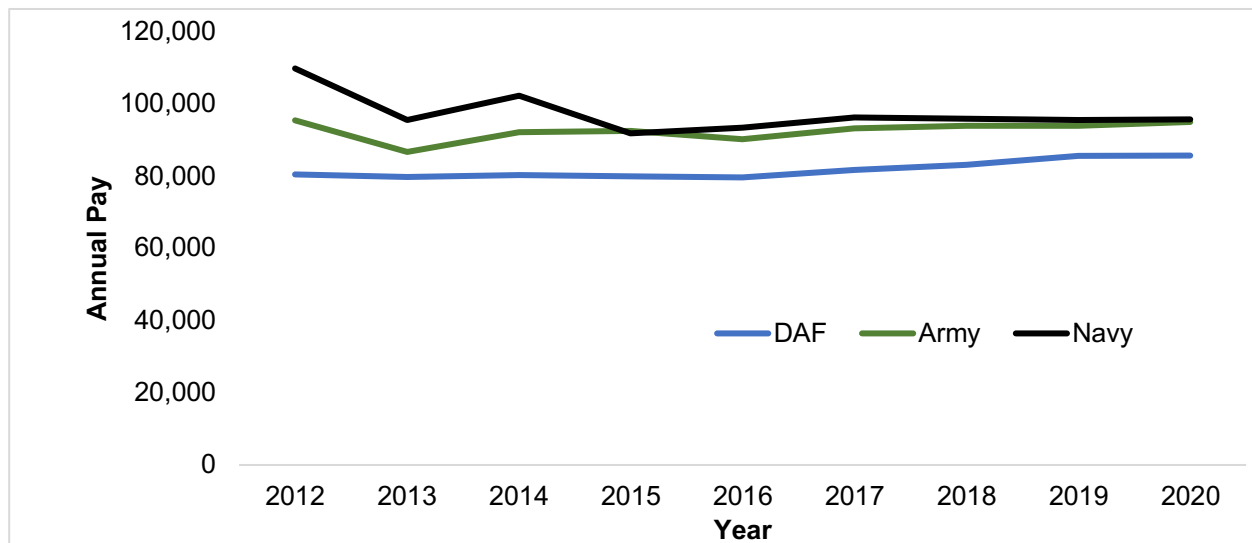
The DAF Pays Airfield Managers Less Than the Army and Navy

The DAF representatives we spoke with regarding Airfield Managers also mentioned concerns about competition with other services, with a perception that pay grades can be higher in the other services. To explore this concern, Figure 7.2 compares annual pay for Airfield Manager personnel across the services, drawing on DMDC data and focusing on Airfield Managers, Supervisory Airfield Managers, and Supervisory Airfield Operations Managers in the Army and Airfield Managers and Supervisory Airfield Management Specialists in the Navy.¹⁴⁸

We find that Army and Navy pay exceeds DAF pay for this occupation across all the years under study and by a substantial amount: in 2020, DAF pay averaged \$85,764 versus \$94,996 for the Army and \$95,849 for the Navy.

¹⁴⁸ These duty titles as comparisons across the services were based on input from the DAF career field management team.

Figure 7.2. Average Annual Pay (\$), Airfield Managers, by Service and Year



SOURCES: RAND calculations of Army and Navy pay from DMDC data and of DAF pay from AFPC files.

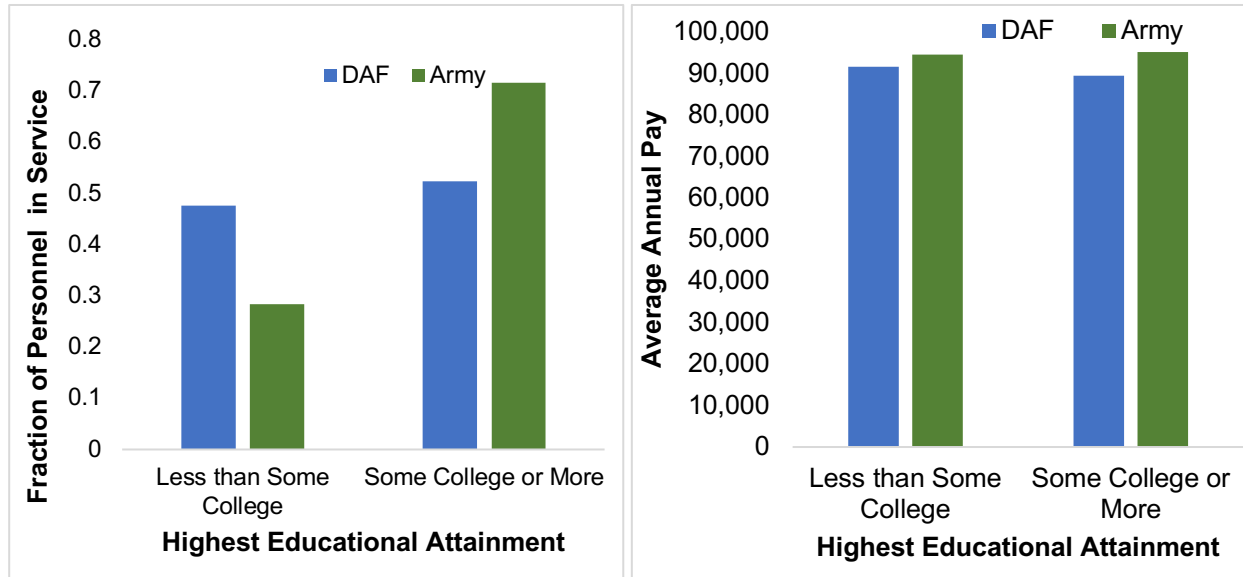
Employee Pay Comparisons

The overall differences shown above may be driven by differences in average characteristics of the personnel across services. In the following figures, we explore two such possible explanations: (1) that Army Airfield Manager personnel are more likely to have higher educational attainment and (2) that these personnel are more likely to be late career. Both would imply that overall Army pay would exceed DAF pay but that this difference is not reflective of the difference in prospective pay for a given employee.¹⁴⁹

As the first panel of Figure 7.3 shows, while there is no mandatory degree requirement for this occupational series, Army Airfield Manager personnel are more likely to have at least some college education: 72 percent of Army Airfield Manager personnel with the target duty titles have at least some college attainment, whereas only 52 percent of DAF Airfield Manager personnel do. However, the second panel of Figure 7.3 shows that Army pay exceeds DAF pay for both levels of educational attainment.

¹⁴⁹ DAF representatives also noted that sister services may have different requirements and responsibilities for Airfield Manager-type positions that may influence the pay grade positions, which are classified in the service. We were not able to make those types of position level responsibility and pay comparisons. Furthermore, there were only 24 Navy “Airfield Manager”-equivalent positions in 2020; therefore, limited observations prevent meaningful comparisons with the Navy for calculations other than overall average pay. We limit our comparisons between the DAF and the Army, for which there are nearly twice as many positions for each, for the rest of this chapter accordingly.

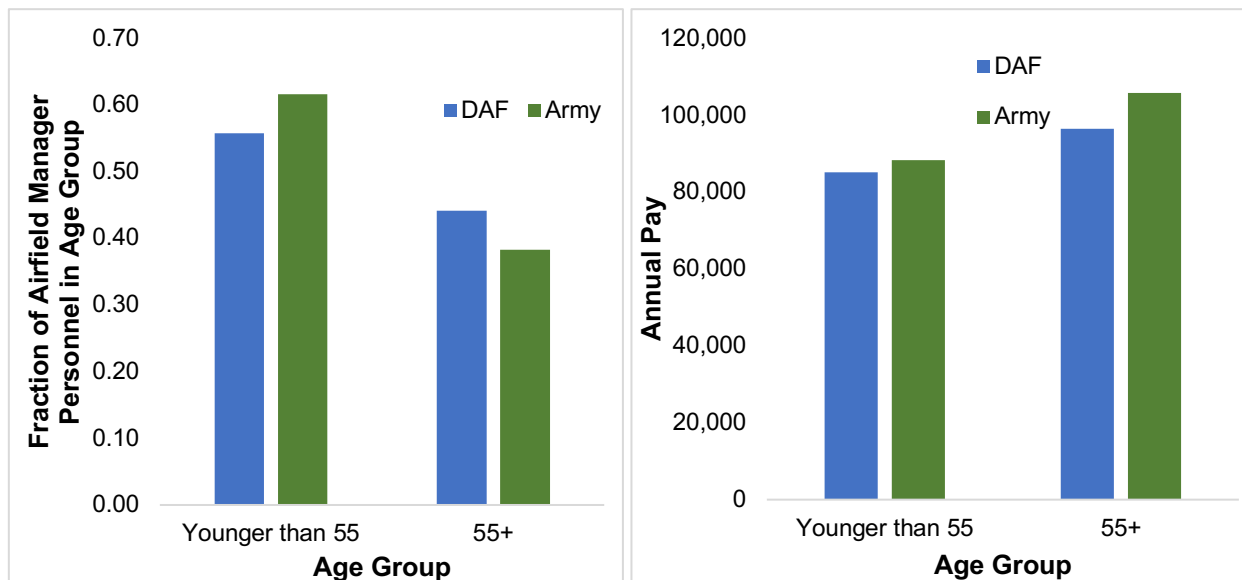
Figure 7.3. Share of Airfield Manager Personnel, by Educational Attainment and Salary, 2020



SOURCES: RAND calculations of Army pay from DMDC data and of DAF pay from AFPC files.

Figure 7.4 provides similar comparisons by age group: In the first panel, we see that DAF Airfield Manager personnel are only slightly less likely than Airfield Manager personnel in the Army to be under the age of 55, but the second panel shows that Army pay exceeds DAF pay within both age groups. Therefore, the educational or age composition alone cannot account for Army's higher pay for this occupation compared to the DAF.

Figure 7.4. Airfield Managers, by Service and Age Group, 2020



SOURCES: RAND calculations of Army pay from DMDC data and of DAF pay from AFPC files.

Finally, we examine another possible source of competition between the DAF and other services: Airfield Managers in other services may be employed at higher pay grades. Table 7.2 shows that the Army has over 40 percent of personnel with the Airfield Manager duty titles focused on for this study in pay grades of GS-13 or higher compared with the DAF, in which the majority of personnel are in the GS-12 pay grade.

As we noted earlier in this section, however, we conducted these pay comparisons using duty titles that may not directly correspond across the services. Therefore, some caution should still be used when interpreting these results. Future studies would benefit from doing a closer examination of pay differences based on position responsibilities. That level of analysis was unfortunately beyond the scope of this study.

Table 7.2. Distribution of Airfield Manager Personnel, by Pay Grade and Service, 2020

GS Grade	Percentage of DAF Airfield Managers	Percentage of Army Airfield Managers
Lower than GS 11	0.0%	28.3%
GS 11	<20%	<10%
GS 12	69.8%	25.0%
GS 13 or higher ^a	<20%	41.7%

^a DAF personnel in the NH-03 pay band are listed here as being in the GS-13 category or higher, but we note that NH-03 could also be equivalent to a GS-12. Sample size for the DAF is 43, due to missing data. We do not provide exact percentages for those cells that contain fewer than ten people.

Conclusion

The DAF has a total of 52 full-time civilian Airfield Managers. DAF personnel in these positions are 98 percent retired military or prior military. Eighty-six percent of Airfield Managers fall under the traditional GS system. Key challenges highlighted by DAF representatives for recruiting and hiring Airfield Managers include the lack of a specific occupational series, difficulties in hiring in more remote locations, and competition with the sister services for talent.

DAF Airfield Managers do not have DHA or special salary rates. Data also indicate that no recruitment, relocation, or retention incentives have been used in the past five years. Although our pay comparisons should be interpreted with some caution given the challenge of directly comparing Airfield Managers across the services, data suggest that the Army pays its Airfield managers at a higher rate than the DAF, predominantly because of positions in higher pay grades.

Chapter 8. Nurse

Overview of the Occupation

The OPM *Handbook of Occupational Groups and Families* describes the Nurse (0610) occupational series as positions that

involve providing care to patients in hospitals, clinics, occupational health units, homes, schools and communities; administering anesthetic agents and supportive treatments to patients undergoing surgery or other medical procedures; promoting better health practices; teaching; performing research in one or more phases of the field of nursing; or consulting and advising nurses who provide direct care to patients.¹⁵⁰

As of January 2021, civilian personnel records indicate that there are 852 full-time civilian personnel in the Nurse occupational series within the DAF. This represents less than 1 percent of all personnel within the occupational series in the federal government, with FedScope data indicating that there are 94,739 Nurses across the federal government.¹⁵¹ As Table 8.1 shows, Nurses are spread out across DAF organizations, with the largest concentrations of Nurses under Air Education and Training Command (24 percent) and AFMC (23 percent). As shown in Figure 8.1, personnel in the Nurse series are also fairly dispersed across locations, with no single location having more than 10 percent of personnel.

¹⁵⁰ U.S. Office of Personnel Management, 2018, p. 55.

¹⁵¹ U.S. Office of Personnel Management, 2021. We did not have access to January FedScope data, so we used March 2021 data.

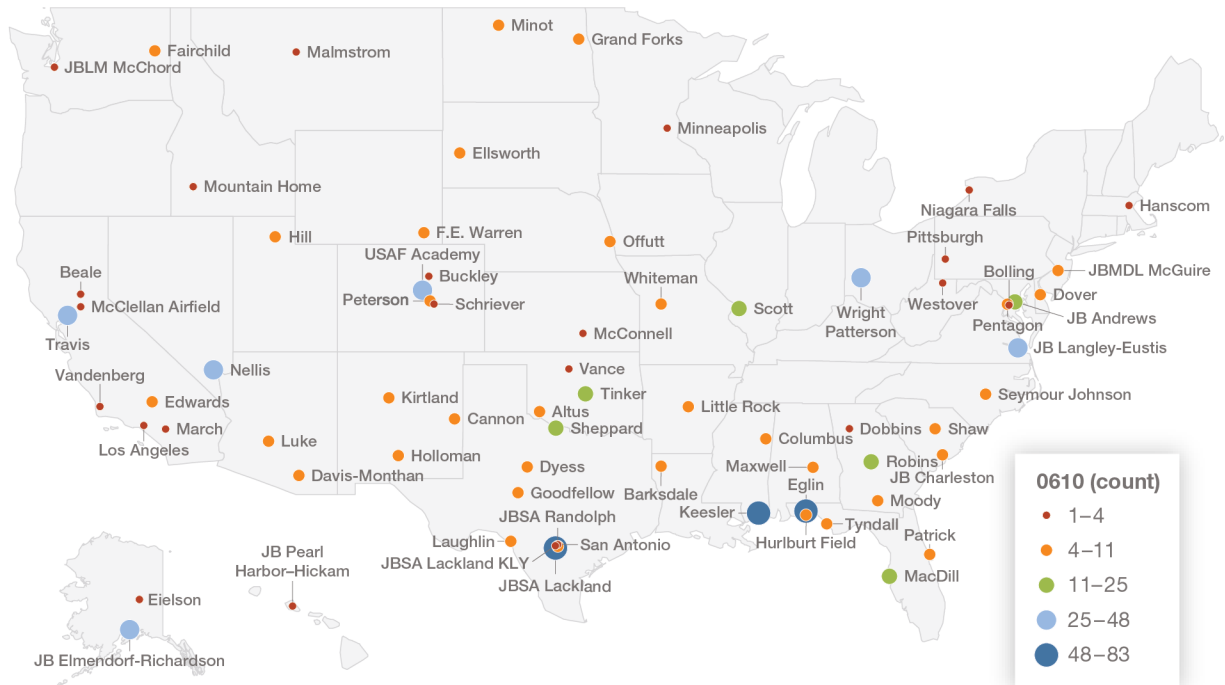
Table 8.1. Nurses, by Air Force Major Commands and Other Organizations

MAJCOM and Other Organizations	Number of Civilian Personnel	Percentage of Total Civilian Personnel
Air Combat Command	134	16%
Air Education and Training Command	200	24%
Air Force Global Strike Command	47	6%
Air Force Materiel Command	192	23%
Air Mobility Command	115	14%
Headquarters, Air Force Reserve Command	16	2%
Pacific Air Forces	35	4%
U.S. Space Force	31	4%
Special Operations Command	14	2%
U.S. Air Forces, Europe	11	1%
Other organization	57	7%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: Organizations included in the “Other organization” category include Air Force MAJCOM sub-agencies and combatant commands. Column may not total to 100 percent because of rounding.

Figure 8.1. Location of DAF Nurses Across the United States



SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Personnel Characteristics

OPM educational requirements state that “a graduate or higher level degree, bachelor’s degree, associate degree, or diploma from an accredited professional nursing educational program is required” for personnel in the Nurse occupational series.¹⁵² According to DAF civilian personnel data, roughly 5 percent of personnel have a high school degree or some college but no degree, 19 percent have an associate’s degree, 57 percent have a bachelor’s degree, 18 percent have a master’s degree, and 1 percent hold a Ph.D. The majority of personnel (66 percent) are non-prior service. AFPC records show that 36 percent of personnel either are currently or will be eligible for retirement within the next five years. Appendix D provides more detail on the demographic characteristics of personnel in the Nurse occupational series.

Table 8.2 shows the distribution of DAF Nurses across pay grades. As the table shows, 86 percent of all DAF Nurses fall under the GS (and GG equivalent) pay scale, with the majority of Nurses holding GS-11 positions (70 percent). Thirteen percent of Nurses are under the AcqDemo pay system (NH positions), which provides more flexible pay banding. Less than 1 percent of Nurses are under AFRLs Lab Demo pay system (DR positions).

Table 8.2. DAF Nurses, by Pay Grade

Pay Grade	Number of Civilian Personnel	Percentage of Total Civilian Personnel^a
GS-09	35	4%
GS-10	30	4%
GS-11	593	70%
GS-12	69	8%
GS-13	<10	<1%
NH-02 (GS-5-11 equiv.)	70	8%
NH-03 (GS-11-13 equiv.)	38	5%
DR-02 (GS-12-13 equiv.)	<10	<1%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: NH pay scale is for the AcqDemo, and DR pay scale is for the Lab Demo.

^a There were also a very small number of personnel who were under a specialized pay plan not included.

Barriers to Recruiting and Hiring

At the time of this study, the Nurse occupational series was not included on the DAF’s list of mission critical occupations. The sponsor requested that Nurses be included as part of our review due to the technical skills required and to ensure that any potential barriers to hiring and employing personnel in the series were identified prior to a transition of oversight of Nurses to

¹⁵² For details on educational requirements, see U.S. Office of Personnel Management, “Nursing Series, 0610: Individual Occupational Requirements,” webpage, undated.

the Defense Health Agency. Approximately 90 percent or more of DAF Nurses are expected to transition under the authority of the Defense Health Agency in response to the 2017 NDAA (Section 702), which requires that the Director of the Defense Health Agency take responsibility for military medical treatment facilities. We were told that this transition is expected to be finalized by 2023.¹⁵³ According to BLS data, employment among Nurses across the U.S. workforce is expected to increase by 9 percent between 2020 and 2030 (consistent with expected average growth for all occupations).¹⁵⁴ There was no discussion with interviewed subject matter experts regarding the impact of COVID-19 on recruitment of Nurses.

To better understand perceived challenges in recruiting and hiring top talent in the Nurse occupational series, we held discussions with MAJCOM representatives, the career field manager, and AFPC's talent acquisition team. Key challenges raised in these interviews include concerns about lower compensation relative to the private sector and lower pay grades relative to the sister services, experience and licensing requirements, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level.

In terms of compensation, interviewees commented that Nursing is a highly competitive market in which the DAF competes with civilian health care facilities that have wider flexibility in what they pay. In certain locations, the DAF also competes with the sister services and the VA, which interviewees said has higher pay grades for the same work. Although other medical occupational series have more flexibility with pay (similar to AcqDemo or Lab Demo) through the Physician and Dentist Pay Plan, in which a pay setting worksheet that accounts for local salary and other factors is used to set the salary, Nursing positions are not currently part of this pay system. We explore the extent to which there is a gap in compensation compared with the private sector, the sister services, and other federal agencies in a later section of this chapter.

More than one interviewee also mentioned challenges in recruiting Nurses due to experience and licensing requirements. Although not an OPM requirement, the level at which the DAF recruits Nurses requires that they have finished their education, have licenses that allow them to practice independently, and have at least one year or more of experience in the private sector. According to recruiting representatives, this is in contrast to the private sector, which largely recruits candidates directly from schools as they graduate. We were told that these requirements can even inhibit the DAF's ability to hire back its own personnel who seek out higher degrees. For example, we were told that someone who is a licensed practical nurse or has an associate degree in nursing and then receives their bachelor of science in nursing would not be able to be hired directly back into the DAF using their higher degree, because the pay grades at which the DAF tends to hire Nurses require experience in addition to a degree. Such Nurses would first have to gain experience in the private sector before returning to a career in the DAF, which can lead to a loss of talent.

¹⁵³ Upon this transition, recruiting and hiring of Nurses will be under the oversight of the Defense Health Agency.

¹⁵⁴ U.S. Bureau of Labor Statistics, 2021.

Similar to challenges already described for other occupational series included in this report, representatives noted lengthy hiring timelines and lack of effective marketing and recruiting at the local level as additional barriers to finding top talent. In particular, because Nurses have DHA, hiring managers have more flexibility in hiring talent on the spot. However, similar to other occupations, we were told that they often find that hiring managers do not always know how to use the DHA to its fullest extent and that there is little proactive marketing or recruiting that takes place.

Use of Hiring Authorities, Special Salary Rates, and Incentives

As described in Chapter 2, the DAF has various hiring flexibilities and incentives it can use to recruit and hire new talent. To better understand what tools the DAF is using and how the DAF is using these tools for employing talent, in the sections below, we provide an overview of hiring authorities, special salary rates, and the use of recruitment, relocation, and retention incentives for Nurses.

Hiring Authorities

Table 8.3 shows the most widely used original hiring authorities for DAF Nurses (i.e., used for at least 2–3 percent of the population). The Nurse occupational series currently has DHA, and, as shown in the table, this is the primary authority under which personnel in this series are brought into the DAF. Representatives we interviewed told us that DHA is very helpful in bringing on talent and have allowed them to shorten hiring timelines to some extent. However, as noted in the section above, representatives still noted concerns regarding hiring managers’ knowledge of how to use DHA to its fullest and proactively recruit candidates. Only 3 percent of Nurses were hired using delegated examining authority. A small percentage have also been hired through special veteran hiring authorities.

Table 8.3. Most Widely Used Original Hiring Authorities for DAF Nurses

Original Hiring Authority	Number of Civilian Personnel	Percentage of Total Civilian Personnel
DHA (GW001 MED)	517	60%
DHA (unspecified)	173	20%
OPM delegated examining (unspecified)	24	3%
Pub. L. 106-117 Section 511 (Special Appointing Authorities for Veterans)	20	2%

SOURCE: DCPDS data provided by AFPC.

NOTES: To ensure that we were able to identify all potential hiring authorities being used, this sample includes all personnel, including part-time and temporary personnel as of January 2021. We show only the most widely used original hiring authorities (authorities used for at least 2–3 percent of the population). 4% of personnel had unspecified hiring authorities.

Special Salary Rates

As described in Chapter 2, special salary rates are often used to help fill positions in occupations where there is difficulty recruiting talent by helping increase the compensation that can be offered beyond the standard pay associated with the GS pay levels. For the Nurse (0610) occupational series, there are 20 special salary rate tables. There is an additional table for Nurse Educator and an additional 23 special salary rate tables specifically for Nurse Practitioners, which also fall under the 610 occupational series. The Nurse special rate tables cover pay grades ranging from GS-4–5 to GS-13, depending on the table, for a variety of localities. The Nurse Practitioner’s tables also cover the Physician’s Assistant (0603) occupational series. As noted in Chapter 2, there are limits on special salary rates, however, such that the minimum rate cannot exceed 30 percent of maximum rate for the pay grade and the maximum rate cannot exceed Level IV of the Executive Schedule (5 U.S.C 5305[a] and 5 CFR 530.304[a]). In a previous report,¹⁵⁵ we documented how these limitations can affect the ability of the DAF to pay more as GS grades increase.

Recruitment, Relocation, and Retention (3Rs) Incentives

As described in Chapter 2, one of the key tools the DAF has to help recruit and retain personnel are the 3R incentives. In our interviews, we were told that installations try to use these incentives to the extent possible in recruiting and retaining Nurses. However, civilian personnel data show that these incentives have only been used in small numbers over the past five years for Nurses. For example, only a total of 21 recruitment incentives (six were used in 2020) and eight relocation incentives (only one was used in 2020) have been used over the past five years for Nurses. When looking at AFPC data on civilian new hires into the Nurse series in the DAF, we estimate that only 5 percent of personnel received recruitment incentives in 2020. In terms of retention incentives, less than ten were used in each of the past five years, with the exception of 21 used in 2018; only three were used in 2020. As noted previously, we do not have data on the percentage of eligible personnel who were offered these incentives and who then chose not to take them. We were only able to obtain data on the total number of incentives used in a particular year.

Comparison of Air Force Pay with the Private Sector and Other Federal Agencies

As in the above chapters, we conducted pay comparisons between Nurses employed by the DAF and similarly trained Nurses employed by the sister services, other federal agencies, and the

¹⁵⁵ Groeber et al., 2021.

private sector. Additionally, we provide detailed comparisons by DAF installations and surrounding or nearby localities.

However, defining *similarly trained Nurses* requires certain assumptions about comparability within the available datasets, given the range of nursing positions in the private sector as well as the range of pay plans used by other federal agencies. In conducting comparisons with the private sector, we use employees in the Registered Nurse occupation (SOC code 29-1141), as well as Nurse Practitioners (SOC code 29-1171) and Nurse Midwives (SOC code 29-1161). These are defined below.

Registered Nurses

Assess patient health problems and needs, develop and implement nursing care plans, and maintain medical records. Administer nursing care to ill, injured, convalescent, or disabled patients. May advise patients on health maintenance and disease prevention or provide case management. Licensing or registration required. Includes Clinical Nurse Specialists. Excludes “Nurse Anesthetists” (29-1151), “Nurse Midwives” (29-1161), and “Nurse Practitioners” (29-1171).¹⁵⁶

Nurse Practitioners

Diagnose and treat acute, episodic, or chronic illness, independently or as part of a healthcare team. May focus on health promotion and disease prevention. May order, perform, or interpret diagnostic tests such as lab work and x rays. May prescribe medication. Must be registered nurses who have specialized graduate education.¹⁵⁷

Nurse Midwives

Diagnose and coordinate all aspects of the birthing process, either independently or as part of a healthcare team. May provide well-woman gynecological care. Must have specialized, graduate nursing education.¹⁵⁸

The 2018 Occupational Requirement Survey, a nationally representative survey of firms conducted by the BLS on working conditions, job demands, and job requirements for U.S. occupations, indicates that 40 percent of Nurses identifying as working in this occupation report that their position does not require a four-year undergraduate degree. This is in contrast to DAF personnel within the Nurse occupational series, who are required to have a four-year undergraduate degree. Furthermore, an examination of DAF occupational titles in this series also indicates that approximately 4 percent of 0610 DAF personnel were identified Nurse Practitioners or Nurse Midwives, which is consistent with the proportion of Nurse Practitioners and Nurse Midwives relative to Registered Nurses in the broader U.S. workforce. Hence, in contrast to the above occupations, we instead heavily rely on ACS data, narrowing our sample to Nurses who report having at least a bachelor’s degree and have an SOC code of 29-1141, 29-

¹⁵⁶ U.S. Bureau of Labor Statistics, 2021.

¹⁵⁷ U.S. Bureau of Labor Statistics, 2021.

¹⁵⁸ U.S. Bureau of Labor Statistics, 2021.

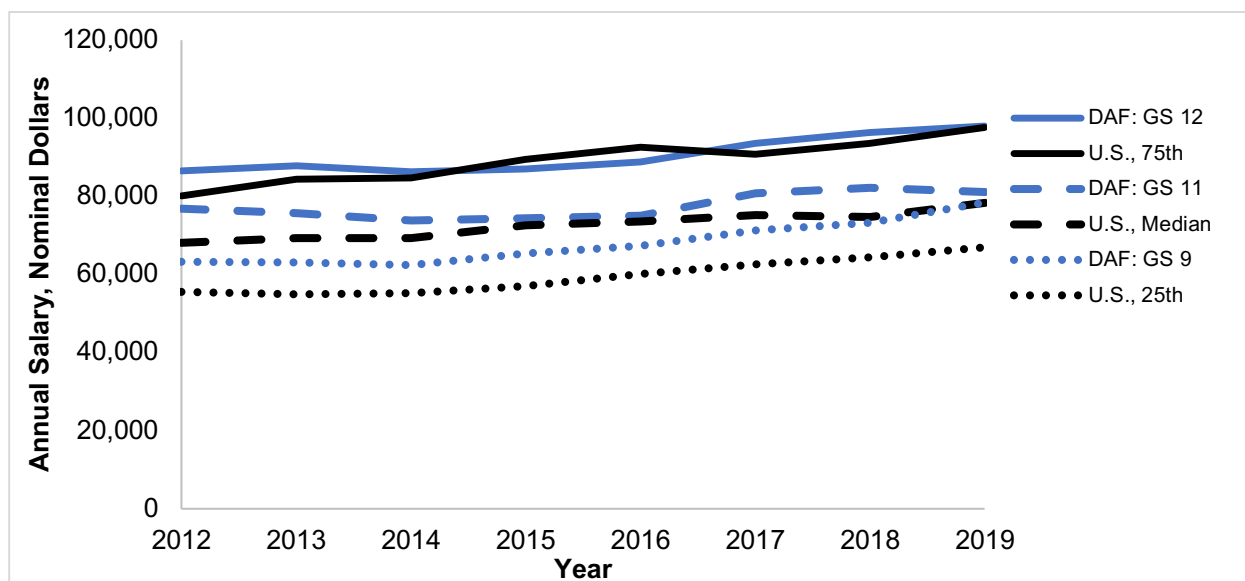
1161, or 29-1171 (the latter two of which are conflated in the ACS occupational classification system). However, for multiple industry and geography-specific comparisons, we continue to rely on BLS OEWS data in order to provide accurate estimates of pay, although the reader should be aware that these estimates include Nurses both with and without bachelor's degrees and represent Registered Nurses only. The result, though, is that in contrast to previous chapters, this analysis focuses on employee-level comparisons.

Workforce Pay Comparisons

DAF Pay Is Competitive with the U.S. Workforce, Especially in the Past Three Years

Figure 8.2 shows high-level comparisons between average pay for DAF Nurses by pay grade and for three percentiles in the earnings distribution for all registered Nurses in the United States with a four-year undergraduate degree. At each of these three levels, DAF pay appears to match or exceed pay in the broader U.S. workforce.

Figure 8.2. Average Annual DAF Pay for Nurses, by Pay Grade Versus Percentiles of Annual Pay for All Full-Time Nurses with BAs in U.S. Workforce



SOURCES: DAF pay from OPM FedScope data; U.S. pay from ACS surveys, limited to Registered Nurses, Nurse Practitioners, and Nurse Midwives with bachelor's degrees, with self-reported earnings adjusted using methodology described in Appendix A.

DAF Installation Pay Is Competitive with Registered Nurse Pay from Nearby Areas, but DAF Pay Falls Behind Department of Veterans Affairs and Department of Justice Nurse Pay

Although the above analysis suggests that DAF pay is competitive, the DAF seeks to fill positions in specific localities and may face competition based on pressure from a specific industry. The DAF also faces significant competition from non-DoD federal agencies when recruiting and retaining Nurses, most notably from VA but also from the U.S. Department of

Justice (DOJ) (driven largely by nursing demand in federal prisons) and U.S. Department of Health and Human Services (HHS) (driven by the Bureau of Indian Affairs and the National Institutes of Health). To provide insight into the DAF’s competitiveness for Nurses along these margins, Tables 8.4 and 8.5 show 2020 pay and Nurse employment for the DAF by pay grade, for these other federal agencies, for competing industries, and for DAF installations and nearby localities. We first note that 85 percent of DAF Nurses are in the GS-11 pay grade, with an average annual pay of \$81,022; overall average DAF pay is thus very close to this level, at \$82,566. As Table 8.4 shows, this level of pay is competitive with DOJ. However, both HHS and the VA pay Nurses with BAs, on average, over \$10,000 more.

We note again that the industry and locality comparisons draw on data that include all registered Nurses, not just those with bachelor’s degrees, and thus should be interpreted as underestimates of competitive pay for a Nurse with said degree. When examining average pay by industry, DAF pay compares favorably to the industry that employs the greatest number of nurses—“General Medical and Surgical Hospitals”—with average pay differing by under \$1,000. Moreover, DAF pay exceeds that of the other industries employing large numbers of registered Nurses, with one notable exception: Average pay for registered Nurses in the Outpatient Care Center industry is nearly \$7,000 more than the DAF’s average pay. Competing with this industry to hire Nurses may require higher pay.

Table 8.4. Pay Comparisons for Registered Nurses or Nurse Personnel Among Pay Grades, Federal Agency, or Industry, 2020

	Mean Annual Pay	Number of Employees
DAF: GS-9	\$78,399	35
DAF: GS-11	\$81,022	593
DAF: GS-12	\$97,957	69
DOJ	\$79,588	335
HHS	\$94,112	1,270
VA	\$93,637	35,388
General Medical and Surgical Hospitals	\$81,680	1,729,200
Offices of Physicians	\$71,660	192,300
Home Health Care Services	\$75,870	169,630
Outpatient Care Centers	\$89,300	150,380
Skilled Nursing Facilities	\$72,090	143,250

SOURCES: DAF pay calculated from DAF civilian personnel files. FedScope data were used for other federal employers; 2020 BLS OEWS data used for industry comparison.

Looking at Table 8.5, we next turn to the DAF installations that employ the largest number of Nurses, and we find that a common pattern appears: Average pay at DAF installations tends to exceed, oftentimes by five figures, or over \$10,000, the pay in the nearest metropolitan statistical area or in the surrounding state. However, we caution the reader on two fronts. First, all Nurses

employed by the DAF have a bachelor's degree, whereas the BLS OEWS data do not allow us to make this restriction in the locality comparisons. Second, and relatedly, we may be comparing otherwise dissimilar Nurses in terms of experience. We thus turn to our age-specific comparisons using FedScope data to compare the DAF with sister services and other federal agencies and ACS data for the largest private industry employer: "General Medical and Surgical Hospitals."

Table 8.5. Pay Comparisons for Registered Nurses or Nurse Personnel Among DAF Installations and Localities, 2020

	Mean Annual Pay	Number of Employees
DAF: Eglin AFB	\$76,006	36
Pensacola-Ferry Pass-Brent, Florida	\$62,710	4,710
Panama City, Florida	\$66,620	1,230
Florida	\$69,510	183,130
DAF: JBSA Lackland	\$93,241	39
San Antonio-New Braunfels, Texas	\$75,110	21,560
Texas	\$76,800	219,330
DAF: Keesler	\$72,994	29
Gulfport-Biloxi-Pascagoula, Mississippi	\$65,150	3,810
Mobile, Alabama	\$59,130	5,320
Mississippi	\$61,250	28,800
DAF: Wright-Patterson AFB	\$88,233	60
Dayton, Ohio	\$71,040	11,030
Cincinnati, Ohio-Kentucky-Indiana	\$71,980	24,750
Columbus, Ohio	\$69,410	24,860
Ohio	\$69,750	129,090

SOURCES: DAF installation pay calculated from DAF civilian personnel files; locality estimates from BLS OEWS data.

Employee Pay Comparisons

In this section, we look at age-specific comparisons to account for potential experience. We use FedScope data to compare the DAF with sister services as well as with other federal agencies, relying on ACS data for comparisons to the largest private industry employer: "General Medical and Surgical Hospitals." We conducted these comparisons in a similar fashion as for the other occupations included in this report, with one notable deviation: Given the occupation under study, we do not separate out by educational attainment. We show average annual pay by age group within DoD, with other federal agencies, and, using ACS data that introduces sampling error and thus produces a 95-percent confidence interval, the largest industry of employment for registered Nurses, all of which limit pay comparisons to Nurses with bachelor's degrees.

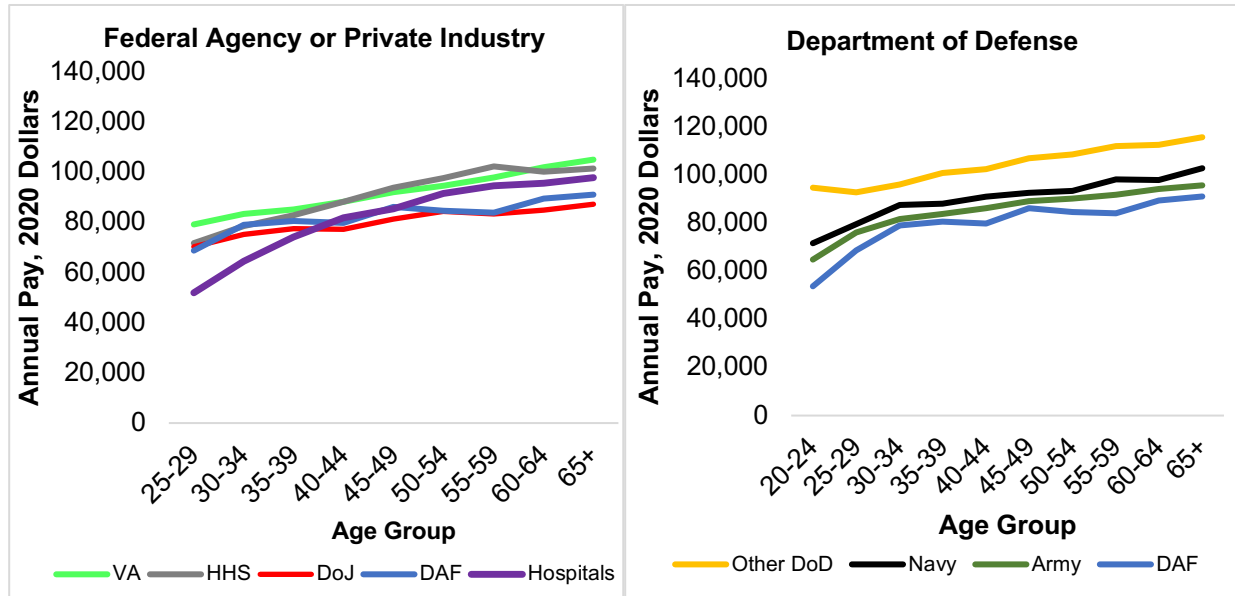
DAF Pay Lags Behind Other Services and Federal Agencies Employing Nurses but Is Competitive with the Private Sector, Especially at Younger Ages

The first panel of Figure 8.3 shows that DAF pay lags behind pay in the rest of DoD at all ages. Although the differences are within a few thousand dollars compared with the Army and Navy, other agencies within DoD pay Nurses substantially more. Fortunately, these differences do not appear to grow over time, suggesting that increases in initial pay and pay raises consistent with this higher base may lead to more competitive pay compared with other services.

The second panel of Figure 8.3 tells a mixed story. First, the VA pays its Nurses in every age group at a higher level than the DAF, suggesting a similar approach to competitive pay as with the sister services: Higher initial pay would close this gap eventually across all age groups. The DAF is competitive with both DOJ and HHS through Nurses' mid-30s; however, HHS Nurses' pay rises more quickly in the ages that follow, leading HHS to pay \$10,000–\$20,000 more for mid- to late-career Nurses than the DAF. The DAF remains competitive with DOJ throughout this period.

Finally, comparison with private industry, namely, General Medical and Surgical Hospitals, presents a different pattern. DAF pay greatly exceeds this private sector pay by approximately \$15,000 for Nurses in their 20s and early 30s. However, this difference shrinks as experience garners higher pay faster in the private sector compared with federal employment, such that private employment meets DAF pay in Nurses' 40s and exceeds DAF pay starting in their 50s. Depending on staffing and experience goals, later-career pay may need to be increased to stay competitive with the private sector.

Figure 8.3. Average Annual Pay for Nurses, by Age and Employer, 2017–2020



NOTE: DoD and federal agency comparisons from 2017–2020 FedScope data, pay inflation adjusted to 2020 dollars with CPI-U-RS. “General Medical/Surgical Hospitals” industry pay averages from 2017–2019 ACS, with self-reported earnings adjusted for misreporting using methodology discussed in Appendix A. Sampling variability introduces additional variation into the ACS estimates; Appendix E depicts the 95% confidence intervals around these estimated series. All comparisons limited to nurses with at least a bachelor’s degree.

Alternative Personnel System in Veterans Affairs and Fewer High-GS-Grade Nurses in the DAF Explain Pay Differences

The differences between DAF pay and pay in other services and federal agencies raise the question as to *why* Nurses of the same age and educational attainment are compensated differently by different agencies within the federal government. We first show in Table 8.6 the percentage of Nurses in each federal agency employed in the GS system, in a demonstration authority, or in an alternative personnel system. The DAF is alone among the services in employing a double-digit percentage of Nurses in these demonstration authorities, although nearly 90 percent are GS employees. The entirety of the VA Nurse workforce is employed under an alternative personnel system, as is over 80 percent of the DOJ Nurse workforce. However, as the second panel of Figure 8.3 shows, the VA uses these systems to pay similarly educated employees of the same age *more* than the DAF, while DOJ pay is at or below DAF pay for comparable Nurses.

Table 8.6. Employment by Pay Plan, by Federal Agency, 2020

	Number of Personnel	Nurses under GS System	Nurses Under Demonstration Authority	Nurses Under Alternative Personnel System
DAF	442	89%	11%	0%
Army	2,797	99%	1%	0%
Navy	813	100%	0%	0%
Other DoD	479	100%	0%	0%
VA	54,066	0%	0%	100%
HHS	1,276	100%	0%	0%
DOJ	346	18%	0%	82%
Rest of federal government	99	93%	0%	7%
Total federal government	41,947	14%	0%	86%

NOTE: Calculations from 2020 FedScope data. Navy includes the U.S. Marine Corps.

However, the other services nearly exclusively employ nurses through the GS system. We next examine the distribution of pay grades among GS employees in each service and agency in Table 8.7.

Table 8.7. Percentage of Nurses by GS Pay Grade, by Federal Agency, 2020

	DAF	Army	Navy	Other DoD	HHS
GS-05	0.0%	0.1%	0.0%	0.0%	0.1%
GS-07	0.0%	0.1%	0.7%	0.0%	2.6%
GS-09	5.5%	1.4%	7.9%	0.0%	11.5%
GS-11	81.4%	60.0%	67.6%	21.1%	20.5%
GS-12	12.3%	27.3%	21.2%	59.1%	25.8%
GS-13	0.8%	10.9%	2.5%	18.1%	31.6%
GS-14	0.0%	0.2%	0.1%	1.6%	7.4%
GS-15	0.0%	0.0%	0.0%	0.1%	0.6%

NOTE: Calculations from 2020 FedScope data. Navy includes Marine Corps.

As the table shows, the DAF employs far fewer Nurses at the GS-12 and GS-13 pay grades than other agencies, with 87 percent of DAF Nurses at GS-11 or lower. For the Army, this number is 62 percent; for HHS, it is 35 percent. The other services, the rest of DoD, and HHS all have Nurses at higher GS pay grades than the DAF.

A few conclusions arise from these pay comparisons: First, the VA is a major competitor for nursing talent, in terms of both quantity of Nurses employed and pay that exceeds DAF pay at every point in the age distribution, employing the entirety of their nursing workforce under an alternative personnel system. The private sector offers a more mixed story: Some industries have substantially lower pay, as do early-career Nurses, compared with the DAF, but more

experienced Nurses earn more in the private sector, and certain industries, such as Outpatient Care Centers, pay more on average. Although DAF pay at specific installations is highly competitive with surrounding localities, the DAF pays less than the sister services, a disparity that largely remains constant over Nurses' careers. An explanation for this lower pay is the distribution of pay grades among nurses employed in the GS system: The other services employed substantially more Nurses in GS-12 and GS-13 than the DAF, for which over 80 percent of Nurses were GS-11s.

Conclusion

The DAF has a total of 852 full-time civilian personnel in the Nurse occupational series, representing less than 1 percent of all personnel within the occupational series in the federal government. Key challenges raised by DAF representatives for recruiting and hiring talent in this series include concerns about lower compensation compared to the private sector (although the data from this study did not support this concern) and lower pay grades compared to the sister services (which is supported by this study), experience and licensing requirements, lengthy hiring timelines, and lack of effective marketing and recruiting at the local level. Furthermore, like other series in this review, although Nurses have DHA, DAF representatives voiced concerns regarding whether DHA and its associated flexibilities were really being used to the fullest extent.

In terms of compensation, Nurses have multiple special salary rate tables to help increase compensation in certain localities. However, data show limited use of recruiting, relocation, and retention incentives. Our pay comparisons show that the VA is a majority competitor of Nursing talent due to higher pay under an alternative personnel system. DAF pay is also lower than sister services, as the DAF has lower GS pay grades.

Chapter 9. Perspectives on Key Factors That Are Important for Recruiting and Hiring Talent

In the previous chapters, we highlighted findings for the specific occupational series under review. In this chapter, we review insights from interviews with three groups of experts to better understand the various factors that candidates, in general, consider when looking for job opportunities, as well as potential recruiting practices that may be helpful for the DAF to consider. We first report university-based career advisers' perspectives on recruiting, both broadly across all employers that recruit on campus and DAF civilian recruiters, in particular.¹⁵⁹ We then provide an overview of findings from our interviews with private-sector recruiting experts regarding their perspectives on what candidates want in job opportunities, as well as trends that have emerged in private sector recruiting that may have implications for DAF recruitment. Finally, interviews with representatives for the sister services and other federal agencies provide insight into what other agencies are doing to improve their recruiting efforts.

We note that these interviews were exploratory in nature and represent the perspectives of the individuals who were selected and volunteered to be interviewed. Further, these represent the viewpoints of career service representatives and recruiting experts, not potential candidates. While all interviewed individuals and groups provided their expertise from a different point of view, there are consistent patterns of findings in what we were told regarding what applicants want and perspectives on how the recruitment experience can be more engaging to entice applicants to apply for DAF jobs. Some of the key overlapping themes are as follows:

- Paying high salaries is important for key technical positions, but there are a number of job considerations that applicants weigh when considering potential employers (e.g., opportunities to innovate and potential for career growth).
- Understanding a prospective employer's mission and values is important, and its values need to match the applicant's values.
- Using social media and internet tools known to applicants is key in reaching the broadest set of potential applicants.
- Expressing through all online and print avenues what an employer is doing with regard to social changes and support for diversity and inclusion is important to job applicants.

Insights from University Career Offices

One set of key informants for developing perspectives on recruiting and hiring talent was leaders and staff of university career services offices. These college- and university-based

¹⁵⁹ It was beyond the scope of the study to review all DAF campus recruiting activities. The focus of this chapter is on highlighting the perspectives of university-based career advisers.

personnel are responsible for working with students during their undergraduate careers, throughout the job search process, and, at some institutions, as alumni. We focused our questions for these informants on the recruitment of Computer Scientists, Engineers, and Operations Researchers, as the qualifications of these career fields best align with undergraduate talent pools. We identified colleges and universities to target for interviews by identifying top-ranking institutions overall, as well as those nearest to key installations and that have a DoD FFRDC affiliation (see Appendix B for additional details on identification and response rate). We had the opportunity to conduct interviews or focus groups with personnel from seven institutions ranging in size, sector, and geography (Table 9.1).

Our interviews with college and university career services personnel yielded insights regarding job candidates' priorities when considering potential positions and employers; current DAF recruitment on campus, including both strengths of and impediments to DAF civilian recruiting; and promising university-based recruiting strategies adopted by employers.

Table 9.1. University-Based Career Advising Offices, Nearby Installation, and FFRDC Affiliation

University	Nearby Installation	FFRDC Affiliation
University of Florida	Eglin AFB, Florida	
University of Oklahoma	Tinker AFB, Oklahoma	
Ohio State University	Wright-Patterson AFB, Ohio	
Carnegie Mellon University	None	Software Engineering Institute
Miami University-Oxford	Wright-Patterson AFB, Ohio	
Emory University	Robins AFB, Georgia	
Embry-Riddle Aeronautical University	Eglin AFB, Florida; Edwards AFB, California	

Overview of Universities' Career Advising Strategy and Recruiting Efforts

To design an effective recruiting strategy, it may be useful to understand the overall career advising and recruiting structures on university campuses. We asked interviewees to describe their university career offices' structure and operations in order to develop and convey the foundational activities and orientations of campus career advising.

The institutions generally use a common career advising model, featuring similar strategies for engaging with employers. Generally, career advising offices are centralized, serving all students on campus, regardless of major, through a common office. Advisors specialize by major in order to provide targeted advising and perspective on relevant employers and career considerations. Two of the institutions have an embedded or hybrid model, where career advising is embedded in the colleges—for instance, having a career advising team based at the College of Engineering or taking a hybrid approach with liaisons in the colleges to complement centralized office programming.

All interviewees reported strategic engagement with employers. Many universities have an employer relations staff to engage with recruiters to complement their coaching staff, which focuses more on student advising. Employer engagement strategies generally focus on creating intentional engagement between employers and student candidates of interest to the employer and communicating with employers—for example, through a monthly newsletter about happenings on campus. Interviewees noted that their engagement with employers often begins with a consultation or strategy meeting to understand the organization’s goals and to find opportunities for recruiting on campus. The strategy that employers adopt “depends on how involved companies want to be,” according to one university career adviser. The most basic engagement was described as attendance at career fairs, posting positions on campus recruiting platforms, and on-campus interviewing. University career advising staff noted that the organizations that are most successful with on-campus recruiting strategically plan the candidate experience from their first introduction to the position and organization through the signing of their offer letter. The candidate’s experience during the recruiting process plays a big role in shaping interest in having a role and organization. One adviser noted that, although the recruiting experience “isn’t necessarily the reason they’re going to pick the job, it makes it easier if they felt like their time was respected and their questions were answered.”

In considering the candidate experience, one adviser recommended reflecting: “From their first engagement with you, what does the time, energy, experience look like?” Advisors noted that it is important for candidates to know where they are in the process and, particular to the DAF civilian talent recruiting experience, whether delays are bureaucratic-, supervisor consideration-, or clearance-related. Because private-sector employers can turn around offers much more quickly, consistent and clear communication is key and can dramatically improve candidate perceptions of the recruiting process.

Employers can also consistently work to enhance their “brand” on campus by engaging regularly with students through events such as workshops, sponsored events and research, and partnerships with faculty or departments. These varied opportunities are more intensive in terms of company recruiter time and financial investment, but university employer relations staff underscored the importance of these efforts in terms of developing candidates’ familiarity with the companies recruiting on campus. At one institution, higher levels of engagement are “pay to play,” with donation thresholds denoting the degree of “partnership,” which translates into access to candidates.

Career advisers suggested that recruiting success requires a consistent presence on campus. Putting the organization’s name in front of students throughout their college career and pairing that name recognition with experiential engagement can build recognition and demand. One career adviser articulated the need for consistency across recruiting cycles:

The freshmen are new every year. You might have talked to people the year before, but the waters refresh each year. If you’re coming in one year here and one year there, or not being intentional about maintaining relationships with

students between years [you won't be successful]. Instead, [recruiters should] work strategically with staff and professionals on campus who can get to know them and represent them as an option between years.

Employers can engage with students in many different ways on campus. Recruiting-focused events may take such forms as office hours, a coffee chat, or “ask me anything” events. Recruiting-focused events during the semester can also take place on the organization's home turf and give a window into the experience of working for the organization: Employers may offer the opportunity for students to shadow employees for a “day in the life.”

Employers can also engage with students through true hands-on, experiential opportunities. Advisors described various institutional partnerships whereby employers sponsor and advise student research and capstone projects and put on events for student organizations and professional associations (e.g., Institute of Electrical and Electronics Engineers, National Society of Black Engineers, Society of Women Engineers). Student organizations and other short- and long-term experiential opportunities are a great access point. By hosting hackathons, showcase days, or leadership development programs, organizations can demonstrate their organizational values and interest in candidates alongside fun, developmental opportunities that give students perspective on what being an employee could look like. Interviewees noted that these experiential events are particularly popular with students. One adviser said,

We want students to come to Career Services but they're busy with classes and projects, so if employers can get involved with university research and capstone projects, then they can have even deeper engagement with students and show off their company culture and the work they do.

Longer-term, experiential engagement with candidates can imbue the organization in students' everyday life on campus rather than a five-minute career fair conversation or a one-hour information session. Companies that get involved in campus life through research and clubs are “top of mind” to students and remain on their radar when the job search begins.

Summer internships are an even more in-depth form of cultivating candidate interest through experience. All the advisers noted that students are interested in summer internships, even as early as after their first year. By the fall of junior year, students are seeking internships that will likely shape their job interests after graduation. Top Engineering, Computer Science, and Operations Research Analytics candidates return from their junior summer internship for their senior year with a job offer in hand or with an interest in pursuing employment with their internship organization.

One adviser noted that organizations that can successfully combine summer internships with on-campus experiences are in a particularly advantageous position for holding candidates' attention. For instance, a defense contractor frequently sponsors a number of projects in its undergraduate research institute and encourages students on the successful projects to apply for a summer internship; by the time that they finish their internship, these students have a year's worth of exposure to the organization and firm-focused skill development.

Longer-term experiential engagement with candidates may prove to be an advantage to DAF recruiting along another dimension: obtaining security clearance. Some advisers noted that defense contractors often recruit freshmen for junior-year internships in order to ensure that they have sufficient time for students to navigate the security clearance process. Over the course of 18–24 months, these intern candidates are able to obtain a security clearance. After doing cleared work during their internship, it is then easier for these firms to hire these candidates for full-time work with a defined start date because the candidate can pick the clearance back up after accepting a full-time offer. Adopting this advance recruiting strategy might both help to give DAF interns a better sense for the work they would do as full-time DAF civilian employees and streamline the recruiting process, removing some of the ambiguity of navigating the security clearance process and waiting on a start date.

Advisors across all universities emphasized the importance of developing a brand, and how enterprise-wide recruiting can provide a foundation for this process. One adviser compared industry to DAF recruiting for engineers:

If I say, “Big 3 Automotive,” students know who the employers are and what their pathways are for particular careers in engineering. Students can then connect that career path to the brand. When you say, “Air Force,” what does that mean? There is so many layers to what the Air Force could be for candidates and where they’re represented. They’re here in the U.S. or global. Candidates can’t put their head around it because it’s so big. There’s potential in that, but they need to build a relationship with the campus and find a lane that gets students excited about that potential. It’s so big, so daunting. There are so many points of entry.

This adviser noted a contrast in candidate knowledge of career pathways in Automotive Engineering versus with the DAF in Engineering. This and other discussions underscored that an enterprise-wide approach to recruiting contributes to cohesive messaging and a clearer understanding of the organization, its mission, and how its constituent parts contribute to that mission, ultimately creating better opportunities for recognition and interest.

What Candidates Want

The university career advisers we interviewed work closely with students in Engineering, Computer Science, and Mathematics and Analytics–focused majors throughout the undergraduate life cycle. According to these discussions, candidates appear to prioritize opportunities to engage in interesting work, alignment with values, investment in mission, and a clear pathway for professional advancement when seeking full-time employment and comparing competing offers.

Interesting Work That Uses Their Skill Sets and That Advances Their Field

Across the interviews, we heard that undergraduate candidates for computer science, engineering, and operations research analyst positions are primarily concerned about finding

opportunities to do interesting, cutting-edge work that leverages the skill sets and technical knowledge they developed during college and that advances their field. One interviewee noted that students would “rather do the work at a no-name organization than sit in meetings at a big-name company.” Another emphasized that, for aeronautics engineering students, finding a job is “all about the team, about the aircraft.” Interviewees clearly communicated that those candidates want to bring their skills and passion to bear on the work that they do day to day. Gaining a grasp of the degree to which a job will be of interest depends on building an understanding of what candidates will be doing, with whom they will be working, and toward what end.

A Mission That Reflects Their Values

Candidates are also interested in work that aligns with their values and organizations in whose mission they feel invested. Interviewees continually reiterated that candidates are looking for *work that they believe will be rewarding and impactful*. While some career advisers noted that seeking value alignment and mission investment might rule out work with DoD for certain candidates, the consensus was that this generation of undergraduate candidates is looking for a connection to a cause. They seek ways to *give back to their community* and build a better society. The work performed by DAF civilian employees could align with these values and goals. For Aerospace Engineering candidates at one university in particular, the career adviser noted that the majority are drawn to DoD civilian positions because “protecting the United States is a big value.”

Opportunities for Advancement

In addition, candidates are looking for a clear pathway for professional advancement, career advisers reported. As candidates consider the offer and organization, they are seeking clarity about *growth potential* within the organization and perspective on *how the position may facilitate their career trajectory* across the field broadly. For example, career advisers said that candidates want to learn about opportunities for promotion and advancement, organization-funded master’s study, and salary growth. In addition, they look to the career paths of alumni and notable figures in their field for perspective on the organization as a launching pad for a successful career in their field.

Competitive Compensation Is an Important, but Not Top, Consideration for Most Candidates

Another key component of professional growth is compensation. In our interviews with DAF representatives, we heard that difficulty recruiting stems primarily from candidates prioritizing compensation. Career advisers on campus also identified compensation as an important factor for candidates, but not the most important one. When faced with simultaneous offers, salary and benefits is one of a number of factors that candidates consider. Across Computer Science, Engineering, and the Operations Research fields, career advisers reported that undergraduate *candidates will take a lower-paying job if they understand that there is a career ladder and have*

a clear idea of what their salary increases are likely to look like in the first five years with the organization. One career adviser stated that “Gen Z cares a little bit less about money. They want to know that they have a future path.”

This perspective about money and career path *underscores the importance of recruiters understanding compensation and promotion* in the organization so they can clearly communicate advancement opportunities and salary growth. A career adviser who is familiar with civilian positions in the government and DoD noted that the salary offers are lower but “pretty on par” and that students do not cite lower pay when they decline a position. This adviser noted that although civilian DoD position salaries are slightly lower and less negotiable than in the private sector, civilian DoD and other federal jobs have competitive ladders for salary growth and career progression. Concrete knowledge of salary growth and opportunities for promotion on a defined timeline can be appealing and should be made clear to candidates.

In contrast, advisers at two of the universities noted that *engineers, in particular, may be more attentive to salary offers*. One adviser noted that engineers “want to be paid what they’re worth and what they spent on college.” Overall, advisers report that salary is not the central factor in engineering candidates’ decisions, but competitive compensation seems to be a greater consideration for engineers than job candidates in the other career fields.

A Modern Work Environment That Values Flexibility, Diversity, and Equity

Advisors noted other secondary considerations for student candidates, including flexibility, representation and diversity, and social justice. These factors were not central to our discussion of candidate considerations but surfaced in most interviews and were reported as a larger factor for candidates at some of the institutions. For example, career advisers noted that candidates are interested in having some *flexibility with regard to work arrangements and geographic location*. They reported that this generation of undergraduates has seen the flexibility afforded white-collar professionals during the COVID-19 pandemic and understands the importance that flexibility held for safety during the pandemic and the convenience that it affords for lifestyle decisions. As one adviser noted, now that flexibility has been normalized, “You can’t put the toothpaste back in the tube,” and candidates may be uninterested in jobs with rigid in-person work requirements.¹⁶⁰

Candidates are also interested in *engaging with colleagues from a diversity of backgrounds*. Candidates of color are looking at promotional materials, recruiting staff, and team composition for *representation of individuals who share their background*. Relatedly, most advisers reported that candidates are looking at whether potential employers use language and take actions that reflect their *attention to domestic social justice movements*.

¹⁶⁰ It is important to note that several of the occupations focused on in this report do not have work-from-home options (e.g., Nurses, Airfield Managers), so this consideration does not apply to all occupations.

Advisors acknowledged that it can be challenging for recruiters to demonstrate these facets of organizational culture. Current employees were noted as a great source of perspective on both the work itself and the work environment and organizational values. Career advisers remarked that alumni can be a particularly powerful support for recruiting, as they allow candidates to see their education, and perhaps values and other dimensions of identity, reflected in the organization.

Overall, our interviews revealed that, when it comes to candidates' priorities, recruitment of top undergraduate students requires attention to more than compensation. According to career advisers, candidates will choose a role with a lower salary now if the work is innovative and puts them on the path to career growth or if they are familiar with and committed to the mission of the organization. Advisers noted that, to ensure that candidates will look beyond compensation, transparency, clarity, and open communication are essential during the recruitment process. If recruiters communicate with candidates, they will learn more about the job, team, and organization and can use that information to inform their decisionmaking.

University Career Advisers' Assessment of Air Force Recruiting

In our interviews, university career advisers believed that current DAF recruiting efforts clearly articulate the service's mission, impact of the work, and prestige. When asked about the relative value of institutional impact and mission, nearly all advisers noted that there is general appreciation for the DAF and its role in national security. However, advisers at most institutions noted that they do not know enough about the actual opportunities to say whether these positions can match the impact that candidates hope to achieve.

During one interview, an adviser pulled up recent DAF recruiting outcomes on her campus and was surprised to find that the DAF was a top recruiter for civilian jobs. She said that the DAF is clearly doing something right and that students are interested in the organization; however, recruiting efforts are flying under the radar, and engagement has not yet elevated the DAF to a named "employer of choice" on campus.

Advisers noted a number of impediments to the DAF's efforts to recruit top undergraduate computer science, engineering, and operations research analyst talent. These impediments included dimensions of awareness of DAF opportunities, perceptions of the opportunity or organization, recruiting and hiring practices, and logistical impediments.

Unaware of Civilian Opportunities

Many advisers articulated that there is a *lack of awareness of civilian opportunities with the DAF* and a lack of visibility of civilian DoD careers on campus that impedes hiring success. This may be due to an *overall lack of branding*, given that nearly all advisers suggested that the DAF

does not have strong branding on campus.¹⁶¹ Not only do candidates know little about the DAF, but many also have the impression that DAF jobs require being in the service and/or working on weapons. Often recruiters from the DAF and sister services wear their uniforms to campus, which reinforces these misconceptions and the inaccessibility of the DAF brand. Students do not know the difference between civilian and military recruiters, and military recruiters may not have information on DAF civilian opportunities.

Negative Perceptions of the Opportunity or Organization

Career advisers mentioned a number of negative perceptions candidates have about DAF opportunities or the organization itself that they noted as impediments to hiring. Over half of the career advisers we interviewed noted that launching their *careers in industry would lead to a better career path* than starting in the public sector. This perception may limit applications to DAF opportunities or deter candidates who receive job offers from accepting them.

Career advisers also spoke of *negative stereotypes about public-sector work*. Impressions of low pay and long hiring timelines may inhibit student candidates from applying for or seriously considering DAF civilian positions. Some advisers noted that proactive communication to dispel these largely inaccurate impressions would be valuable.

In reference to the DAF more specifically, career advisers from half of the institutions noted some *hesitance among some student populations to engage in defense work*. While the relative size of this population varied by university, advisers suggested that there is a substantial body of students who are already interested in DoD careers or would likely be interested if they knew that civilian opportunities were available.

Recruiting Practices Are Not Cohesive, and Hiring Practices Are Seen as Opaque, Bureaucratic, Untimely, and Outdated

The recruiting and hiring practices of the DAF were also viewed as impediments. First, advisers noted the *lack of a cohesive recruiting pipeline*. They reported that DAF recruiting practices contribute to confusion among candidates about the differences between positions and difficulty discerning for what work they are applying. During our conversation, one adviser logged into Handshake and found DAF job postings that contained different language describing the overall organization and had inconsistent formatting and procedures. Advisers noted that this lack of cohesion projects a fragmented image and creates confusion for students and their advisers.

Relatedly, advisers spoke of the challenges of candidates having *limited information about hiring processes and considerations*. Candidates need additional information on the steps and timing of DAF hiring and the security clearance process to mollify concerns and pique interest.

¹⁶¹ Embry-Riddle Aeronautical University (ERAU) was a notable outlier along this dimension. Our interviewee from ERAU noted that the DAF is an employer of choice among students across the university, in particular among engineers.

Some advisers noted a *misalignment with industry hiring timelines*. Private-sector employers post positions in August or September and extend offers to top candidates by Thanksgiving or Christmas, at the latest. The DAF and government agencies typically post positions in January, when the top candidates in the cycle have likely already accepted offers. One adviser attributed the delay for the DAF and government agencies as being tied to the end of the fiscal year.

In addition to hiring slightly off-cycle, advisers noted that *bureaucracy impedes timely engagement with college staff and candidates*. Advisers contrasted industry recruiters' consistent, timely contact with student candidates to the DAF's inconsistent contact with students using multiple recruiters. One adviser noted that to participate in the institution's career fair, DAF recruiters "have to go through nine people just to get payment completed." In contrast, top industry employers have designated campus contacts who have the autonomy to make decisions and pay for campus engagement. The DAF's contact with student candidates may also be inconsistent in terms of its timing and often is accompanied by a lack of coordination among recruiting entities.

Advisers also noted that there are challenges when it comes to the offers themselves, particularly related to *compensation and contract features*. Limited ability to negotiate salary and uncertainty around start dates and timing of obtaining clearance make the DAF's recruiting and offer consideration process less responsive and more nerve-racking than candidates' engagement with industry employers.

Lastly, advisers at three universities noted that *DAF recruiting has not stayed current or cutting-edge*. Advisers noted that DAF recruiters do not seem to be up to date on topics and ideas of importance to student candidates (e.g., social movements) and lack training on how to best integrate technology into recruiting. This projects a dated image that is inconsistent with the DAF's significant efforts in technology and work that is consistent with candidates' interests.

Candidates May Balk at Less Diverse Locations, and International Students Doubt Their Eligibility

DAF recruiting may also face logistical challenges in hiring at universities. First, advisers noted that some candidates are particular about the *geographic location of positions*. For some students, being in an urban area or in a particular geography is important. Positions at DAF installations may not appeal to these students or immediately jump out to their peers. Also, students often use metropolitan area geographic filters in job search engines, even when they are not committed to a specific geographic preference. DAF opportunities may slip through the cracks in these circumstances.

Second, the limits to students' *eligibility for opportunities* where many positions cite requirement to be a U.S. citizen narrow the potential pool of candidates. Advisers at multiple universities noted that a substantial proportion of their engineering and computer science students are international students or undocumented resident students. These students are

uncertain about their eligibility for DAF opportunities and the potential opportunity for the DAF to support their visas or pursuit of citizenship.

Conclusions from Interviews with University Career Service Offices

While there may be some differences based on the occupation, compensation is a factor in job and employer selection, but it is not as important as other dimensions that the opportunity offers the candidate. Job candidates look for value and interest alignment with the mission; they are interested in knowing what they will help accomplish and the effect their work in a company will have. Candidates who recently graduated from college also seek personal development and contribution in their field of study. They are excited about learning more on the job, using innovative techniques, and exploring novel methodologies. Recruitment on campus is more successful with a continued presence and students having name recognition of the organization or agency. The top-tier students are offered positions at the beginning of their senior year or before if they have an intern relationship with the employing organization. The length and the complexity of the federal hiring process, along with students' limited understanding of how the process works, are impediments to hiring.

Insights from Private-Sector Recruiters

In this section, we provide an overview of key findings from interviews with a select number of recruiting experts in the private sector. Interview participants were a combination of senior experts and executives in industry who had worked for and with private sector corporations, and with the federal sector, in recruitment and hiring for 20 or more years, as well as a small panel of recruiters and recruiting leadership who focus exclusively on filling DoD and DAF contracting roles, mostly technical. We provide an overview of perspectives and their recommendations on effective approaches to hiring top talent in the private sector, and in the federal workspace, what candidates are looking for in a new position, and potential recruitment barriers.

Effective Approaches in Hiring Top Talent in the Private Sector in Today's Recruiting Environment

Use of Social Media and Internet Recruiting Sites

Interviewees noted that *job boards*, the term used for recruitment websites, have become a ubiquitous tool for recruiters in all environments and specialties. Of the numerous available job boards, LinkedIn was by far the most highly regarded. The job board environment appears to be undergoing consolidation, according to our experts, and candidates are increasingly migrating to LinkedIn because it can aggregate data from multiple sources. One recruiting expert reported, "Indeed is out there, Ladders is out there, but if I could pick one, it would be LinkedIn." Other job boards that were mentioned were CareerBuilder and Entelo (especially for diversity candidates). For IT professionals, recruiting experts also mentioned coding sites, such as GitHub

and Stack Overflow, and social networking sites for coders as sites in which recruiters could find higher-end technologists.

Interviewees noted that *campus recruiting* continues to be important. Our experts said, “Ninety percent of our customers are advertising on campus,” and “Campus recruiting is huge. Campus recruiting is not going away.” However, the approach and methods are changing and moving to *virtual platforms*. For example, the Handshake platform lets students build online profiles, and employers can reach out to the students with internships and jobs.¹⁶² One expert told us, “These platforms like Handshake are on every single campus in the U.S. The last time I looked, all but one Fortune 500 was using it.” We heard that companies are now asking why they would spend money to go back to the same schools every year when they can use technology instead. For example, one expert reported that his company was giving a *video interview platform* to campus career centers so their students could practice taking video interviews. One expert summed it up this way: “So while campus recruiting has gone virtual, it is very real and in play.”

A Focus on Recruiting Diverse Talent

Diversity, equity, and inclusion (DEI) is a foremost consideration for companies seeking to be competitive for top talent. Our experts told us that companies see their emphasis on DEI not only as a way to actually hire diverse talent, but also as part of their business strategy to get ahead. For example, one expert commented, “Companies are pumped up about their DEI—our most successful employers . . . are advertising the heck out of it, whether it is aspirational, true or not true.” We were told that part of this effort is to ensure that companies are tapping into all available talent and are benefiting from the diversity of the talent pool.

What these companies do is that they’re trying very hard to be diverse, by pushing DEI, they’re getting the best of everybody. . . . these are people who understand that diversity is profitable.

By pushing the DEI agenda, they get the best people and financial success for their company.

According to our interviewees, DEI is particularly crucial in campus recruiting. For example, one expert noted “DEI figures into the calculus” of campus hiring, and companies are using technology “to cast a wider net.” Companies advertise with different clubs on campus, such as women’s engineering clubs and lesbian, gay, bisexual, transgender, and queer or questioning (LGBTQ) organizations. Additionally, our experts stressed the importance of not waiting until students graduate: Recruiters need to be reaching out much earlier. Our experts had many recommendations for federal recruiting of diversity candidates, which we discuss later in this chapter.

¹⁶² Handshake, homepage, undated.

Affinity groups are a type of employee resource group, wherein employees with commonalities (often underrepresented groups) form a voluntary group; these groups provide mutual support and networking, and they help educate the business on how to better support its employees. Our experts emphasized the importance of affinity groups in recruiting and hiring:

When you have affinity groups—that is where you get the people.

Do you have affinity groups? Are you supportive of [employees] taking an hour of their day to take care of ideas? When you are pushing inclusivity, are you promoting those ideas?

What is Booz Allen Hamilton doing? What is Lockheed doing? They all have booths at various events. The General Services Administration (GSA) finally stood up a Hispanic-American GSA employment group.

Expanding diversity through *federal internships* was another topic. When discussing the design of internship programs and the resulting impact on diversity, one expert shared this perspective:

You cannot wait until after they are graduated to recruit. And you don't have to wait until the junior year. The government already has those [intern] programs but talk about anti-diversity! The government does unpaid internship programs. Those should be illegal. The Center for American Progress gives their interns \$600—what college student has the money to do that? No normal person has the money to do that.

The experts did provide insight into some areas where they thought DoD and the DAF might have an advantage. One of these was *hiring women and minorities into high-tech federal jobs*. They suggested that if the DAF could market its culture and values more effectively, it would likely stack up very well compared to these descriptions of the private high-tech sector. For example, one expert commented, “Any female engineer that has come up in a software environment in Silicon Valley will tell you it’s toxic. Female engineers are great candidates [for DAF positions] if they don’t want to play the West Coast machismo game. . . .”

More Traditional Approaches to Recruiting Still Exist

Other, more traditional recruiting practices are still used in the private sector, of course. These include *contractor conversions* (“a quarter to a third of our new employees are contractor conversions”). Retained and contingency *recruiting firms* are used for particular roles. *Employee referral bonuses* are still in place. One expert discussed *boot camps*. Companies will offer a few weeks of boot camp, with the curriculum similar to that of a technical school. After taking these “crash courses” in, for example, data science, the student/candidate then becomes a low-level contractor for the company. Companies pay a tuition fee, but if the candidate ends up not liking the firm, the company can demand reimbursement for some of its investment in the student. The experts we interviewed did not favor the boot camp practice, however, because of the large degree of risk that resides with the student/candidate.

What Candidates Want

A principal emphasis of our experts was the importance of focusing on what candidates are looking for in job opportunities, which they indicated had changed markedly from the past, when job applicants were often most interested in long-term careers. The interviewed experts indicated that job applicants are looking at more socially conscious companies with job flexibilities, compensation, and benefits that they know exist due to the availability of increased information on the internet about companies and organizations.

Compatible Mission and Values with Applicant Beliefs

Brand, values, and mission were the most common factors raised by our interviewees regarding what candidates are looking for in job opportunities. “Values and mission are #1. Flexibility is #2” is how one expert summed it up. We were told that *brand recognition* has always been and continues to be an important factor in successful recruitment into an organization, but more recently candidates have begun to emphasize the *values that a brand represents*. *Industry credibility* is an important consideration; for example, we heard that candidates are not considering Bank of America and looking instead at other financial institutions. As one expert said, “It now seems as if that the money will be there is a given, but it is now more about the values of the company. . . .” Recommendations from our experts to recruiters included, “You want to be clear what your company stands for. Brand and also culture are selling points. . . .” They also conveyed that companies realize they must make the case that “The companies are concerned about corporate values. Their reputation and their positions in the market.”

In some cases, such as for Nurses, we also heard that there can be a particular value proposition that candidates are looking for in a job. For example, we were told that Nurses are invested in health care and helping others, and an overemphasis within hospitals on profit, as more hospitals have become profit centers, is often received poorly among Nurses. As one expert stated,

18-year-olds don’t go into nursing because of the money—they are going into it because it is a career, plus the science, and they are doing good. They say it is a good combination. They can make money and help people. Take any of that away, and they ask—what am I doing here?

Thus, this may be one area where DoD and the DAF have an advantage over private-sector job opportunities for Nurses, given that Nurses are not focused on making a profit for hospitals but rather on providing good health care.

Our recruiting experts did not give high marks to DoD for explaining its mission and values, however. One recruiter noted that DoD’s stigma came from “building bombs,” but went on to say, “But DoD does cool work that should be marketed.” One manager of recruiting services across many organizational clients, a veteran himself, had these comments:

I think the U.S. military is just not doing a nearly good enough job of advertising each humanitarian mission. I bet you, in the course of 34 years in the military, I went on easily four times as many humanitarian missions as I went on what I would call offensive missions. And the majority of defensive missions is not defending military assets as much as we were defending foreign civilian assets. I think when we are recruiting civilians, that is a really good time to talk about all of the humanitarian missions that the U.S. military does. Immeasurable. I bet if you looked at the whole defense budget, probably 80 percent of it is humanitarian in nature.

This recruiting expert suggested that the time, money, and effort expended by DoD in service of humanitarian aid is not always visible to civilians. Taken together, the comments from recruiting experts suggested that clearer communication to the public and potential candidates of the multifaceted nature of DoD and DAF work would better show the mission, values, and actual work of service members and civilians in DoD jobs.

Another expert thought the DAF might be in a slightly better position than the other services, in that the DAF made its work sound “cool and high tech.” One comment related to DoD’s campus recruiting was that

From an attraction perspective, I think it’s values. DoD does not do a good job of explaining what it provides. Patriotism has died down since 9/11, and the government does not do a good job of going to the student and saying here is what we offer.

We were told that technical talent, too, is increasingly *judging organizations on their values*. Indicative of this trend, one expert noted,

I think all computer scientists and engineers are lumped together because they are a very detailed tech population, and there are the same issues with them. They are also becoming values driven. We have seen engineers refusing to work on DoD projects.

This development of technical employees in companies outside DoD whose companies have DoD contracts but are refusing to work on them was also reported by another expert: “The government has a problem where the individual’s values don’t align with that of the government’s. Seeing more in tech companies.” And although this development is not about directly recruiting for DoD and DAF positions, it does speak loudly about the sentiments of the population from which DoD and services are trying to recruit.

Job Flexibility

We were told that *job flexibility*, which since the advent of the pandemic usually means the ability to work remotely, has become increasingly valued and expected by candidates. As an expert quoted above said, “Flexibility is #2.” The issue of location has changed dramatically in importance, and “Newer workforces are looking for flexibility.” One of our interviewees reported that at his company, all teams used to sit together, co-located, and if you wanted the position, you had to move to that city. But, he said, “All that has gone completely by the

wayside.” Another expert said, “If you are not offering remote work for these jobs, you are not going to get the good talent.” While this flexibility may not be possible for all occupations, it is an important concept to keep in mind as a significant change in workplace dynamics.

In contrast, our experts reported that candidates want *community* as well. Some candidates, described as more traditional “corporate America” candidates, prefer the camaraderie of an office environment. Both environments—in the office and out of it—have perceived value by candidates:

Goldman Sachs is one of our big customers. . . . It is trying to figure out how to get the right mixture of mentorship and human connection, community. People want community. How do you give them that, without requiring them to be in the office every day?

Compensation

More traditional concerns are also important to candidates, as we were told that *compensation* continues to be an important factor for candidates. It was stressed that it is important to be competitive in compensation, but the approach varies by industry. For example, we were told that in the financial sector, the *bonus structure* is of great importance to candidates. In tech, it is the *vesting structure* that is of salient interest because tech companies often give candidates equity (company shares).

Factors Unique to Nurses

Finally, we also heard several unique factors mentioned as important particularly for Nurses. For example, recruiting experts commented that most *Nurses are interested in staying local*, either in their hometowns or near the nursing school from which they graduated. One expert said, “Most Nurses are looking to work in a specific knowledge area and in a specific geographic area. For the most part, they are not interested in moving for a job.” As a result, we were told, “Health care companies go to local [nursing] schools.” Relatedly, experts noted that the DAF may face a barrier due to the *lack of mobility of many Nurses*. As noted in Chapter 8 on Nurses, the level at which the DAF hires Nurses requires prior private-sector experience, and Nurses tend not to be recruited directly out of school by the DAF. However, our recruiting experts commented that by the one-year point in a Nurse’s career, the individual has likely moved into a specialty and become established within a hospital system. As one expert explained,

Once someone has worked one year in that specialty area, [that person] is making a little more money and they’re in the hospital system. If they’re going to make a move, it won’t be for less money in the same specialty area. You’re limited because they are not mobile. You’re limited to people in that area, and then you limit yourself by not doing new grad hires.

A further observation addressed Nurses’ propensity to stay long-term in health care organizations where they are happy: “The Air Force is . . . limiting their capability to get someone in who may stay a long time. If Nurses like the environment and the pay is good, they stay.”

Experts also indicated that health care institutions' lack of flexibility around specialty tracks can also create barriers to obtaining and keeping Nursing talent. For example, one expert commented,

But health care companies are creating their own problem. They look for very specific experience—X years of Y experience. Not enough Nurses with that experience after college doing detailed work to fit the job opening. They should just take three months to upskill them. Plenty of Nurses available that you could upskill effectively. It's analogous to a Computer Scientist—they might not know Python, but they know C++, and they can learn Python. Same thing, teach a Nurse oncology in 90 days even if they came from internal medicine.

Barriers to Recruiting Top Talent

Length of Hiring Process

One of the biggest barriers raised in recruiting top talent was the *time frame and speed* involved in federal hiring. Comments on this barrier included the following:

If you can't go from applicant to hire in under 30 days, you are not even in the ballpark for getting the right people. You really need to be closer to 15 days. If you can't do that, then you are never going to get the best people. That is not the time frame from when they closed the job on USAJOBS. It is from the day they open the announcement until the day they make the offer, and that is the only time frame that matters to the candidate. Having all these metrics that track anything less than that is meaningless in terms of getting the right person for the job.

Timeline is a problem. Anything federal government related is very procedural and drawn out. Anything to increase efficiency and decrease time to hire. People will drop out if they get other, better job offers.

Interviewees indicated that *slow hiring processes* are especially detrimental for recruitment of technologists:

The firms that move quickly, particularly for technologists, that is key. The ability to make good and quick offers keeps you at pace. Most of the tech candidates will have multiple offers. It is an employees' market.

The recruiting experts did recognize that the *clearance process* offers special challenges when it comes to speed. One interviewee noted,

From a competition and supply standpoint, that is where supply and demand work against the DoD/[Air Force]. If I am an AWS software engineer, and I have one clearance-contingent position with DoD vs. four other companies that need to know right away, then they will take the other position.

Compensation Is Not Sufficient to Attract Technical Talent

Finally, our experts addressed compensation for technical talent as a recruiting challenge within the federal government, DoD, and the DAF. They reiterated that the tech sector has a *tight labor market*: "For technical jobs there are not that many people with that background, or who

are looking for a new job,” and “The technologists have a hot market.” The consensus was that the *federal pay scale is not sufficient* to recruit and retain computer scientists and programmers:

For Computer Scientists, it is all about the money. [Our company] pays our Software Engineers more money than any GS-15 or SES is legally allowed to make.

I think the GS pay scale is appropriate for 2210s [Information Technology Management Series], below the GS-15/SES levels. Yes, for 2210s. But it is the 800s, General Engineering Series, who are the real programmers. The federal government is not in the ballpark.

The issue of clearances only complicates compensation challenges for this technical talent:

We are going to have a hard time recruiting candidates who can be cleared for the technical jobs. We have a lot of foreign employees who are technical, but we cannot get them clearances.

Conclusion from Interviews with Private-Sector Recruiting Experts

Similar to our findings in the previous section, from the interviews with private-sector recruiting experts, we found that while compensation is a factor in high-demand positions, it is not the only factor that candidates consider. In particular, how the applicant values the mission of the prospective employer is a key decision factor for candidates in today’s employment environment. Additionally, flexibility—particularly in the ability to work remotely—was voiced as an important consideration for today’s applicants. Private-sector recruiting experts also indicated that DEI is crucial in campus recruiting, with students wanting to know how the prospective organization is addressing social change and justice issues. The ability of private-sector recruiters to offer positions faster than DAF recruiters is a key deterrent in the recruitment process. Finally, recruitment of Nurses can present unique challenges, with Nurses having strong preferences related to geography and resistance to moving.

Insights from the Sister Services

Representatives from the Departments of the Army and the Navy were contacted and asked to share their experiences in recruiting and retaining top-tier talent in the six identified occupational areas. We were able to interview representatives from both the Army and Navy.

The Army interviews provided insight into the transformation that the service is undergoing to move to an enterprise-wide recruiting program. This move is just beginning, so there are no lessons learned yet to share. The Army has restructured its career programs from 32 independent career programs to 11 career fields. It is working to increase awareness of Army civilian positions by designing a marketing and branding campaign along with revising the civilian portion of the Go Army website,¹⁶³ which does not mention civilians until the bottom of the

¹⁶³ GoArmy.com, website, undated.

homepage, under the title “More Ways to Serve.” The Army expects the changes to be in place during FY 2022–2023. It will also use the Handshake system mentioned earlier in this chapter by the university placement offices for outreach and recruitment of college students. Army representatives indicate that Handshake provides them immediate and direct access to potential applicants so they can contact them. A discussion on Airfield Managers resulted in our understanding that the Army has a large portion of retired military, but they target universities with an Airfield Manager degree. They do not traditionally have a problem filling Airfield Manager positions.

The Navy interviewee indicated that *Navy recruitment is decentralized* to 20 commands, and each command operates differently. In recruiting for five of the six occupational series in this study, the Navy traditionally uses *competitive announcements* on USAJOBS, DHAs, and *merit promotion*. The Navy also uses *social media* and *web-based recruiting services*. The Navy representative indicated that the service is very active in supporting *job fairs* and *diversity recruiting events*, with one command going to more than 200 events per year. In the past 18 months, the Navy has moved to using *virtual career fairs* because of the COVID-19 pandemic’s impact on recruiting. The recruiting authority the Navy uses most is DHA. To help with recruiting Engineering Technicians, in some locations the Navy has *agreements with training schools* as a pipeline for newly trained technicians. For Nurses, a majority are contractor-provided, and the Navy *recruits among the contractor workforce* when it has openings. Once the Navy has filled a civilian Nurse position, it uses an OPM-approved accelerated promotion process to reduce the time Nurses have to serve at a grade level before promotion. Additionally, the Navy has challenges in retaining Nurses; the interviewee indicated that the service has lost many Nurses to *higher salaries in the private sector*.

Insights from Other Federal Agencies

Eleven other federal agencies were asked by AF/A1C to support our study by providing points of contact for interviews. Of the 11 agencies, we were able to interview representatives from six, with four of the representatives coming from sub-agencies or bureaus. The U.S. Department of Homeland Security (DHS), Federal Emergency Management Administration (FEMA); DOJ, Bureau of Prisons; National Aeronautics and Space Administration (NASA); U.S. Department of the Treasury, Internal Revenue Service (IRS); VA; and the U.S. Department of Transportation (DoT), Federal Aviation Administration (FAA) all participated in interviews explaining their recruitment process and providing insights into their future recruitment plans. We provide an overview of key themes from these interviews below.

Hiring Authorities Are Somewhat Limited

Many of the agencies interviewed use only OPM’s *government-wide DHAs* and do not have the extensive DHAs that are available to DoD. While they all have some appointments using the

IPA and experts, their appointments for the six occupations under review for this project are for traditional government employees. FEMA is the only agency we interviewed that has more temporary and intermittent employees than permanent employees, due to its mission and different funding streams. FEMA can *use temporary employees as a recruitment pool* for its permanent positions but cannot use the permanent employees to assist in recruiting temporary positions. All the agencies we spoke with that are outside DoD indicated that the one thing they could use to help improve their recruitment efforts is additional DHAs.

Agency Recruitment Structure and Practices Prevent an Enterprise-Wide View

Several agencies indicated that they have or are moving to a streamlined *enterprise-wide recruitment system* to focus on the recruitment needs of the entire agency. Moving to an enterprise-wide recruitment system allows for an overarching recruitment perspective. Those agencies we interviewed that still have decentralized recruitment lack an expansive view of recruiting, and suborganizations only know what they themselves are doing to recruit and hire candidates. The majority of agencies interviewed cited the *lengthy recruitment process* as limiting their ability to fill positions. They know that industry can offer positions much more quickly than government agencies, which puts the agencies at a disadvantage in competing for top talent. All agencies interviewed struggle to fill positions in *locations where candidates are traditionally not interested*. One representative said a manager at his agency believes they should “post a vacancy or vacancies without a location and be able to negotiate the duty location after selection.”

Increased Use of Specialized Recruiters

There is a movement, among the agencies interviewed, to increase the number of specialized recruiters, as opposed to staffing specialists. Staffing specialists focus on the traditional aspects of posting vacancies and processing hires. Recruiters focus on sourcing candidates and setting up and participating in university recruitment activities and job fairs. Since the COVID-19 pandemic, prospective employers have *switched to more virtual events and systems such as Handshake and recruitment sites* that allow for the agency recruiters to have direct conversations with prospective candidates. One agency is “*resume mining in USAJOBS* to find candidates who have already indicated interest in federal jobs,” an agency representative said.

Improved Marketing and Branding

Many agency representatives discussed efforts to improve brand and marketing to better inform potential candidates about their agency, its mission, job opportunities, and how to apply. These efforts are expanding the presence of federal agencies on *social media* and will further the use of *paid advertising* to educate the public about job opportunities in the government. Some of the agencies are slowly making progress but will not realize the benefits of their increased presence for a few years.

Use of Accelerated Promotions for Nurses and a Recruitment Source

Two agencies (the Navy and the Bureau of Prisons) that have large populations of Nurses indicated that they use an accelerated promotion model as an effective method of retention. OPM approval of an accelerated promotion program is in accordance with 5 CFR 300.603, which provides an *exception to the required 52 weeks between promotions* from one grade level to the higher grade. The exception is based on the employee satisfactorily completing a six-month training program. One agency indicated that, like the Navy, it uses contractor Nurses and then *recruits from the contractor Nurses* when there is a vacancy.

Conclusions from Interviews with Sister Services and Other Federal Agencies

From the agencies we interviewed, we learned that they all struggle with how to attract, hire, and retain top talent. One of the most helpful tools that the agencies have to aid in recruitment of top talent is the use of DHAs. The representatives from the other federal agencies indicated that they did not have DHAs beyond the OPM government-wide authorities and they would like to have more. DoD agencies have a much broader spectrum of DHAs through authorities provided in various NDAAs. These authorities are listed in Appendix D. The agency representatives all agree that use of social media and such internet services as LinkedIn and recruiter services are important, along with the use of specialized recruiters. For DoD agencies, there is a push to get more information to the public on civilian positions through social media and advertising to raise public awareness that there are significant opportunities for civilian jobs and careers. Many of these initiatives are a few years out from completion. Two agencies we interviewed have used OPM-approved accelerated promotion for Nurse positions. This program allows for these agencies to offer faster advancement than typically found when moving from one grade level to another in order to increase Nurse retention.

Conclusion

In interviews with university career services offices and private-sector recruiting experts, participants noted that, in their experience, competitive compensation is important to job candidates, but it may not be the only or even the most important factor. Instead, representatives highlighted the importance of the organization's mission and values, having opportunities for innovation and professional growth, and job flexibility (e.g., telework options). Participants also highlighted the importance of building more familiarity with the DAF brand and civilian opportunities through continued engagement, increasing use of social media and online tools for recruiting, and improving the transparency and length of the hiring process. As noted earlier, these interviews were exploratory in nature and represent the perspectives of the individuals who were selected and volunteered to be interviewed. However, we heard several consistent themes across the experts interviewed that highlight helpful considerations for the DAF as it aims to strengthen its civilian recruiting and hiring efforts.

Discussion with representatives from the sister services and other federal agencies show that many agencies are moving to an enterprise-wide recruitment structure and are trying to increase their use of specialized recruiters to help with marketing and branding. Additional specialized recruiters in DAF would help expand the ability of AFPC to help fill a broader set of positions. Interviews also highlighted the importance of DHA to agencies, with DoD having more DHAs than non-DoD agencies.

Chapter 10. Conclusion and Recommendations

As demand for technical talent is expected to increase across the U.S. workforce over the next decade, the DAF wants to ensure that it is competitive in attracting, hiring, and retaining top-tier talent. The objective of this study was to help the DAF by identifying barriers related to the ability of current hiring authorities and practices to attract top-tier civilian talent in certain technical areas and explore alternative recruitment, hiring, and employment options that the DAF may be able to use to better compete for that talent. The study focused on the following six occupational series identified by the sponsor as priorities for the DAF: Computer Science (1550), Operations Research (1515), Electronics Engineer (0855), Engineering Technician (0802), Airfield Managers (within Transportation Management [2150]), and Nurse (0610).

Although each of the occupations included in this study faces its own challenges (which were described in more detail in the main chapters), we briefly summarize several key overarching findings:

- Common barriers identified by DAF representatives to recruiting and hiring top-tier talent include the existence of a small talent pool with the desired skills and credentials for certain occupations (particularly for STEM occupations), lower compensation relative to the private sector, lengthy hiring timelines, challenges with hiring in more remote or overseas locations, and lack of effective marketing and recruiting at the local level. To the extent possible, we tried to validate these perceptions through quantitative data. However, as noted throughout the report, we did not have access to data to assess all the points raised in our discussions with DAF representatives (e.g., length of time to hire, use of DHAs, impact of incentives on recruiting). Therefore, we recommend that a future effort focus on better understanding the available data for civilian workforce planning on where there are gaps to make future workforce planning more effective.
- Although many of the occupations included in this review have DHA, DAF representatives voiced concerns regarding whether DHA and its associated flexibilities were really being used to the fullest extent.
- Data also show inconsistent or minimal use of recruiting, relocation, and retention incentives for some occupational series. However, we were not able to obtain data to assess whether increased use of these would have improved recruiting and retention.
- For several occupations, pay comparisons show that DAF pay lags behind that of the other services, the rest of DoD, and certain federal government agencies. This gap is partly due to the result of fewer positions under demonstration projects and alternative personnel systems, which provide more flexible pay through pay banding scales and lower DAF pay compared with services and other agencies within pay plan type—GS, demonstration projects, or alternative personnel systems.
- Interviews with university career services offices and private-sector recruiting experts indicate that recruitment of top undergraduate candidates and experienced talent requires more than compensation; it demands emphasis on mission and values (e.g., diversity), innovation, and professional opportunities.

- These same interviews along with interviews with representatives from other federal agencies highlighted the importance of increased marketing and branding through the use of specialized recruiters and the use of social media and internet tools.

Overarching Recommendations

Using the study findings, we provide recommendations for actions the DAF can take to improve current recruiting and hiring practices to better compete for top-tier talent.

Ensure That Hiring Managers Are Aware of and Understand How to Use Available Hiring Authorities and Related Flexibilities

One of the consistent concerns we heard from DAF representatives across occupations was that hiring managers are often not aware of or do not fully understand the available hiring authorities and related flexibilities they can use when recruiting talent. In particular, representatives expressed concern that many hiring managers are still using the “post and pray” method even when DHA allows for on-the-spot hiring.¹⁶⁴ As our analyses show, additional authorities—such as those authorized by IPAs, authorities for HQEs, and the 3R incentives—also appear not to be used to their fullest potential. We acknowledge that there are funding limitations that affect the use of incentives and pay, and we recommend that these be reviewed in future research. A barrier that can be addressed in the immediate term is potential lack of knowledge of available resources.

Therefore, we recommend that the DAF work to find effective methods for ensuring that hiring managers are aware of and understand how to use available hiring authorities and related flexibilities (e.g., required training, interactive handbook, or website with decision trees). Based on interviews with DAF representatives, we acknowledge that the DAF is already working to proactively educate hiring managers in many of these areas. We recommend that the DAF particularly focus on the following:

- Use of DHA to its fullest extent (e.g., take advantage of on-the-spot hiring).
- Increase awareness of other authorities that can bring in talent (e.g., the IPA, HQEs).
- Ensure that hiring managers are knowledgeable about the availability of incentives and how to use them.¹⁶⁵
- Expand knowledge of pay band flexibility to provide increased pay to aid in recruiting.
- Stress the importance of shortening the length of the hiring process.¹⁶⁶

¹⁶⁴ Unfortunately, to our knowledge, there are no available data to confirm or refute this concern. Future research may also benefit from conducting a survey with hiring managers regarding their knowledge of and use of DHA and its associated flexibilities.

¹⁶⁵ We acknowledge that budget limitations can also affect the use of incentives. Additional recommendations on incentives are included in a previous report on the DAF civilian workforce (see Groeber et al., 2021).

¹⁶⁶ We acknowledge that the DAF has been proactive in trying to reduce the time-to-hire and continues to review metrics in this area. Our recommendation is intended to further highlight the importance of reducing time-to-hire.

Review Current Outreach and Marketing Efforts to Ensure That They Address Factors Important to Potential Candidates and Emphasize a Consistent Brand

Focus on mission and values to help create a clear, consistent DAF brand. Our interviews with representatives from university career services offices, private-sector recruiting experts, and representatives from other federal agencies highlighted that although compensation can be important for highly technical jobs, it is not the only or even main factor that candidates consider. In particular, representatives highlighted the importance of the organization's mission and values to candidates. In addition to the importance of sharing information on the organization's values, interviewees commented on the importance of an organization's stance on social justice and diversity issues and the importance of making candidates aware of organizational efforts in these areas.

In addition, while some agencies, such as NASA, have immediate brand recognition, other agencies have to work at getting the general population to understand the civilian jobs and careers they have in their agency. This is particularly true in DoD agencies, for which many potential candidates may not be aware that civilian jobs are available. Agency representatives recommend increasing the efforts underway to brand agencies and increase their appeal as employers of choice. As noted in a previous study on attracting civilian talent (Groeber et al., 2021), job postings on USAJOBS are often very lengthy and complex compared with private-sector job postings. They also often fail to highlight the DAF mission. These job postings, along with the use of other tools, can provide a key avenue to advertise the mission and culture of the DAF and how civilians can play a role in supporting the mission.

Use social media and internet tools known to applicants to reach the broadest set of potential applicants. The DAF talent acquisition team already uses various internet recruiting tools and social media to try to advertise positions. However, the team has a small staff focused on targeting specific occupations. Experts in our interviews highlighted the importance of these tools in creating a stronger public-facing campaign on overall DAF mission and values for civilians. In particular, several private-sector recruiting experts discussed the importance of building "communities" of interest—not through advertising, but through social media, reaching out to diverse populations of job-seekers by providing ongoing content, not just ads in media. For example, one expert commented, "I don't think the answer is advertisement. The Air Force has good values. Look at what companies are doing right now—these channels have a live community, they have content. There are plenty of ways to distribute content. You don't have to pay to get it out. The content has to be compelling, and you have to live those values." We recommend that the DAF explore additional options for enterprise-wide branding related to civilian jobs through the use of such tools.

Create opportunities throughout the educational life span of students to build familiarity with the DAF and potential civilian job opportunities. Career advisers with whom we spoke raised the importance of consistent engagement with students and strategic, ongoing

engagement with professionals on campus who can get to know the organization and represent that organization as an option to students over time. This includes going beyond a booth at the career fair and job postings on university recruiting sites. We were told that the most successful employers take a more enterprise-wide approach that includes common and transparent language in job postings and informational materials that can help candidates form a cohesive impression of the organization and help them decide which postings are the best fit for their background and interests.

In addition, advisers across all universities underscored the importance of leveraging university alumni in recruiting efforts. They emphasized that engagement with alumni facilitates the ability of students to imagine themselves in an organization and visualize their career path. It also communicates that the organization values their degree. University candidates often learn of opportunities by word of mouth, from friends and alumni who have had a good experience with the organization. Advisers recommend, where possible, that employers shine a light on institutional alumni who are in the organization, their career path to date, and their potential future growth.

Consider the Increased Use of Specialized Recruiters at the Air Force Personnel Center

The DAF currently has a talent acquisition team located at AFPC that is responsible for outreach and recruiting to talent across a variety of occupations. However, this team is fairly small given the number of occupations and personnel for which the DAF recruits. Representatives from other federal agencies highlighted the use of specialized recruiters in their own efforts and expressed that they believe it has improved their ability to recruit by having subject-matter experts whose sole focus is relationships, outreach, and targeted social media recruiting. While the number of professionals engaged in these activities is relatively small, those agencies that use specialized recruiters would like to have more because of the impact they have on focused recruiting. The DAF should explore whether there could be benefits from increasing the number of personnel it has performing this function, particularly from an enterprise-wide recruitment perspective. These specialized recruiters could also serve as the front line of the agency in interactions with universities and colleges and perform social media outreach along with accessing resumes available on recruitment websites.

Review Position Scope and Level of Work to Determine Whether Positions Are Comparable to Sister Service Positions

For several of the occupations included in this review, we found that other services and federal agencies paid similar employees more than the DAF due to having larger percentages of personnel in higher pay grades. It was beyond the scope of this study to assess whether the responsibilities and requirements for these positions were different from those in the DAF or whether there are differences in how similar positions have been classified. Therefore, we recommend that the DAF further investigate the possibility that other services and federal

agencies have personnel in higher pay grades compared with the DAF and review the scope and level of work performed and the position classification to determine whether the positions are comparable and classified at the correct GS level.

Explore Options for Expanding or Adopting Alternative Pay Structures That Allow for More Competitive Compensation Through Pay Banding

For several occupations, pay comparisons show that DAF pay lags behind that of the other services, the rest of DoD, and certain federal government agencies due to lower rates of employment in demonstration projects and alternative personnel systems, which provide more flexible pay through pay banding scales. In addition, our analyses found that even within similar pay plans, other services and federal agencies often paid personnel higher (i.e., used the higher end of the pay band). While acknowledging that there are funding limitations for civilian pay, we recommend that the DAF assess why positions are not covered by alternative pay structures that could be and explore opportunities to expand or adopt alternative pay structures for greater numbers of personnel to allow for more competitive compensation. The DAF should also review how current pay bands are used, including ensuring that hiring managers understand the flexibility that is available under these alternative pay systems.

Occupation-Specific Recommendations

Two of the occupations we reviewed were significantly distinct from the others, and we offer two recommendations to address issues specific to these occupations.

Explore the Feasibility of Creating a Specific Occupational Series for Airfield Managers in Collaboration with Other Services, the FAA, and OPM

In our discussions with DAF representatives, one of the main challenges for Airfield Managers was that they lack their own occupational series, with positions falling under the much broader transportation occupational series. We were told that this presents several difficulties in hiring qualified candidates due to the lack of standardized position descriptions, job titles, and requirements. To help facilitate more direct career field management of Airfield Managers, we recommend that the DAF explore the feasibility of creating a specific occupational series for Airfield Managers with other services, the FAA, and OPM. This could help facilitate the establishment of unique responsibilities and requirements for these positions and address concerns regarding the nonstandardization of position descriptions. Further, having an occupational series that applies across DoD can help ensure standardization across the services in what is required to operate DoD airfields.

Explore Options for More Creative Recruitment of Nurses

While the competition for Nurses is a challenge in today's employment environment, the DAF may have an advantage over some private-sector organizations in that it can provide a more stable, patient-centric nursing experience that Nurses may not experience in hospitals and clinics that are profit-driven. We recommend the following actions that could improve the DAF's ability to attract and hire new Nurses:

- Review the DAF practice of expecting a year of private-sector experience and recruit Nurses directly out of school.
- Recruit Nurses whose college is in near proximity to where the DAF has position vacancies.
- Offer interesting assignments using the full availability of DAF nursing position locations to possibly entice candidates from their local geographic environment.
- Allow for nursing specialty retraining opportunities via developmental training announcements as a recruitment tool.
- Offer accelerated promotions with training agreement to advance new nursing employees more quickly.

Conclusion

As demand for certain technical talent is expected to increase across the U.S. workforce over the next decade, it will be important for the DAF to continue exploring its use of all available hiring authorities and other flexibilities that can be used to attract and hire diverse, high-quality candidates. Some of the findings and recommendations contained within this report would require additional resources to ensure that DAF compensation stays competitive with the private sector, sister services, and other federal agencies. However, our interviews with recruiters and universities suggest that compensation is not the only factor, or even main factor, that job candidates consider. There are other actions the DAF can take to increase its brand awareness and become an employer of choice for civilian talent by highlighting its mission, values, and opportunities for innovation and career growth.

Appendix A. Data Sources and Methodology for Comparisons to the Sister Services and Private Sector

In this appendix, we describe the data sources and methods that we used in the main report for our quantitative analyses.

Data Sources

We use five primary data sources in this report. First, we use personnel data from AFPC to analyze DAF civilian employee data. We also use four other data sources to compare DAF civilians to civilians in other DoD services, other federal agencies, and the private sector.

Air Force Personnel Center Data

Our primary data source for DAF civilian employees is personnel data that we received from AFPC. The AFPC data include data on demographics (e.g., sex, race, age), education level, occupation, hiring authority, and salary. Except where noted, we restricted our sample to include only full-time, non-seasonal employees who earned at least minimum wage, as we do in the ACS survey-based data.¹⁶⁷

Defense Manpower Data Center

We also use personnel data on DoD civilians provided by the DMDC to compare DAF civilian employees with civilian employees employed by the other DoD services. We use the civilian master file and the civilian pay files. The civilian master file includes information on employee demographics, occupation, and location. The civilian pay files include information on an employee's pay, including base pay, locality pay, and other special pays or bonuses. The civilian pay files include information on the types and amount of pay each employee receives each pay period. We use the civilian pay files to determine an annual gross pay variable using the same process as McIntosh et al. (2020).¹⁶⁸ We limit our sample to include full-time non-seasonal

¹⁶⁷ We approximate such an employee to be one who earns \$7.25 per hour, 35 hours per week, 50 weeks per year, or \$12,687.50.

¹⁶⁸ McIntosh et al. (2020, p. 29) describe this process as follows:

We use the variable for gross pay, with several adjustments, from the DMDC Civilian Pay File. First, gross pay is reported by pay period, not annually. For cases in which an employee was employed as a DoD civilian for a partial year, we scale up their income based on the number of pay periods they worked in comparison with the total number of pay periods in a given fiscal year. The total number of pay periods is 26 in most years. However, in fiscal year (FY) 2012, it was 25; and in FY 2006, FY 2013, and FY 2017, it was 27. For less than 2 percent of the sample, the

defense civilians who earned at least minimum wage. Because we rely on the number of pay periods to determine annual gross pay, we also remove about 1 percent of employees from our sample who were paid more than bi-weekly (e.g., paid weekly). Our sample includes annual snapshots of the DoD workforce, from December 2010 through December 2020.

OPM FedScope

FedScope is an OPM online tool that provides data from OPM’s Enterprise Human Resources Integration Data Warehouse, which contains data from federal agency human resources information systems. We use personnel data provided by OPM about the federal workforce to compare DAF employees with federal employees employed by other federal agencies and sister services. We use these agencies’ publicly available, individual-level employment datasets.¹⁶⁹ These public use files includes information about the federal agency and organization, education level, occupation, age level, years of service, pay plan, pay grade, and annual salary (includes basic pay and locality pay). The publicly available FedScope data do not include an employee’s sex, race, or specific age (age levels are included). We limit our sample to include federal, full-time, non-seasonal employees who earned at least minimum wage and who were employed in December 2020.

Occupational Employment and Wage Statistics

The most statistically reliable source for estimates of gross pay for non-self-employed civilian employees in the United States by detailed occupational code is the BLS OEWS.¹⁷⁰ The BLS samples from the universe of non-farm employers in the United States, including the federal government, eliciting gross pay for employees by occupation. These surveys elicit pay by the SOC coding system, which classifies employees into one of 867 detailed job titles with a corresponding six-digit code. The BLS annually reports estimates based on the most recent three years of data, providing total employment, annual, and hourly earnings at the 10th, 25th, 50th, 75th, and 90th percentile, as well as the means, with standard errors provided for employment and mean earnings. The published statistics therefore reflect wages and salaries reported by firms for each occupation over the past three years. Therefore, care should be taken in extrapolating any patterns from single-year changes, instead focusing on general, multiyear trends.

The BLS not only provides national-level estimates of pay and employment for each occupation but also provides industry-specific estimates, state-specific estimates, and MSA-specific estimates, although not all statistics are available for all subnational units for all

number of times an individual was paid exceeds the number of pay periods in that fiscal year. We remove these individuals from our sample so that we can calculate annualized income.

¹⁶⁹ OPM FedScope’s public use data files are available at U.S. Office of Personnel Management, “Datasets Available from OPM,” webpage, undated.

¹⁷⁰ U.S. Bureau of Labor Statistics, undated.

occupations, since the BLS suppresses statistics wherein the sample size would result in confidentiality concerns.

However, these OEWS data do not contain any employee-level characteristics, such as educational attainment or age, limiting the comparability for a given employee.

American Community Survey

To address how pay may vary by employee characteristics, we use the U.S. Census Bureau's ACS, an annual cross-sectional survey of one in 40 households, resulting in over 1 million prime-working-age respondents per year.¹⁷¹ Because the ACS is a household survey and elicits information on each individual residing in the household, it contains extensive sociodemographic measures, most notably age and educational attainment. It also asks individuals, whether currently employed or not, about their current or most recent occupation, at a similar level of detail as the OEWS. Although not specifically designed to provide occupation-specific calculations of pay, its sampling strategy and sample size allows for statistically accurate calculations, depending on the specific occupation, geographic level, and demographic restriction. We limit our calculations of annual salaries in the ACS among the occupations we study to full-time (50 or more weeks per year, 35 or more hours per week), non-self-employed employees with annual reported earnings exceeding income corresponding to full-time minimum wage work.

However, comparing household survey data with administrative records leads to concerns over validity, stemming from two sources: error in reporting and definitional differences. For example, research has indicated that self-reported data systematically deviate from administrative records.¹⁷² Rounding of incomes can result in *heaping*, such as bunching at multiples of 10,000, and confusion over income *definition* can result in either overestimates (e.g., reporting of premium pay, non-incentive-based bonuses, or on-call pay) or underestimates (e.g., reporting of post-tax pay instead of pre-tax pay) of gross pay, which is the income definition in the administrative data used in these analyses.

However, referring to these deviations as “misreporting” assumes some correct benchmark measure of earnings. In prior studies comparing private-sector pay with DoD civilian pay (McIntosh et al., 2020; Groeber et al., 2021), ACS income has been upward-adjusted based on comparisons between median full-time employee employer-reported pay in the BLS OEWS data relative to the employee-reported pay in the ACS. A different *correction factor*—calculated as

¹⁷¹ U.S. Census Bureau, undated.

¹⁷² John M. Abowd and Martha H. Stinson, “Estimating Measurement Error in Annual Job Earnings: A Comparison of Survey and Administrative Data,” *Review of Economics and Statistics*, Vol. 95, No. 5, 2013; Adam Bee and Joshua Mitchell, “Do Older Americans Have More Income Than We Think?” *Proceedings of the Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association*, Vol. 110, January 2017; Jeffrey C. Moore, Linda L. Stinson, and Edward J. Welniak, “Income Measurement Error in Surveys: A Review,” *Journal of Official Statistics*, Vol. 16, No. 4, 2000.

the ratio between median annual pay in the BLS OEWS data and median self-reported annual earnings in the ACS—was estimated for each occupation under study, and that factor was applied uniformly for all ACS reported pay. This factor exceeded one for all occupations under study, indicating that the benchmarked BLS OEWS estimates of pay were larger than that from the self-reported data; that is, self-reported data were underreported at the median, and hence the correction factor scaled up these ACS measures. However, the extent to which the BLS OEWS data corresponded to the same gross pay measure used in the administrative data analyses was not established, nor were disparities between ACS and BLS OEWS data explored at other points in the earnings distribution. We address these issues by conducting similar adjustments in this report, with two notable innovations:

- We show that BLS OEWS measures of annual pay among federal employees in our occupations of interest,¹⁷³ throughout the distribution of pay, align with comparable statistics produced from FedScope data throughout the pay distribution, as shown in Table A.1. This comparability—all correction factors are close to one, never deviating from one by more than the uncertainty in the BLS OEWS as measured by the relative mean standard error—shows that BLS OEWS data are an appropriate benchmark when making comparisons to administrative data.
- We then develop correction factors for ACS employee-reported earnings, using the BLS OEWS data as a benchmark, at five points in the earnings distribution (10th, 25th, 50th, 75th, and 90th percentiles) for each occupation and year under study. We apply these adjustments to the self-reported earnings data using linear interpolations for each respondent before subsequent analyses, while applying the 10th percentile factor for all earnings under the 10th percentile and the 90th percentile factor for all earnings over the 90th percentile. We show these adjustment factors in Table A.2. Across the occupations under study, employees at the lower end of the earnings distribution tend to underreport earnings relative to BLS OEWS estimates, while employees at the higher end of the earnings distribution overreport earnings relative to BLS OEWS estimates, further justifying the use of adjustment factors that vary across the earnings distribution for each occupation.

Given the distributional nature of the comparisons presented below (e.g., at different points in the overall earnings distribution and at different years of professional experience), these adjustments allow for more accurate comparisons in pay across datasets.

¹⁷³ We exclude Airfield Managers from these comparisons, given their lack of separate observation in BLS, FedScope, and ACS data.

Table A.1. Comparisons Between FedScope Pay and BLS OEWS Federal Employee Annual Earnings, by Occupation, Year, and Earnings Percentile

		Percentile of Earnings Distribution				
		10th	25th	50th	75th	90th
Computer Science						
	2017	0.97	1.01	1.02	1.02	1.02
	2018	0.97	1.00	1.02	1.02	1.02
	2019	0.98	0.99	1.00	1.00	1.00
	2020	1.01	0.99	1.02	1.05	1.06
Electronics Engineer						
	2017	0.97	1.00	1.00	0.99	0.98
	2018	0.96	1.00	1.01	0.99	0.99
	2019	0.96	0.98	1.00	0.98	0.98
	2020	0.99	0.99	1.02	1.00	1.00
Engineering Technician						
	2017	1.06	1.03	1.03	1.04	1.03
	2018	1.05	1.04	1.03	1.03	1.03
	2019	1.03	1.02	1.02	1.02	1.02
	2020	1.05	1.04	1.04	1.04	1.05
Operations Researcher						
	2017	0.99	1.01	1.01	1.02	1.01
	2018	1.00	1.01	1.01	1.02	1.01
	2019	0.97	1.00	1.00	1.00	1.00
	2020	0.98	1.02	1.03	1.02	1.03
Nurse						
	2017	1.02	1.02	1.01	1.01	1.02
	2018	1.02	1.02	1.02	1.01	1.03
	2019	1.01	1.01	1.00	1.00	1.01
	2020	1.04	1.04	1.03	1.03	1.04

Table A.2. Correction Factors for ACS Annual Earnings from BLS OEWS Benchmark Annual Earnings, by Occupation, Year, and ACS Earnings Percentile

	Percentile of ACS Earnings Distribution				
	10th	25th	50th	75th	90th
Computer Science					
2012	1.63	1.30	1.23	1.05	1.01
2013	1.53	1.28	1.25	1.15	1.01
2014	1.50	1.32	1.20	1.10	1.04
2015	1.45	1.35	1.22	1.14	1.03
2016	1.44	1.41	1.14	1.08	1.00
2017	1.56	1.43	1.18	1.12	0.96
2018	1.41	1.27	1.16	1.07	0.92
2019	1.42	1.28	1.17	1.06	0.95
Electronics Engineer					
2012	1.17	1.10	1.04	1.05	1.01
2013	1.14	1.07	1.05	1.03	0.98
2014	1.12	1.08	1.06	1.01	0.98
2015	1.15	1.11	1.07	1.02	1.01
2016	1.20	1.12	1.06	1.03	1.04
2017	1.19	1.10	1.08	1.07	1.03
2018	1.18	1.09	1.05	1.06	1.01
2019	1.15	1.10	1.06	1.02	1.00
Engineering Technician					
2012	1.09	1.03	1.02	0.96	0.90
2013	1.10	1.05	1.01	0.98	0.92
2014	1.12	1.07	1.03	0.97	0.95
2015	1.12	1.08	1.05	0.99	0.97
2016	1.13	1.09	1.04	0.98	0.94
2017	1.11	1.11	1.06	0.98	0.93
2018	1.14	1.10	1.04	0.97	0.92
2019	1.12	1.08	1.03	0.97	0.94
Operations Research					
2012	0.97	0.97	0.96	0.97	1.04
2013	1.00	1.00	1.00	0.99	1.03
2014	1.07	1.02	1.01	1.02	1.04
2015	1.06	1.02	1.01	1.05	1.02
2016	1.03	0.99	0.99	1.03	1.02
2017	1.01	1.00	1.02	1.03	1.00
2018	1.04	1.02	1.04	1.03	1.02

Percentile of ACS Earnings Distribution					
	10th	25th	50th	75th	90th
2019	1.08	1.05	1.06	1.06	1.01
Nurse					
2012	1.25	1.11	1.06	0.98	0.95
2013	1.27	1.09	1.07	1.00	0.96
2014	1.27	1.09	1.06	1.01	0.99
2015	1.29	1.11	1.04	1.03	1.02
2016	1.27	1.12	1.05	1.03	1.00
2017	1.28	1.15	1.08	1.01	0.99
2018	1.28	1.18	1.05	1.04	0.99
2019	1.30	1.16	1.05	1.03	1.01

Appendix B. Interview Methodology

In this appendix, we describe the methodology we used for four sets of interviews with (1) DAF representatives involved in the recruitment and hiring of civilian personnel, (2) representatives from university career services offices, (3) private-sector recruiting experts, and (4) representatives from the sister services and other federal agencies.

Department of the Air Force Representatives

To help gather information on current DAF recruiting and hiring policies and procedures, as well as challenges the DAF is encountering when trying to attract and hire candidates into each of the identified occupational series, we conducted interviews with the following DAF representatives: (1) Air Force MAJCOM and U.S. Space Force representatives responsible for overseeing civilian recruiting and hiring, (2) career field manager teams responsible for career management and development of each of our target occupations, and (3) AFPC's talent acquisition team, which provides enterprise marketing and recruiting for all hard-to-fill positions that are eligible for direct hire.

We conducted an initial round of interviews with representatives from all Air Force MAJCOMs (i.e., Air Combat Command, Air Education and Training Command, Air Force Global Strike Command, AFMC, Air Force Reserve Command, Air Force Special Operations Command, Air Mobility Command, Pacific Air Forces, U.S. Air Forces in Europe and Air Forces Africa) and U.S. Space Force representatives and AFPC's talent acquisition team in December 2020 through January 2021 to first help identify the potential target occupations we should include for our study. Using the information from these interviews and discussions with the study sponsor, we identified the six occupational series included in this report for further review.

Once the target occupations had been identified, we conducted a second round of interviews with Air Force MAJCOM and U.S. Space Force representatives and AFPC's talent acquisition team in March through July to obtain additional insight into recruiting methods and potential barriers to attracting and recruiting candidates for each of the specific target occupations. We focused our follow-up interviews with Air Force MAJCOM and U.S. Space Force representatives on only those occupations for which the organization had more than 5 percent of personnel in the particular occupational series. Not all organizations were available for the follow-up interviews. For the second round of interviews, we also included career field management teams who oversee and manage the career field. Table B.1 lists the number of representatives from each group with whom we spoke.

Table B.1. Total Number of DAF Representatives Included in Project Interviews

Interview Type	Number of Participants
MAJCOM or U.S. Space Force representative	17
AFPC representative	6
Career field management team	7

We used a semi-structured protocol that was adapted to the specific position of each group of representatives being interviewed. Each interview session lasted roughly 60 minutes and was conducted virtually using Microsoft Teams video or phone conference. For each session, a senior project team member facilitated the interview while another team member took detailed notes, including, where possible, verbatim quotes regarding key points.

Once interviews were complete, we compiled and reviewed all interview notes, focusing on identifying key information and themes aligned with the protocol topics. We used an inductive approach to analyzing the notes by focusing first on relevant information for each target occupation and identifying factual information regarding recruiting methods and relevant policies and procedures, as well as perceived barriers to hiring and recruiting discussed by representatives. We then reviewed notes to identify potentially similar themes regarding barriers for attracting and recruiting candidates across the different occupations. We also searched for variation in responses across the representatives we interviewed to account for potential differences by organization.

DAF REPRESENTATIVES SEMI-STRUCTURED INTERVIEW PROTOCOL

Overview Questions

1. Our understanding is that you employ the following numbers of civilian personnel in the following occupations. Is this correct? Our focus is on those occupations below that comprise 5 percent or more of the total population of DAF employees in that occupational series.
1. Computer Scientists (1550) - XX personnel in 2020 - XX percent of total population
2. Operations Research Analysts (1515) - XX personnel in 2020 - XX percent of total population
3. Electronics Engineers (855) - XX personnel in 2020 - XX percent of total population
4. Engineering Technicians (802) - XX personnel in 2020 - XX percent of total population
5. Airfield Managers (2150) - XX personnel in 2020 - XX percent of total population
6. Nurses (610) - XX personnel in 2020 - XX percent of total population
2. Do you currently have challenges in hiring or retaining personnel in these occupations?

Technical fields of interest and recruiting process

Next, we'd like to discuss the identified occupations and technical areas.

1. We'd like to get a sense for the recruitment process for the identified occupations. What are the procedures for posting open jobs? Where are jobs posted?
 - a. What methods do you use to advertise and recruit potential candidates? Are there particular schools you target? Partnerships or feeder programs?
 - b. Who facilitates the recruitment process? Please describe their roles in each stage of the process.
 - c. What is the average number of days to fill open positions for these occupations?
2. Can you please describe specific hiring authorities or other hiring flexibilities or programs that can be used to help attract and employ talent in these technical areas?
 - a. To what extent have these been effective in recruiting and employing talent?
 - b. Do you have data or reports you are able to share on how often these are used and their effectiveness?
3. Are you looking to hire at the entry, journeyman, or senior level positions?
 - a. If multiple: How does your recruiting strategy differ depending on the level of experience you're seeking?
4. Do you expect civilian technical talent to come in with all the skills that they need or is there opportunity to develop existing talent to fill gaps?
 - a. *If open to developing talent among current civilian employees:* How do you decide whether to hire from outside versus focus on developing talent from within for particular technical roles?

Potential barriers to attracting and hiring top talent

Next, we'd like to focus on potential barriers to attracting and hiring top talent in these fields.

1. What do you understand to be the primary challenges during the recruitment and hiring process? Where do you hit snags?
 - a. Timeline to hire
 - b. Installation-specific challenges
2. What would you identify as the top impediments to attracting and hiring top talent in the identified occupations?
 - a. To what extent is [AREA] a barrier?
 - 1) Compensation
 - 2) Contract features
 - 3) DAF culture/mission
 - 4) Geographic location of positions
 - b. Other challenges?
3. What strategies do you currently use to navigate the challenges that you have described?

4. How effective are these resources in mitigating challenges that you face in recruiting and hiring for technical roles?
5. Are there other strategies that you would like to use but cannot presently use?

Recommendations for policy improvements

To conclude, we'd like to hear about recommendations for improvements to policy, procedure, and practice and then reflect on what we may have missed in our discussion today.

1. Are there changes that DAF can make to policies and procedures in order to facilitate the recruitment and hiring of talent for technical roles?
 - a. Department of Defense changes?
 - b. Legislative changes?
2. Is there anything that we missed in our questions or that you wish that we had discussed today?

University Career Services Offices

To determine the university career services offices we would target for our focus groups and interviews, we identified top-ranking institutions overall, top institutions near to key installations, and institutions that have a DoD FFRDC affiliation. We identified top-ranking colleges and universities that offer majors in the target career fields for this task: computer science, engineering, and operations research. We used the U.S. News and World Report 2021 rankings and online search tool to identify the top-ranked schools offering majors in these fields. To identify top institutions near key installations, we first drew on DAF occupational data to identify installations with at least 10 percent of each occupational series. Then, we used the U.S. News and World Report top colleges and universities search tool to find top-ranking institutions within 100 miles of the institution. In larger states with fewer postsecondary institutions, we expanded this search to include the entire state. Lastly, we also identified higher education institutions with a DoD FFRDC affiliation.

We cross-referenced these lists to target 11 colleges and universities (Table B.2). We received responses from nine institutions; seven institutions agreed to participate in the research. We constructed a semi-structured protocol that focused on job candidates' priorities when considering potential positions and employers, the nature of recruiting on campus, current DAF recruitment on campus, including both strengths of and impediments to DAF civilian recruiting, and recommendations for university-based recruiting strategies.

Table B.2. University-Based Career Advising Offices, Proximate Installation, and FFRDC Affiliation

University	Participants	Proximate Installation or FFRDC Affiliation
Carnegie Mellon University	3	Software Engineering Institute
Embry-Riddle Aeronautical University	1	Eglin AFB, Florida
Emory University	3	Robins AFB, Georgia
Miami University-Oxford	2	Wright-Patterson AFB, Ohio
Ohio State University-Columbus	2	Wright-Patterson AFB, Ohio
University of Oklahoma	3	Tinker AFB, Oklahoma
University of Florida	1	Eglin AFB, Florida
California Institute of Technology	N/A	Jet Propulsion Laboratory
Massachusetts Institute of Technology	N/A	Lincoln Laboratory
University of Georgia	N/A	Robins AFB, Georgia
University of Utah	N/A	Hill AFB, Utah

Between May and July 2021, we facilitated interviews or focus groups with 15 staff from these seven institutions. Each discussion lasted roughly 60 minutes and was conducted virtually using Microsoft Teams video or phone conference. We took detailed notes, including, where possible, verbatim quotes regarding key points. After conducting all the interviews and combining team members' notes, we analyzed the data by identifying and sorting notes and quotations from the discussion based on relevant topics or themes. We used an inductive coding approach, allowing the data to drive the initial set of themes. We determined the prevalence and variation of particular themes and identified relevant quotations that exemplified each theme. We searched for variation and disconfirming cases in order to capture the differences in perspective between institutions and ensure that we were drawing defensible conclusions based on our coding.

We note that the insights from our university career services office interviews are exploratory in nature. The contacted institutions constitute a purposive sample of institutions, and we were only able to speak with 15 key informants across seven institutions. Though the perspectives are not representative of all university career services offices and are few in number, they represent the perspectives of key informants from universities with top candidates for DAF civilian jobs. Additionally, the professional experiences of university career services advisers have been affected by the COVID-19 pandemic; while participants spoke from their experiences with campus recruiting and student advising broadly, their responses and perspectives may have been shaped by their more recent experiences with a primarily virtual recruiting experience.

UNIVERSITY PLACEMENT OFFICES SEMI-STRUCTURED INTERVIEW PROTOCOL

Overview questions

We'd like to start by getting a sense for your role and responsibilities.

1. Please describe your current position and responsibilities.
 - a. How long have you been in your current position?
 - b. What did you do prior to taking on this role?
 - c. Which of the identified occupations or career fields you would be able to speak to specifically regarding recruiting?
2. Can you please describe your engagement with students? Your engagement with potential employers?
 - a. Is your caseload of students based on their interests, program of study, or some other dimension?
 - b. Are you responsible for building or maintaining relationships with particular employers or industries?
3. Can you please describe your work with commercial employers/employers from industry?
 - a. What do recruiting efforts on campus look like?
 - b. Do these employers seek particular degrees, credentials, or prior experiences in candidates?
4. Can you please describe your work with recruiters for civilian positions in the federal government and Department of Defense in particular?
 - a. What do recruiting efforts on campus look like?
 - b. Do these employers seek particular degrees, credentials, or prior experiences in candidates?
 - c. Have you worked with individuals recruiting civilian technical talent for the Air Force?
 - 1) What did that collaboration look like?
 - 2) What types of positions were they recruiting for?
 - 3) Were there any particular challenges or successes of that recruiting process?

Student interests and job search considerations

1. In general, what would you say drives student interest in particular job opportunities?
 - a. Alignment of job opportunity with skills?
 - b. Alignment of job opportunity with interests?
 - c. Alignment of employer/job opportunity with values?
 - d. Geographic considerations?
 - e. Compensation and benefits?
 - f. Job flexibility?
 - g. Perceived prestige of job opportunity or employer?

2. What tools/platforms or forums do your students use to find employment opportunities?
 - a. Do these vary by field?
3. For each of the identified fields, can you please describe students' interest in careers in industry? Their interest in jobs or careers as a civilian in the Department of Defense or the Air Force, in particular?

Technical fields of interest and potential barriers to attracting and hiring top talent

Next, we'd like to discuss potential challenges to attracting and hiring top talent in the occupational areas identified for this study.

1. Can you please describe the recruiting process and student considerations regarding employment for each of the identified occupations?
 - a. What types of jobs are advertised to your students?
 - b. Are virtual or onsite job fairs effective?
2. What information are students looking for from recruiters?
3. What is the timing of the recruiting cycle for the identified occupations?
 - a. At what point in the academic year do students look for job postings? By what time do they expect to have found employment?
4. How competitive is it to secure jobs in the identified occupations?
5. Have recruiters articulated challenges that they face in recruiting the talent that they seek?
 - a. Are these challenges pervasive and stable or do they vary between recruiting cycles, employers, and industries?
6. Of the identified occupations, do you anticipate that the Air Force will have difficulty in attracting and hiring top civilian talent in particular areas in the next several years? Why?

Probes:

- 1) Competition with industry?
- 2) Supply of qualified individuals?
- 3) Geography?
- 4) Compensation?
7. Based on your understanding of student considerations and Department of Defense hiring practices, what would you identify as the Department of Defense's top impediments to attracting and hiring top talent in the identified occupational areas?
 - a. To what extent is [AREA] a barrier?
 - 1) Compensation
 - 2) Contract features
 - 3) DAF culture/mission
 - 4) Geographic location of positions
 - b. Other challenges?
 - c. Air Force hiring practices? Air Force impediments, in particular?

8. Are students aware of civilian job opportunities with the Air Force?

Recommendations for improvements

To conclude, we'd like to discuss recommendations that you would make to improve recruitment of top technical talent to the Air Force, as well as to reflect on what we may have missed in our discussion today.

1. What changes might the Air Force make to mitigate some of the impediments to recruiting technical talent that you shared today?
2. Is there anything that we missed in our questions or that you wish that we had discussed today?

Private-Sector Recruiting

The set of industry interviews was a convenience sample, enabled through our networks of contacts, focusing on potential interviewees with many years of industry human resources and staffing experience. We identified experts in the recruitment of Computer Scientist, Electronics Engineering, Engineering Technician, Nursing, and Operations Research Analysis career fields.

Several of the experts had 25 or more years of experience in recruitment of these career fields, most with executive positions reflective of their senior professional standing and long experience. These experts were asked to speak from their comprehensive professional backgrounds in recruitment of these career fields, conveying their overall professional knowledge and experience, and not just as representatives of their current employers. The team also convened a panel of recruiters working with DoD to place candidates in contracting positions in these technical career fields, with panel composition including executive, management, and recruiter levels. We provide an overview of the background of participants in each interview session below:

- Chief industrial/organizational psychologist with 20+ years of experience in building machine learning and artificial intelligence assessments and whose organization has a large federal practice.
- Chief learning officer, former head of Talent Management, and multi-decade leader in human resources. Currently chief learning officer of a government-sponsored enterprise of a federal agency.
- Head of the government services sector in a company doing technology-based assessments to support companies and organizations in their hiring efforts; has deep experience with federal hiring processes.
- Recruiter with several years' experience in technical recruiting, formerly an employee of a technical staffing organization for 30,000–60,000 technical IT consultant roles. Currently at one of the three largest and most visible technology companies.
- Chief industrial/organizational psychologist whose responsibilities included recruitment across the nursing career field.
- Panel of three recruiters from a firm that exclusively places candidates in federal contracting positions. Panel spanned executive, manager, and individual recruiter levels.

We conducted a total of five in-depth individual interviews and one panel interview. We used a semi-structured protocol that was adapted to the specific position of each group of representatives being interviewed. Each interview session lasted roughly 60 minutes and was conducted virtually using Microsoft Teams video or phone conference. For each session, a senior project team member facilitated the interview while another team member took detailed notes, including, where possible, verbatim quotes regarding key points.

Once interviews were complete, we compiled and reviewed all interview notes using an inductive qualitative thematic approach to identify emergent themes across the interview sessions. We also highlighted key quotes to help illustrate and give depth to the themes that emerged across the interviews.

Similar to our interviews with university career services offices, we note that these interviews were exploratory in nature and reflect the perspectives of a small sample of recruiting experts who were identified through convenience sampling. Specifically, the set of interviewees was developed from industry networks and contacts specific to the RAND team members. Therefore, our findings may be biased due to selection and are not generalizable to larger populations of industry experts. Therefore, while clear themes emerged across the interviews, results should be interpreted as exploratory only, given the small sample size and potential for selection bias.

PRIVATE SECTOR SEMI-STRUCTURED INTERVIEW PROTOCOL

Background questions

We'd like to start by getting a sense for your role and responsibilities.

1. Please describe your current position and responsibilities.
 - a. How long have you been in your current position?
 - b. What did you do prior to taking on this role?
2. Can you please describe your familiarity with or experience with hiring for your current organization and your previous organizations?
3. If relevant, can you please describe your work to recruit for civilian positions in the Federal Government and Department of Defense in particular, or for contractor positions for the Federal Government and Department of Defense?

Candidate job search approaches, interests, and considerations

1. What tools/platforms or forums would you say that potential candidates use to find employment opportunities in today's job market?
 - a. Do these vary by field?
2. At a general level, what would you say drives job seekers or potential candidates to have an interest in particular job opportunities?

Probe:

- Alignment of job opportunity with skills?
 - Alignment of job opportunity with interests?
 - Alignment of employer/job opportunity with company values?
 - Geographic considerations?
 - Compensation and benefits?
 - Job flexibility?
 - Perceived prestige of job opportunity or employer?
3. Are there one or two characteristics, benefits, or other particulars that job seekers and candidates are especially looking for, in your experience?

Technical fields of interest and potential barriers to attracting and hiring top talent

Next, we'd like to discuss potential challenges to attracting and hiring top talent in the occupational areas or fields identified for this study.

1. Can you tell us which of the identified occupations or career fields you would be able to speak to specifically regarding recruiting or hiring?
2. If not these specific positions, are there any closely related occupations or career fields that you would like to speak to? (e.g., engineers in general, other types of analysts, other types of IT roles)
3. In addition to your overall experience with candidates and job seekers, here are some specific interests for our study:
 - a. The recruiting process and recruiting platforms for these or similar positions
 - 1) Virtual or onsite job fairs
 - 2) LinkedIn
 - 3) Other online platforms
 - 4) Contingent or retained recruiting agencies
 - 5) Employee referrals
 - 6) Others you are aware of
 - b. Information that potential candidates are looking for from recruiters about these jobs
 - c. Degree of competition (or lack of competition) within these fields for jobs
4. Have recruiters spoken to you of the challenges they face in recruiting the talent they need?
 - a. Are these challenges pervasive and stable or do they vary given
 - 1) recruiting cycles?
 - 2) employers or employers' reputations?
 - 3) industries?
 - 4) professional levels?
 - 5) locations?
 - 6) any other factors?

5. Regarding the identified occupations or career fields, do you anticipate that the Air Force will have difficulty in attracting and hiring top civilian talent in the next several years? Why?
 - a. Probes:
 - 1) Competition with industry?
 - 2) Supply of qualified individuals?
 - 3) Geography?
 - 4) Compensation?
 - 5) Perceptions of lack of innovation or current technologies?
6. Based on your understanding of job seeker or candidate considerations and Department of Defense hiring practices, what would you identify as the Department of Defense's top impediments to attracting and hiring top talent in the identified career field or occupational areas?
 - a. awareness of potential civilian jobs in the Federal Government
 - b. difficulties in the actual application process
 - c. compensation
 - d. contract features
 - e. DAF culture/mission
 - f. geographic location of positions
 - g. other challenges
7. Would your perceptions of these challenges be similar to or the same for Air Force positions?

Recommendations for improvements

In our last section of questions, we would like your ideas on recommendations that you would make to improve recruitment of top technical talent for the Air Force, Department of Defense, or the federal government.

1. What changes might the Air Force, DoD, or the federal government make in order to mitigate some of the specific impediments to recruiting technical talent that you shared today?
2. Is there anything that we missed in our questions or that you wish that we had discussed today? Is there any additional information you would like to share? Have we missed any important topics?

PRIVATE-SECTOR SEMISTRUCTURED INTERVIEW PROTOCOL FOR NURSES

Background questions

As you know, we have spoken with you before about other professional categories. Today, we would like to focus on nursing as a profession, and the recruitment of nurses.

1. Can you please describe your work regarding the recruitment of nurses, either new graduates or experienced nurses?

2. Have you recruited nurses for private sector hospitals, public hospitals, other types of organizations, or for positions with the federal government or Department of Defense?

Candidate job search approaches, interests, and considerations

1. What tools/platforms or forums would you say that potential nursing candidates use to find employment opportunities in today's job market?
 - a. Do these vary by specialty or experience level?
2. Generally, what would you say drives job seekers or potential candidates to have an interest in particular nursing job opportunities?

Probe:

- Alignment of job opportunity with skills?
 - Alignment of job opportunity with interests?
 - Alignment of employer/job opportunity with company values?
 - Geographic considerations?
 - Compensation and benefits?
 - Job flexibility?
 - Perceived prestige of job opportunity or employer?
3. Are there one or two characteristics, benefits, or other particulars that job seekers and candidates for nursing positions are especially looking for, in your experience?

Platforms for recruitment and potential barriers to recruitment of nurses

Next, we'd like to discuss platforms or venues for attracting and hiring nurses and potential barriers to successful recruitment of nurses.

1. We are interested in your experience with different platforms for recruitment of nurses. Have you utilized these platforms, and if so, have they been successful?
 - a. Virtual or onsite job fairs
 - b. LinkedIn
 - c. Other online platforms
 - d. Contingent or retained recruiting agencies
 - e. Employee referrals
 - f. Other platforms or venues you are aware of
2. Can you tell us what information potential candidates are looking for from recruiters about nursing jobs?
3. What would you say is the degree of competition (or lack of competition) within the field of nursing for jobs?
4. Regarding the profession of nursing, do you anticipate that the Air Force will have difficulty in attracting and hiring nurses in the next several years? Why?

Probes:

- Competition from hospitals and other medical organizations?
- Supply of qualified individuals?

- Geography?
 - Compensation?
 - Perceptions of lack of innovation or current technologies in medicine?
5. Based on your understanding of nursing candidate considerations and federal government or Department of Defense hiring practices, what would you identify as potential impediments to attracting and hiring nurses for Air Force positions?
 - a. awareness of potential civilian jobs in the federal government
 - b. difficulties in the actual application process
 - c. compensation
 - d. contract features
 - e. DAF culture/mission
 - f. geographic location of positions
 - g. other challenges
 6. Would your perceptions of these challenges be similar to or the same for Air Force positions?

Recommendations for improvements

In our last section of questions, we would like to hear your ideas on recommendations to improve recruitment of nurses for the Air Force, Department of Defense, or the federal government.

1. What changes might the Air Force, DoD, or the federal government make in order to mitigate some of the specific impediments to attracting and hiring nurses that you shared today?
2. Lastly, is there anything that we missed in our questions or that you wish that we had discussed today? Is there any additional information you would like to share? Have we missed any important topics?

Other Federal Agencies and Sister Services

To determine the federal agencies to be interviewed, we looked at OPM FedScope data for the agencies (outside DoD) that had the three highest number of employees for each of the six occupational series under review. The data were reviewed at the highest agency level, letting the agency further break down the bureau or sub-agency that has the largest population of positions in questions. This methodology resulted in the following agencies identified for potential interviews, including the total number of personnel in the particular occupational series:

- Computer Science (1550)
 - Department of Commerce—284
 - DoT—252
 - HHS—204
- Operations Research (1515)

- DoT—221
 - DHS—165
 - Department of Treasury—132
- Electronics Engineer (0855)
 - NASA—833
 - DoT—721
 - Department of Commerce—295
- Engineering Technician (0802)
 - U.S. Department of Agriculture (USDA)—849
 - DoT—597
 - Department of Interior—479
 - NASA—324
- Airfield Manager (2150)—The majority of the positions were assumed to be Transportation Management versus actual Airfield Managers since Airfield Managers do not have a separate occupational series.
 - GSA—381
 - DHS—184
 - USDA—174
- Nurse (0610)
 - VA—79,974
 - HHS—3,133
 - DOJ—1,687

We also added NASA for the Engineering Technician series because of the significant number of technicians and because those positions would complement the information gathered on the Electronics Engineer.

Also using data from OPM FedScope, Table B.3 shows the number of Army and Navy employees in the selected occupational series.

Table B.3. Number of Employees in Each Occupation

Occupation	Army	Navy
Computer Science (1550)	1,286	4,374
Operations Research (1515)	1,355	1,354
Electronics Engineer (0855)	2,158	7,326
Engineering Technician (0802)	3,314	7,561
Transportation Operation (2150) ^a	174	420
Nurse (0610)	6,156	1,687
Total	14,443	22,722

SOURCE: DMDC data, 2020.

^a Some of which are Airfield Manager positions.

After agencies were identified, AF/A1C sent an email to the agency chief human capital officers (CHCOs) asking for their participation in the study. Emails were sent to the FAA, the USDA, NASA, DoT, the Department of the Interior, GSA, DHS, the U.S. Department of Commerce, HHS, the U.S. Department of the Treasury, VA, and DOJ. The CHCOs for the Army and the Navy were added to the email to solicit support from the sister services in DoD. We followed up with emails to all agencies if there was no response to the initial AF/A1C email, and we contacted agency points of contact that were provided to set up interviews. Ultimately, we held computer video and voice interviews with eight agencies involving 16 agency experts on human resources and career programs. In the interviews, we used two interview protocols, one for other federal agencies and a slightly different one for the DoD sister services.

OTHER FEDERAL AGENCIES SEMI-STRUCTURED INTERVIEW PROTOCOL

Overview questions/participant background

We'd like to start by getting a sense for your role and responsibilities.

1. Please describe your current position and responsibilities.
 - a. How long have you been in your current position?
2. Can you please tell us a bit about your background and experience prior to this position?

Current practices for attracting and recruiting talent for relevant technical fields

1. Could you please describe how your organization hires to fill openings in any of the identified occupational areas?
 - a. What methods do you use to advertise and recruit potential candidates for these positions?
 - b. Are there specific schools that you target? Partnerships or feeder programs?
 - c. How long have these programs or partnerships been in place?
 - d. Are there strategies you'd like to use, but cannot presently use?

2. Can you please describe specific hiring authorities or other hiring flexibilities or programs that you use to help attract and employ talent in these technical areas?
 - a. To what extent do you use IPAs, HQEs, or Expert and Consultant Appointments?
 - b. To what extent have these been effective in recruiting and employing talent?
 - c. Do you have data or reports you are able to share on how often these are used and their effectiveness?
3. What would you identify as the top impediments to attracting and hiring top talent in any of the identified occupational areas?
 - a. To what extent is [AREA] a barrier?
 - a. Compensation
 - b. Federal hiring regulations
 - c. Culture/mission
 - d. Geographic location of positions
 - e. Other aspects of the recruiting and hiring process
4. Are you looking for particular skill sets, degrees/credentials, or experiences to fill these roles?
 - a. If yes: Do you expect civilian technical talent to come in with all of the skills that they need or is there opportunity to develop existing talent to fill gaps?
 - b. How has demand for any of the skills you mentioned changed over time? Has there been a noticeable shift in what you're looking for in the past few years?

Current practices for growing and retaining technical talent

Next, we'd like to discuss how your organization retains and grows its technical workforce.

1. Are you experiencing any challenges related to personnel turnover, specifically with those in technical fields?
 - a. In general, how long is the average tenure in any of the identified occupational series? Does it differ for those starting at an entry-level position vs. experienced hires?
2. Who do you feel like you're primarily competing with for talent in this area?
 - a. If other federal agencies: Are you aware of any recruitment strategies that these organizations are using that you would like to adopt?
 - b. If participant mentions inability to compete with industry for top technical talent: Do you think more flexible, shorter term appointments/rotations developed in partnership with the private sector might be beneficial?

Recommendations for statute or government regulation improvements

To conclude, we'd like to hear about recommendations for improvements and then reflect on what we may have missed in our discussion today.

1. Are there changes to laws or government regulations that should be made in order to facilitate the recruitment and hiring of talent for technical roles?
2. Is there anything that we missed in our questions or that you wish that we had discussed today?

SISTER SERVICES SEMI-STRUCTURED INTERVIEW PROTOCOL

Overview questions/participant background

We'd like to start by getting a sense for your role and responsibilities.

1. Please describe your current position and responsibilities.
 - a. How long have you been in your current position?
2. Can you please tell us a bit about your background and experience prior to this position?

Current practices for attracting and recruiting talent for relevant technical fields

Next, we'd like to discuss how your organization has responded to any challenges of attracting civilian technical talent.

1. Could you please describe how your organization hires to fill openings in any of the identified occupational areas?
 - a. What methods do you use to advertise and recruit potential candidates for these positions?
 - b. Are there specific schools that you target? Partnerships or feeder programs?
 - c. How long have these procedures been in place?
 - d. Are there strategies you'd like to use, but cannot presently use?
2. Can you please describe specific hiring authorities or other hiring flexibilities or programs that you use to help attract and employ talent in these technical areas?
 - a. To what extent do you use IPAs, HQEs, or Expert and Consultant Appointments?
 - b. To what extent have these been effective in recruiting and employing talent?
 - c. Do you have data or reports you are able to share on how often these are used and their effectiveness?
3. What would you identify as the top impediments to attracting and hiring top talent in any of the identified occupational areas?
 - a. To what extent is [AREA] a barrier?
 - 1) Compensation
 - 2) Federal hiring regulations
 - 3) Culture/mission
 - 4) Geographic location of positions
 - 5) Aspects of the recruiting and hiring process
 - b. Other challenges?
4. Are you looking for particular skill sets, degrees/credentials, or experiences to fill these roles?
 - a. If yes: Do you expect civilian technical talent to come in with all of the skills that they need or is there opportunity to develop existing talent to fill gaps?

- b. How has demand for any of the skills you mentioned changed over time? Has there been a noticeable shift in what you're looking for in the past few years?

Current practices for growing and retaining technical talent

1. Are you experiencing any challenges related to personnel turnover, specifically with those in technical fields?
 - a. In general, how long is the average tenure in any of the identified occupational series? Does it differ for those starting at an entry-level position vs. experienced hires?
2. Who do you feel like you're primarily competing with for talent in this area?
 - a. If other federal agencies: Are you aware of any recruitment strategies that these organizations are using that you would like to adopt?
 - b. If participant mentions inability to compete with industry for top technical talent in software or engineering roles, ask the following: Do you think more flexible, shorter term appointments/rotations developed in partnership with the private sector might be beneficial?

Recommendations for statute or government regulation improvements

To conclude, we'll think about recommendations for improvements to laws, regulations or DoD policies and then reflect on what we may have missed in our discussion today.

1. Are there changes to policies and regulations that would help facilitate the recruitment and hiring of talent for technical roles?
 - a. (If relevant for organization) Department of Defense changes?
 - b. Legislative changes?
2. If you were speaking with an individual in your role in another area/Military Department that was beginning to hire talent for the technical roles we discussed today, what would be one key strategy or action that you would recommend that they take?
3. Is there anything that we missed in our questions or that you wish that we had discussed today?

Limitations

We note that the findings from many of our interviews are exploratory in nature and reflect the perspectives of limited personnel in the DAF, private-sector recruiting, college and university career offices, the sister services, and other federal agencies. Our findings may be biased by selection. For instance, we targeted 11 higher education institutions but only received responses from seven; there is a chance that willingness to participate in an interview or focus group is related to key dimensions of the data such that our analysis is skewed or has blind spots due to the commonalities among institutions that opted in or out of participation. While clear trends emerged across the interviews and focus groups, results should be interpreted with caution given the small sample size and potential for selection bias.

Appendix C. Overview of Direct Hire Authorities

OPM Direct Hire Authorities

OPM has granted five DHAs across a variety of occupations for federal agencies to hire civilians into hard-to-fill and critical job positions. These DHAs focus on medical occupations; IT occupations; Veterinary Medical Officers; STEM positions; and Cybersecurity positions. These authorities are listed in Table C.1.

Table C.1. OPM Direct Hire Authorities

Coverage	Coverage	Expiration
Medical Occupations—Diagnostic Radiologic Technologist, GS-0647, Medical Officer, GS-0602, Nurse, GS-0610, GS-0620, Pharmacist, GS-0660	All grade levels at all locations for the listed occupations	None given
Information Technology (IT) Management (Information Security)—2210	For positions GS-09 and above at all locations	Indefinitely or until OPM terminates
Veterinary Medical Officers	For positions GS-11 through GS-15 grade levels (or equivalent) nationwide to include oversea territories and commonwealths including Puerto Rico, Guam, and Virgin Islands	Indefinitely or until OPM terminates
Scientific, Technical, Engineering and Mathematics (STEM) positions—Economists (110), Biological Science (401), Fishery Biologist (482), General Engineer (801), Civil Engineer (810), Physical Sciences (1301) (1306) (1310) (1320), Actuary (1510), Mathematics (1520), Mathematical Statistician and Statistician (1529) (1530), Acquisition (1102)	For positions at the GS-11 through GS-15 grade levels (or equivalent) nationwide for enabling simple and strategic hiring to attract top talent and to create a workforce for the 21st century where a severe-shortage or critical hiring need has been identified. These appointments are subject to public notice requirements in 5 U.S.C. 3327 and 3330 and 5 CFR 330, as well as procedure in 5 CFR 330 pertaining to candidates' eligibility for priority selection, and requirements in 5 CFR 332.402.	October 10, 2023
Cybersecurity related positions—Computer Engineers (Cybersecurity) (854), Computer Scientist (Cybersecurity) (1550), Electronics Engineers (Cybersecurity) (855), IT Cybersecurity Specialist (2210)	For cybersecurity related positions GS-11 through GS-15 grade levels (or equivalent) nationwide for enabling simple and strategic hiring to attract top talent to create a workforce for the 21st century where severe-shortage or critical hiring need has been identified. These appointments are subject to public notice requirements in 5 U.S.C. 3327 and 3330 and 5 CFR 330, as well as procedure in 5 CFR 330 pertaining to candidates' eligibility for priority selection, and requirements in 5 CFR 332.402.	Indefinitely or until OPM terminates

SOURCE: U.S. Office of Personnel Management, "Direct Hire Authority: Governmentwide Authority," webpage, undated.

DoD Direct Hire Authorities

DoD also has a number of DHAs for civilian positions provided by NDAA legislation each year. Many of these authorities are used to fill key occupations with recent graduates in a

streamlined manner, requiring fewer approvals for the hiring process. Table C.2 outlines the different DHAs provided by NDAA legislation for DoD civilian hires in the past five years.

Table C.2. DoD Direct Hire Authorities, FY 2016–2021

Authority	Coverage	Expiration
NDAA FY2016 Section 1112: DHA for Select Technical Acquisition Positions (qualified veteran candidates to scientific, technical, engineering, and mathematics positions, including technicians into the defense acquisition workforce)	Secretary of Defense may carry out a pilot program to assess the feasibility and advisability of appointing qualified veteran candidates to positions in the defense acquisition workforce of the military departments without regard to the provisions of 5 U.S.C., Chapter 33, Subchapter I. Authority is limited to 1% of the total number of scientific and engineering positions within the acquisition workforce of that military department.	November 22, 2020
NDAA FY2016 Section 1113: DHA for Select Technical Acquisition Positions (qualified candidates possessing a scientific or engineering degree directly to scientific and engineering positions within the defense acquisition workforce)	Each Secretary of a military department may appoint qualified candidates possessing a scientific or engineering degree to scientific and engineering positions within the defense acquisition workforce without regard to the provisions of 5 U.S.C., Chapter 33, Subchapter I. Authority is limited to 5% of the total number of scientific and engineering positions within the acquisition workforce of that military department.	December 31, 2020
NDAA FY2017 Section 1106: DHA for the DoD for Post-Secondary Students and Recent Graduates	Provides DoD with on-campus recruiting authority under title 10 as an alternative to the federal government-wide Pathways program (established by Executive Order 13562) and other title 5 hiring authorities. Requires DoD to provide public notice and advertising of positions offered under this authority.	September 30, 2021
NDAA FY2017 Section 1110: DHA for Financial Management Experts in the DoD Workforce	Secretary of a military department provided direct appointment authority to appoint qualified candidates possessing a finance, accounting, management, business administration, or actuarial science degree to financial management, accounting, auditing, and actuarial positions within the Department of Defense workforce. The authority is limited to 10 percent of the total number of finance, accounting, management, actuarial science, or financial management positions within each military department that are filled as of the close of the fiscal year last ending before the start of such calendar year.	December 31, 2022
NDAA FY2017 Section 1125: Temporary DHA for Domestic Defense Industrial Base Facilities, the Major Range and Test Facilities Base, and the Office of the Director of Operational Test and Evaluation	Provides directors of Department of Defense test and evaluations facilities the same direct hire authorities already provided to the directors of the Department's science and technology laboratories. DHA for DoD industrial base facilities located in the United States, as well as the Major Range and Test Facilities Base.	September 30, 2018
NDAA FY2017 Section 1105b: Non-competitive Temporary and Term Appointments to Meet Critical Hiring Needs in the Department of Defense DHA for Shortage Category and/or Critical Need Positions	The Secretary of Defense may make a temporary appointment or a term appointment (1–5 years) in the Department when the need for the services of an employee in the Department is not permanent. If there is a critical hiring need, the Secretary of Defense may make a noncompetitive temporary appointment or a noncompetitive term appointment in the DoD, without regard to the requirements of 5 U.S.C. Sections 3327 and 3330, for a period that is not more than 18 months.	N/A

Authority	Coverage	Expiration
NDAA FY2017 Section 1122: Codification and Modification of Certain Authorities for Certain Positions at Department of Defense Research and Engineering Laboratories	The director of any STRL may appoint qualified candidates possessing a bachelor's degree, qualified veteran candidates to positions, qualified candidates enrolled in a program of undergraduate or graduate instruction leading to a bachelor's or an advanced degree in a scientific, technical, engineering or mathematical course of study at an institution of higher education as an employee in a laboratory described in that paragraph without regard to the provisions 5 U.S.C., Chapter 33, Subchapter I (other than Sections 3303 and 3328 of such title). The appointment authority under subsection can't exceed 6, 3, and 10 percent (respectively) of the total number of scientific and engineering positions in such laboratory that are filled as of the close of the fiscal year last ending before the start of such calendar year.	N/A
NDAA FY 2017 Section 1139: Direct hiring for federal wage schedule. Employees	The Director of the Office of Personnel Management shall permit an agency with delegated examining authority under 5 U.S.C. 1104(a)(2) to use DHA under section 5 U.S.C. 3304(a)(3) of such title for a permanent or nonpermanent position or group of positions in the competitive services at GS-15 (or equivalent) and below, or for prevailing rate employees, if the Director determines that there is either a severe shortage of candidates or a critical hiring need for such positions.	
NDAA FY2018 Section 559: DHA for Department of Defense for childcare services providers for Department child development centers.	The Secretary of Defense may appoint, without regard to any provision of 5 U.S.C., Chapter 33, Subchapter I, qualified childcare services providers in the competitive service if the Secretary determines that—(1) there is a critical hiring need for childcare services providers for Department of Defense child development centers; and (2) there is a shortage of childcare services providers.	September 30, 2021
NDAA FY2018 Section 1101: DHA for the DoD for Personnel to Assist in business transformation and management innovation.	The Secretary of Defense may appoint in the DoD individuals described in subsection (b) without regard to the provisions of 5 U.S.C., Chapter 33, Subchapter I, for the purpose of assisting and facilitating the efforts of the Department in business transformation and management innovation. The individuals described in this subsection are individuals who have all of the following: (1) A management or business background. (2) Experience working with large or complex organizations. (3) Expertise in management and organizational change, data analytics, or business process design. The number of individuals appointed at any one time may not exceed 10 individuals. Any appointment under this section shall be on a term basis, and shall be subject to the term appointment regulations in 5 CFR 316 (other than requirements in such regulations relating to competitive hiring). The term of any such appointment shall be specified by the Secretary at the time of the appointment.	September 30, 2021
NDAA FY2018 Section 1111: Establishment of Senior Scientific Technical Managers at Major Range and Test Facility Base Facilities and Defense Test Resource Management Center.	10 U.S.C. 2358a is amended for DoD Lab Demo authority. Each facility of the Major Range and Test Facility Base, and the Defense Test Resource Management Center" is added after 'each STRL. The personnel demonstration projects at laboratories of the DoD except that the director involved shall determine the number of such positions at each facility of the Major Range and Test Facility Base and the Defense Test Resource Management Center, not to exceed 2% of the number of scientists and engineers, but at least one position, employed at the Major Range and Test Facility Base or the Defense Test Resource Management Center.	N/A

Authority	Coverage	Expiration
NDAA FY2019 Section 1101: DHA for certain competitive service positions	5 U.S.C. Chapter 99 is amended by adding at the end of the following 9905 direct hiring authorities for certain personnel for the Department of Defense. The Secretary of Defense may appoint, without regard to the provisions of 5 U.S.C., Chapter 33, Subchapter I (other than sections 3303 and 3328 of such chapter), qualified candidates to any of the following positions in the competitive service of the Department of Defense. • Department Maintenance Act activities, including depot maintenance and repairs • Cyber security • Acquisition workforce that manages any services contracts necessary to the operation and maintenance of programs • Any science, technology, or engineering position, including any such positions at the Major Range and Test Facilities Base	September 20, 2025
NDAA FY2020 Section 1107: Extension of DHA for Domestic Industrial Base Facilities and Major Range and Test Facilities Base	Extends Section 1125 of NDAA FY2017 and Section 1102 of NDAA FY2018 through 2025.	"through 2025"
NDAA FY2020 Section 1109: Modification of DHAs for the DoD	The FY2020 NDAA streamlines DHAs outlined by Section 9905 of title 5 used across the DoD as follows: • Includes all cyber workforce positions, all STEM positions (excluding those in an STRL), medical or health professionals, childcare services positions, financial management and all related positions (including accounting, cost estimation, auditing, actuaries, operational research, and business administration), and others The following DHAs are suspended as a result of being included in this revision: • Select Defense Acquisition Workforce Positions • Certain Defense Health Care Occupations • Select Technical Acquisition Positions • Financial Management Experts in the DoD Workforce • Cyber Workforce Positions • Childcare Services Providers for Department Child Development Centers • Personnel Assisting in Business Transformation and Management Innovation • Certain Competitive Service Positions	September 30, 2025
NDAA FY2021 Section 1117: Expansion of DHA for certain DoD personnel to include installation military housing office positions supervising privatized military housing.	Adds to 5 U.S.C. 9905(a) coverage for "Any position in the military housing office of a military installation whose primary function is supervision of military housing covered by subchapter IV of chapter 169 of title 10."	N/A

Appendix D. Overview of Characteristics of DAF Civilian Personnel in Selected Occupational Series

Table D.1. DAF Employee Gender Breakdown, by Occupational Series

Occupational Series	Gender	
	Female	Male
Computer Science (1550)	18.31%	81.69%
Operations Research (1515)	30.56%	69.44%
Electronics Engineer (0855)	11.46%	88.54%
Engineering Technician (0802)	7.71%	92.29%
Airfield Manager	9.30%	90.70%
Nurse (0610)	86.97%	13.03%
DAF Total	35.12%	64.88%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Table D.2. DAF Employee Age Breakdown, by Occupational Series

Occupational Series	Age	
	55 and Older	Under 55
Computer Science (1550)	21.35%	78.65%
Operations Research (1515)	27.36%	72.64%
Electronics Engineer (0855)	27.54%	72.46%
Engineering Technician (0802)	40.43%	59.57%
Airfield Manager	46.51%	53.49%
Nurse (0610)	39.55%	60.45%
DAF Total	32.98%	67.02%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Table D.3. DAF Employee Race and Ethnicity Breakdown, by Occupational Series

Occupational Series	Race and Ethnicity					
	Asian/Pacific Islander	Black	Hispanic	Other	Unknown	White
Computer Science (1550)	11.72%	7.16%	4.70%	1.23%	1.42%	73.77%
Operations Research (1515)	5.54%	5.28%	4.94%	1.56%	<1%	81.90%
Electronics Engineer (0855)	15.76%	7.16%	7.18%	1.76%	<1%	67.56%
Engineering Technician (0802)	6.84%	8.23%	7.45%	2.77%	3.12%	71.60%
Airfield Manager	<10%	20.93%	<10%	<10%	<10%	65.12%
Nurse (0610)	7.86%	13.03%	8.22%	2.11%	2.58%	66.20%
DAF Total	7.85%	13.29%	8.09%	1.64%	3.06%	66.07%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: All individuals who identified as Hispanic are categorized as Hispanic. All others are non-Hispanic.

Table D.4. DAF Employee Education Levels, by Occupational Series

Occupational Series	Education Level					
	High School	Some College, No Degree	Associate's Degree	Bachelor's Degree	Master's Degree	Doctorate Degree
Computer Science (1550)	<1%	<1%	N/A	65.04%	31.93%	2.09%
Operations Research (1515)	<1%	<1%	N/A	30.74%	62.94%	5.54%
Electronics Engineer (0855)	<1%	<1%	N/A	53.22%	41.78%	4.55%
Engineering Technician (0802)	46.09%	15.01%	14.75%	18.61%	4.74%	<1%
Airfield Manager	30.95%	<10%	<10%	30.95%	<10%	N/A
Nurse (0610)	3.77%	1.53%	19.08%	56.54%	17.90%	1.18%
DAF Total	24.39%	7.08%	6.83%	29.11%	29.68%	2.59%

SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

NOTE: N/A indicates that no personnel held this degree. Although not included in the table, less than 1 percent of personnel have less than a high school degree.

Table D.5. DAF Employees with Prior Military Service, by Occupational Series

Occupational Series	Type of Prior Military Service					
	Military Service, Not Retired	No Military Credit	Retired Enlisted Air Force	Retired Enlisted Other	Retired Officer Air Force	Retired Officer Other
Computer Science (1550)	11.15%	83.87%	2.18%	<1%	2.09%	<1%
Operations Research (1515)	16.62%	64.24%	1.21%	<1%	14.63%	3.20%
Electronics Engineer (0855)	12.18%	84.43%	<1%	<1%	2.71%	<1%
Engineering Technician (0802)	31.95%	42.16%	22.34%	2.86%	<1%	<1%
Airfield Manager	<10%	<10%	79.07%	<10%	0%	0%
Nurse (0610)	22.77%	66.31%	1.64%	<1%	8.33%	<1%
DAF Total	26.80%	46.97%	17.96%	2.32%	4.88%	1.17%

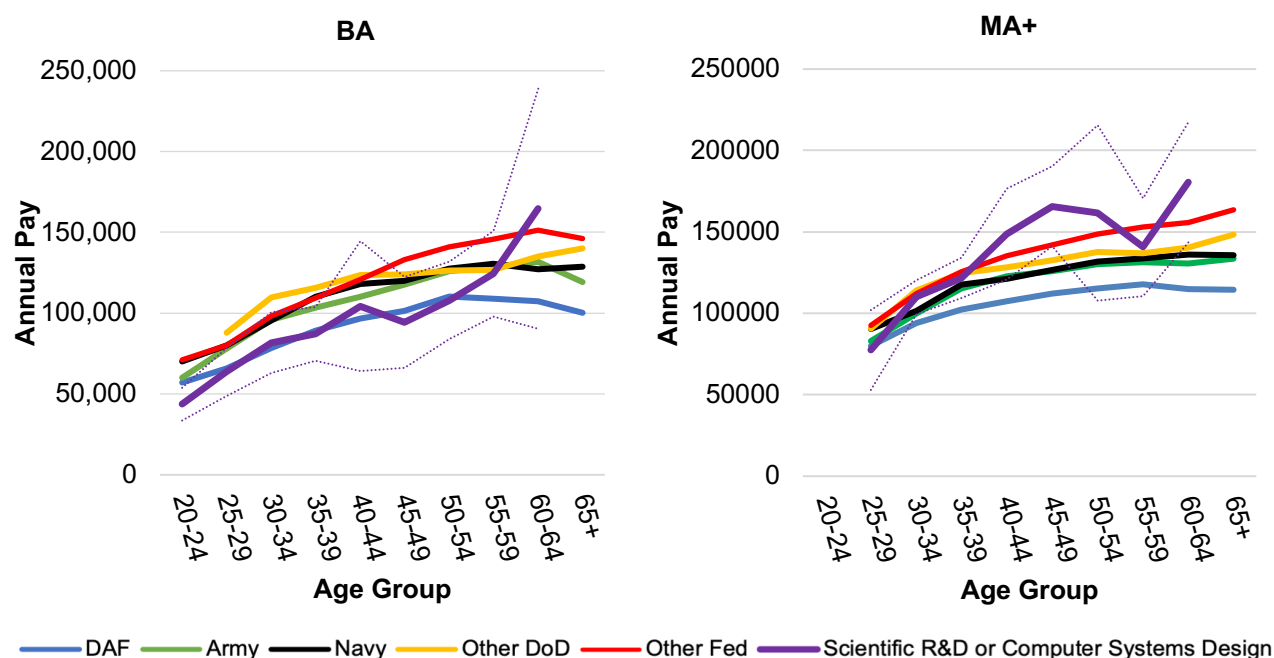
SOURCE: RAND calculations from DAF civilian personnel data files, as of January 2021.

Appendix E. Pay Plan Analyses

Computer Science

We begin this section by reproducing Figure 3.3, but with the inclusion of 95 percent confidence intervals for mean private-sector pay by education and age in Figure E.1, which provides insight as to the uncertainty around estimated average pay for Computer Science workers in the Scientific Research and Development or Computer Systems Design industries. Given both the higher variance in pay for this occupation relative to the others in this report and the relatively small size of this occupation in the U.S. workforce, and hence the small number of respondents in the ACS survey, these intervals are relatively large, especially at older ages.

Figure E.1. Average Annual Pay (\$), by Service, Agency, or Industry, Computer Science Personnel, BA and MA+, 2017–2020



NOTE: DAF, Army, Navy (includes Marine Corps), other DoD, and other federal employee pay based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors. Scientific Research and Development or Computer Systems Design industry Computer Science employee pay calculated from ACS 2017–2019 samples, adjusted for misreporting as described in Appendix A, with 95% confidence intervals shown as dotted purple lines. All pay adjusted to 2020 dollars with the CPI-U-RS.

DAF Has Fewer Computer Science Personnel Under Demonstration Authorities Than Other Services

Tables E.1 and E.2 show the total employment of Computer Science personnel across the DoD services, the rest of DoD, the three non-DoD federal agencies that account for the highest employment level of this series, and the rest of the federal government. These tables also show the percentage of this employment in the GS system, AcqDemo, or Lab Demo (“Demonstration Authority”), and other alternative personnel systems. Table E.1 provides these statistics for personnel with a bachelor’s degree, while Table E.2 provides these statistics for personnel with graduate degrees.

Table E.1. Employment, by Agency and Type of Pay Plan, Computer Science Personnel with BA, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	1,188	43%	52%	5%
Army	614	27%	73%	1%
Navy	2,724	10%	90%	0%
Other DoD	125	84%	2%	14%
DoT	152	1%	0%	99%
U.S. Department of Commerce	78	35%	0%	65%
HHS	44	77%	0%	23%
Rest of federal government	143	97%	1%	3%
Total federal government	5,068	25%	69%	6%

Table E.2. Employment, by Agency and Type of Pay Plan, Computer Science Personnel with MA+, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	701	23%	66%	11%
Army	634	22%	78%	0%
Navy	1,439	8%	91%	1%
Other DoD	183	79%	2%	19%
HHS	218	52%	0%	48%
U.S. Department of Commerce	173	12%	0%	88%
NASA	112	97%	0%	3%
Rest of federal government	256	48%	1%	50%
Total federal government	3,716	25%	61%	14%

SOURCE: FedScope data, 2020.

Among the DoD services, the DAF employs not only the fewest number of Computer Science personnel in demonstration project authorities but also the highest percentage of Computer Science personnel in DoD in alternative personnel systems. Other federal agencies, such as the rest of DoD, HHS, DoT, and the U.S. Department of Commerce, employ substantial fractions of their Computer Science personnel in alternative personnel systems. The DoT's Computer Science personnel, most of whom are accounted for by the FAA, are nearly exclusively employed in the FAA's alternative personnel system.

As we show below, pay in demonstration authorities exceeds pay in the GS system, so other services' greater utilization of these authorities accounts for a portion of the pay disparity between the DAF and these other services. Furthermore, pay in alternative personnel systems tends to exceed that in the GS system, so other non-DoD agencies' utilization of these systems accounts for a portion of the pay disparity between the DAF and these federal agencies. However, differences in pay *within* pay plans provide further explanation of why DAF pay lags behind that of other services and the rest of the federal government for this occupational series.

As an example of this difference in the GS system, Table E.3 shows the distribution of grade levels among GS Computer Science personnel in each DoD service, other DoD, and in the rest of the federal government.

Table E.3. Distribution of Grade Levels Among GS Computer Science Personnel, by Agency, 2020

	DAF	Army	Navy	Other DoD	Rest of Federal Government	Total Federal Government
GS-5	2.3%	0.3%	0.0%	0.0%	0.0%	0.8%
GS-7	22.1%	6.9%	9.3%	1.4%	0.7%	10.3%
GS-9	17.0%	12.7%	14.5%	1.4%	3.2%	10.8%
GS-11	10.2%	3.9%	11.5%	1.7%	3.2%	6.9%
GS-12	13.8%	33.3%	24.0%	1.0%	10.7%	15.7%
GS-13	28.1%	35.3%	33.8%	56.0%	28.8%	33.6%
GS-14	5.2%	5.9%	5.1%	27.3%	29.6%	13.8%
GS-15	1.2%	1.6%	1.7%	11.3%	23.9%	8.0%

SOURCE: FedScope Data, 2020

The DAF employs a greater fraction of Computer Science personnel at the GS-9 grade level or below than the other services and the rest of the federal government while employing fewer at the GS-12 or above grade levels. We thus expect that average pay would differ across services and agencies.

Flexibilities Within Pay Plans Contribute to the DAF's Lagging Pay

In addition to differences in which system Computer Science personnel are employed in, there are also differences in how DoD services and agencies use each pay plan's pay flexibilities. The next set of tables explores these differences by examining pay among agencies and services *within* pay plan.

Tables E.4 and E.5 show overall and age-group-specific pay for GS Computer Science personnel across DoD services, other DoD, and federal agencies. Table E.4 provides these statistics for personnel with a bachelor's degree but no graduate degree, while Table E.5 provides these statistics for personnel with a graduate degree.

Table E.4. Average Annual Pay (\$), Overall and by Age Group, GS Computer Science Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD	Department of Commerce	HHS	Rest of Federal Government
Overall	73,704	94,193	90,512	120,736	109,814	126,129	95,076
20–29	58,038	67,585	71,818	84,774	77,080	58,400	61,833
30–39	70,703	94,308	95,001	112,003	99,892	101,755	76,415
40–49	95,222	104,025	102,651	123,984	NA	131,166	104,678
50–59	110,163	116,823	109,617	126,898	155,867	132,984	116,650
60+	104,225	119,760	114,852	136,368	158,140	147,227	158,481

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with "NA" had no personnel in this age range and agency or service.

The DAF lags behind the sister services overall and at every age under study, with the exception of 50–59-year-olds in the Navy. The rest of DoD pays its Computer Science personnel substantially more at all ages. Although the DAF is competitive with GS employees in the rest of the federal government (excluding the U.S. Department of Commerce) for employees in their 20s, pay in the rest of the federal government quickly outpaces DAF pay at older ages.

Table E.5 shows pay for GS Computer Science personnel with graduate degrees. The three non-DoD agencies under study—HHS, the Department of Commerce, and NASA—pay substantially more overall and at every age group, as does the rest of DoD outside of the services. However, DAF and Navy pay is closer than for personnel without graduate degrees.

Table E.5. Average Annual Pay (\$), Overall and by Age Group, GS Computer Science Personnel with MA+, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD	HHS	Department of Commerce	NASA
Overall	103,714	109,304	104,166	129,610	133,286	131,360	149,620
20–29	73,856	77,231	79,788	87,242	NA	77,792	95,832
30–39	92,168	101,907	98,905	119,484	118,091	123,714	122,599
40–49	105,297	109,899	104,611	130,713	122,687	127,161	142,629
50–59	116,290	118,256	114,022	136,732	136,918	137,055	163,210
60+	117,525	119,074	130,549	142,024	149,197	151,773	158,353

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Rest of federal government excluded due to limited number of GS system employees, the majority of whom were employed by the FAA. Cells marked with “NA” had no personnel in this age range and agency or service.

Tables E.6 and E.7 shows similar comparisons for Computer Scientists working under AcqDemo or Lab Demo authorities by educational attainment. Both tables show a similar pattern: For younger employees, pay among DoD services is similar; however, the Army and Navy increase pay faster in these pay band authorities, leading to substantially lower pay in the DAF for Computer Science personnel over the age of 30.

Table E.6. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Computer Science Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
Overall	97,664	108,865	108,306	116,143
20–29	79,533	75,759	76,520	103,126
30–39	90,452	103,539	104,577	NA
40–49	99,087	118,371	120,126	NA
50–59	108,658	133,251	130,664	122,670
60+	104,983	133,103	128,343	122,632

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

Table E.7. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Computer Science Personnel with MA+, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
Overall	109,015	124,716	123,097	120,274
20–29	84,058	84,958	90,418	NA
30–39	100,185	112,516	111,999	118,525
40–49	111,374	129,069	125,362	123,771
50–59	117,320	135,557	133,919	NA
60+	113,957	138,464	136,151	NA

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

The pay disparity for Computer Science personnel working for the DAF relative to the Army is driven by two factors: The Army pays GS Computer Science personnel without graduate degrees more, especially mid-career, and, although the Army and the DAF have similar percentages of Computer Science personnel in demonstration authorities, the Army compensates its personnel in these authorities substantially more than the DAF does. The pay disparity between the DAF and the Navy is driven by these demonstration authorities: The Navy both employs a greater percentage of Computer Science personnel in demonstration authority pay plans and pays these personnel who are employed within these pay plans more.

Tables E.8 and E.9 show comparisons for alternative personnel systems for Computer Science personnel between the DAF and other agencies in the federal government. Given the relative rarity of alternative personnel system employment in the rest of DoD, we do not provide corresponding estimates.

Table E.8. Average Annual Pay (\$), Overall and by Age Group, Alternative Personnel System Computer Science Personnel with BA, by Agency, 2017–2020

	DAF	DoT	Department of Commerce	HHS
Overall	104,039	125,146	131,939	159,902
20–29	76,691	85,286	76,205	117,191
30–39	91,366	106,389	110,020	150,460
40–49	108,241	123,480	146,615	164,536
50–59	113,071	147,946	154,872	164,388
60+	111,909	150,054	149,963	155,928

NOTE: DAF and other federal agency pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.9. Average Annual Pay (\$), Overall and by Age Group, Alternative Personnel System Computer Science Personnel with MA+, by Agency, 2017–2020

	DAF	DoT	Department of Commerce	Rest of Federal Government
Overall	112,305	151,102	146,851	143,204
20–29	89,777	NA	83,133	108,630
30–39	104,938	111,344	117,089	117,914
40–49	106,994	142,853	146,803	139,089
50–59	117,247	165,382	154,868	148,717
60+	114,054	175,435	165,835	152,304

NOTE: DAF and other federal agency pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

As with the pay band systems, DAF pay is, on average, substantially lower than that of other agencies in the federal government across the age groups in this study. Tables E.1 and E.2 show that non-DoD federal agencies are more likely to employ Computer Science personnel in alternative personnel systems than the DAF; the combination of higher average pay in demonstration authorities and alternative personnel systems and a higher proportion of personnel in these authorities and systems explains the pay disparity seen in Figure 3.3 between the DAF and the rest of the federal government.

Finally, we provide similar comparisons, but in lieu of average pay by age range and education—which allowed for comparisons to private sector workers, for which in-occupation experience is generally unobserved in datasets of sufficient size to conduct reliable analyses—we provide comparisons by *years of service* and education to attempt to address any variation in pay that may arise due to systematic differences in years of service within age ranges across services or agencies. We caution the reader, however, that although years of service is a measure of experience within the federal government, it does not include any experience that workers may have accrued outside federal employment. As noted in the report, if there are systematic differences in nonfederal employment across services or agencies, then any difference in pay may be partially attributable to these workforce-level differences.

However, as Tables E.10 through E.13 show, a similar narrative arises when making years-of-service comparisons as with age-group comparisons: Although DAF GS pay is broadly similar to GS personnel in the other services, with the exception of other DoD personnel, other services’ pay in demonstration authorities rises faster with more experienced personnel than the DAF’s demonstration authority pay. Thus, the combination of other services’ greater employment of Computer Science personnel in demonstration authorities and higher pay in these authorities accounts for the DAF’s less competitive pay in this occupation.

Table E.10. Average Annual Pay (\$), by Years of Service, GS Computer Science Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	60,782	73,628	76,855	92,532
5–9	94,857	102,176	101,653	116,494
10–14	104,211	108,074	103,104	121,737
15–19	120,645	118,047	110,562	124,257
20–24	122,140	112,178	111,207	130,798
25–29	129,525	126,160	113,562	135,872
30+	117,139	122,957	116,118	142,426

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

Table E.11. Average Annual Pay (\$), by Years of Service, GS Computer Science Personnel with MA+, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	84,349	90,136	87,834	100,187
5–9	105,948	110,570	101,239	124,576
10–14	108,529	112,962	115,587	130,853
15–19	116,121	114,647	126,159	140,196
20–24	123,866	126,360	124,092	138,252
25–29	131,742	126,122	127,580	149,478
30+	127,617	128,558	141,580	149,244

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

Table E.12. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Computer Science Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	88,757	88,811	85,879	122,651
5–9	97,400	109,407	107,231	103,126
10–14	105,220	118,329	118,478	NA
15–19	108,904	132,249	125,979	NA
20–24	112,162	135,229	133,044	NA
25–29	119,473	142,999	134,037	NA
30+	114,381	145,786	137,293	NA

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

Table E.13. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Computer Science Personnel with MA+, by Agency, 2017–2020

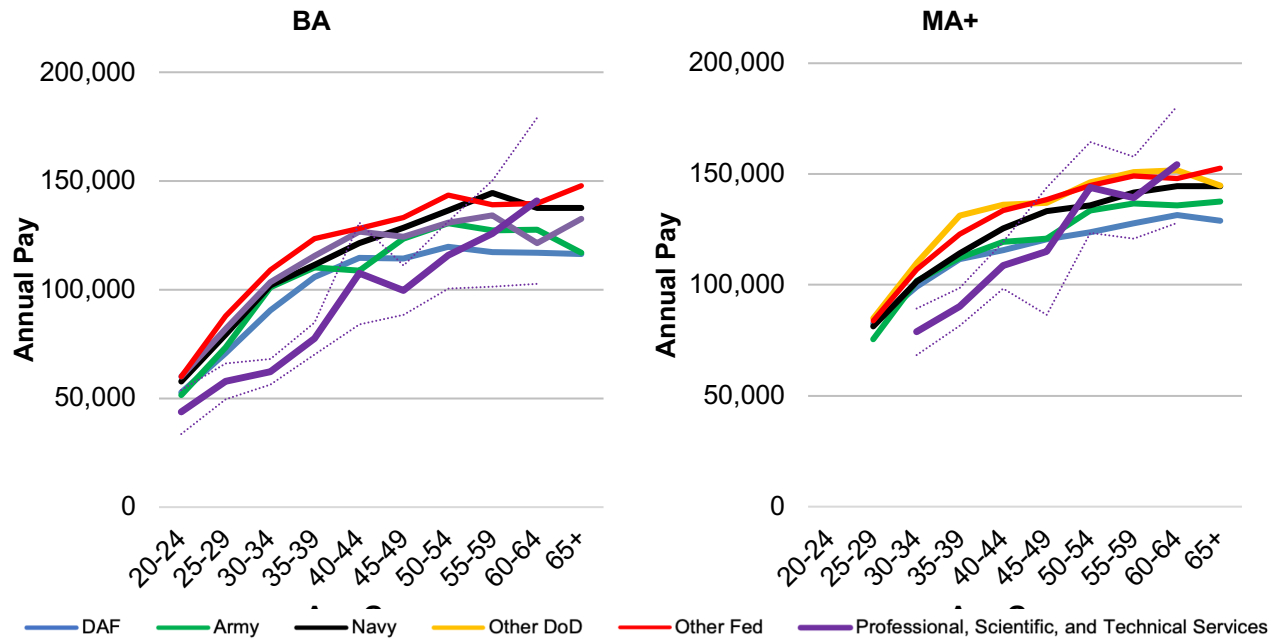
	DAF	Army	Navy	Other DoD
0–4	97,103	107,976	103,830	118,525
5–9	103,152	118,246	116,480	NA
10–14	115,274	126,037	125,668	123,771
15–19	120,426	133,948	132,448	NA
20–24	124,486	148,516	139,730	NA
25–29	124,350	145,126	140,887	NA
30+	129,851	145,388	147,547	NA

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

Operations Research

We begin this section by reproducing Figure 4.3, but with the inclusion of 95 percent confidence intervals for mean private sector pay by education and age in Figure E.2, which provides insight as to the uncertainty around estimated average pay for Operations Research workers in the Professional, Scientific, and Technical Services industries.

Figure E.2. Average Annual Pay (\$), by Service, Agency, or Industry, Operations Research Personnel, BA and MA+, 2017–2020



NOTE: DAF, Army, Navy (includes Marine Corps), other DoD, and other federal employee pay based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors. Professional, Scientific, and Technical Services industry pay is calculated from ACS 2017–2019 samples, adjusted for misreporting as described in Appendix A, with 95% confidence intervals shown as dotted lines. All pay adjusted to 2020 dollars with the CPI-U-RS.

To examine how utilization of pay plans in the DAF, the other services, and other agencies throughout the federal government contributes to overall differences in pay, we examine employment and pay across these pay plans below.

The DAF Employs Majority of Its Operations Research Personnel in GS System; the Navy Employs Majority of Its Operations Research Personnel Using Demonstration Project Authorities

Tables E.14 and E.15 show the total employment of Operations Research personnel across DoD services, the rest of DoD, the three non-DoD federal agencies that account for the highest level of employment of this series, and the rest of the federal government. They also show the fraction of this employment in the GS system, AcqDemo, or Lab Demo (“Demonstration Authority”), and other alternative personnel systems. Table E.14 provides these statistics for personnel with a bachelor’s degree, and Table E.15 provides these statistics for personnel with graduate degrees.

Table E.14. Employment, by Agency and Type of Pay Plan, Operations Research Personnel with BA, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	321	63%	32%	5%
Army	454	62%	37%	1%
Navy	599	34%	66%	0%
Other DoD	156	67%	29%	3%
DHS	69	86%	0%	14%
DoT	62	34%	0%	66%
HHS	34	100%	0%	0%
Rest of federal government	103	94%	2%	4%
Total federal government	1,798	56%	40%	4%

SOURCE: FedScope data, 2020.

Table E.15. Employment, by Agency and Type of Pay Plan, Operations Research Personnel with MA+, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	755	54%	42%	4%
Army	937	61%	37%	2%
Navy	746	33%	67%	0%
Other DoD	356	72%	17%	10%
DoT	132	25%	0%	75%
DHS	112	88%	0%	13%
Energy	101	85%	13%	2%
Rest of federal government	278	84%	0%	16%
Total federal government	3,417	57%	36%	7%

SOURCE: FedScope data, 2020.

The DAF and the Army employ similar fractions of Operations Research personnel in demonstration project authorities, in contrast to Computer Science personnel. However, these fractions are a minority of personnel in this series, and thus the majority of DAF Operations Research personnel are employed in the GS system. The Navy, however, employs the majority of its personnel in this series using demonstration project authorities.

In the rest of the federal government, Operations Research personnel are generally employed in the GS system, with the exception of DoT, which employs the majority of its personnel in an alternative personnel system. DHS employs 13 to 14 percent of its Operations Research personnel in an alternative personnel system as well, and 13 percent of Operations Research

personnel with graduate degrees working for the Department of Energy are employed under demonstration project authorities.

Given that the majority of DAF employment is in the GS system, we next turn to the distribution of grades levels within the GS system across DoD services, other DoD, and the federal government in Table E.16.

Table E.16. Distribution of Grade Levels Among GS Operations Research Personnel, by Agency, 2020

Pay Grade	DAF	Army	Navy	Other DoD	Rest of Federal Government
GS-05	0.0%	0.0%	0.7%	0.0%	0.0%
GS-07	4.2%	3.0%	10.1%	0.8%	1.2%
GS-09	7.2%	5.7%	10.8%	0.5%	2.0%
GS-11	5.7%	6.6%	5.6%	1.1%	2.8%
GS-12	12.0%	10.6%	13.2%	19.5%	8.6%
GS-13	43.7%	40.7%	23.8%	21.9%	29.7%
GS-14	23.2%	27.0%	24.0%	27.2%	40.8%
GS-15	4.0%	6.4%	11.9%	29.1%	14.9%

SOURCE: FedScope Data, 2020.

The grade level distribution in the GS system is broadly similar between the DAF and the Army, with similar proportions of GS personnel in this series at each pay grade. The Navy, on the other hand, has a much greater fraction of GS personnel at the GS-9 or lower pay grades. Other agencies in the DoD and the federal government, however, employ substantially greater fractions of Operations Research personnel at high pay grades: over 55 percent of personnel in these other agencies are employed at GS-14 or 15. Only 27 percent of DAF Operations Research personnel are employed at these pay grades, with 33.4 percent of Army personnel and 35.9 percent of Navy personnel also at these pay grades. Therefore, the DAF has the highest fraction of GS-13 Operations research personnel, but the lowest in the GS-14 and 15 grade levels.

Flexibilities Within Pay Plans Contributes to the DAF's Lagging Pay

In addition to differences in which pay system Operations Research personnel are employed, there are differences in how agencies use each pay plan's pay flexibilities. The next set of tables explores these differences by examining pay among agencies and DoD services *within* pay plan.

Tables E.17 and E.18 show overall and age-group-specific pay for GS Operations Research personnel across DoD services, other DoD, and federal agencies. Table E.17 provides statistics for personnel with a bachelor's degree but no graduate degree, and Table E.18 provides statistics for personnel with at least one graduate degree.

Table E.17. Average Annual Pay (\$), Overall and by Age Group, GS Operations Research Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD	DoT	DHS	DoE	Rest of Federal Government
Overall	92,623	99,109	93,366	115,883	124,960	111,013	120,218	126,251
20–29	59,042	64,102	63,149	87,328	92,358	67,743	78,701	88,205
30–39	96,851	101,756	97,855	109,505	121,703	110,182	117,504	117,225
40–49	114,839	106,838	113,162	117,719	138,371	128,805	136,838	121,931
50–59	119,800	121,601	130,977	128,776	139,444	148,149	145,184	140,007
60+	114,481	119,830	132,096	120,044	142,022	132,631	134,946	135,369

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Within age group and educational level among GS personnel, DAF pay tends to lag behind that of the other DoD services and is substantially lower than the rest of the federal government, especially for employees at older ages. Although DAF pay for Operations Research personnel in their 40s with BAs is highest among the DoD services, this is the one age group for which DAF has a pay advantage. Furthermore, the Navy employs a greater fraction of its personnel under demonstration project authorities, which pays, on average, more to those employees than GS employees make.

For GS Operations Research personnel with graduate degrees, DAF pay is generally competitive with the Army at most ages and with the Navy and Department of Energy at younger ages. However, other agencies in federal government pay these GS Operations Research personnel substantially more.

Table E.18. Average Annual Pay (\$), Overall and by Age Group, GS Operations Research Personnel with MA+, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD	DoT	DHS	Department of Energy	Rest of Federal Government
Overall	118,536	116,446	122,272	135,667	136,307	130,514	120,099	128,624
20–29	76,010	71,984	73,460	89,309	84,445	91,377	78,637	85,139
30–39	102,435	104,238	101,915	122,950	99,305	116,484	102,213	121,010
40–49	120,565	112,957	123,608	130,792	128,462	137,939	120,297	142,784
50–59	125,783	127,048	135,547	142,472	152,877	139,188	140,844	143,269
60+	130,291	128,759	143,659	147,618	147,005	149,912	157,336	142,804

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

We next turn to pay under demonstration project authorities in Tables E.19 and E.20.

Table E.19. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Operations Research Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
Overall	110,114	121,548	116,876	116,196
20–29	85,931	72,902	80,138	73,355
30–39	105,987	110,930	109,726	108,966
40–49	114,550	127,325	127,581	133,981
50–59	117,515	137,957	143,367	140,550
60+	119,120	130,032	137,937	169,796

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.20. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Operations Research Personnel with MA+, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
Overall	116,859	135,656	127,252	134,254
20–29	87,785	86,629	85,496	NA
30–39	109,641	115,899	110,924	110,698
40–49	116,250	132,088	131,796	138,960
50–59	125,797	144,042	139,975	155,217
60+	131,491	144,279	143,788	144,570

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

A clear pattern emerges from both education groups: The DAF pays younger Operations Research personnel more than the other DoD services, and in the case of 20–29 year-old personnel without graduate degrees, substantially more. However, this favorable DAF pay gap diminishes at older ages, and for Operations Research personnel over the age of 40, the other DoD services pay their personnel \$15,000 to \$50,000 more, depending on the age group.

Tables E.21 and E.22 show comparisons for alternative personnel system Operations Research personnel between the DAF and other agencies in the federal government. Given the relative rarity of alternative personnel system employment in the rest of DoD, we do not provide corresponding estimates for the other services.

Table E.21. Average Annual Pay (\$), Overall and by Age Group, Alternative Personnel System Operations Research Personnel with BA, by Agency, 2017–2020

	DAF	DHS	DoT
Overall	95,314	131,499	124,874
20–29	79,566	100,097	89,017
30–39	93,165	127,898	103,982
40–49	100,179	128,407	128,125
50–59	108,497	130,391	140,732
60+	118,115	178,697	140,514

NOTE: DAF and other federal agency pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.22. Average Annual Pay (\$), Overall and by Age Group, Alternative Personnel System Operations Research Personnel with MA+, by Agency, 2017–2020

	DAF	DHS	DoT	HHS
Overall	118,769	147,483	146,848	138,129
20–29	85,880	96,829	NA	81,097
30–39	103,181	120,375	137,224	121,959
40–49	111,527	152,785	141,766	NA
50–59	132,869	157,941	150,807	167,232
60+	133,034	157,729	155,590	182,228

NOTE: DAF and other federal agency pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

As with the pay band systems, DAF pay is, on average, substantially lower than other agencies in the federal government, both overall and across the age groups in this study. Tables E.17 and E.18 showed that non-DoD federal agencies compensate GS employees more, and pay differentials contribute to the higher average pay for Operations Research personnel employed by other DoD and other federal agencies compared with the DAF. Differences between the Navy and the DAF arise from both the Navy’s greater use of demonstration project authorities and greater pay within these authorities for mid- to late-career personnel. Although the Army and the DAF employ similar fractions of their Operations Research workforce in demonstration project authorities, the higher pay for mid- and late-career Army Operations Research personnel in these demonstration project authorities leads to the observed overall pay disparities between DoD services.

Finally, we provide similar comparisons, but in lieu of average pay by age range and education—which allowed for comparisons to private sector workers, for which in-occupation experience is generally unobserved in datasets of sufficient size to conduct reliable analyses—we provide comparisons by *years of service* and education to attempt to address any variation in pay that may arise due to systematic differences in years of service within age ranges across services

or agencies. We caution the reader, however, that although years of service is a measure of experience within the federal government, it does not include any experience that workers may have accrued outside of federal employment. As noted in the report, if there are systematic differences in nonfederal employment across services or agencies, then any difference in pay may be partially attributable to these workforce-level differences.

However, as Tables E.23 through E.26 show, a similar narrative arises when making years-of-service comparisons as with age-group comparisons: Although DAF GS pay is broadly similar to GS personnel in the other services, indeed substantially higher at the highest levels of experience for Operations Personnel with BAs, other services' pay in demonstration authorities rises faster with more experienced personnel than the DAF's demonstration authority pay. Thus, the combination of other services' greater employment of Operations Research personnel in demonstration authorities and higher pay in these authorities accounts for the DAF's less competitive pay in this occupation.

Table E.23. Average Annual Pay (\$), by Years of Service, GS Operations Research Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	69,587	68,065	66,152	97,530
5–9	106,060	103,207	109,220	114,839
10–14	116,273	116,050	123,646	127,310
15–19	121,679	121,963	129,276	122,677
20–24	133,560	119,857	134,664	121,581
25–29	141,759	126,005	132,532	119,452
30+	127,545	127,851	134,104	128,269

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.24. Average Annual Pay (\$), by Years of Service, GS Operations Research Personnel with MA+, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	89,531	91,773	99,621	116,672
5–9	117,225	115,540	125,296	132,024
10–14	127,149	121,514	132,923	145,912
15–19	127,068	128,201	134,206	140,529
20–24	137,451	130,902	150,150	139,727
25–29	135,351	131,369	141,132	151,741
30+	135,733	133,190	141,433	143,297

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.25. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Operations Research Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	90,812	79,970	86,900	85,089
5–9	113,304	111,897	108,616	125,920
10–14	114,171	123,458	129,602	138,250
15–19	120,865	131,908	137,466	145,067
20–24	131,355	141,118	146,449	119,387
25–29	115,868	142,822	157,041	159,788
30+	129,393	142,579	146,438	165,574

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.26. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Operations Research Personnel with MA+, by Agency, 2017–2020

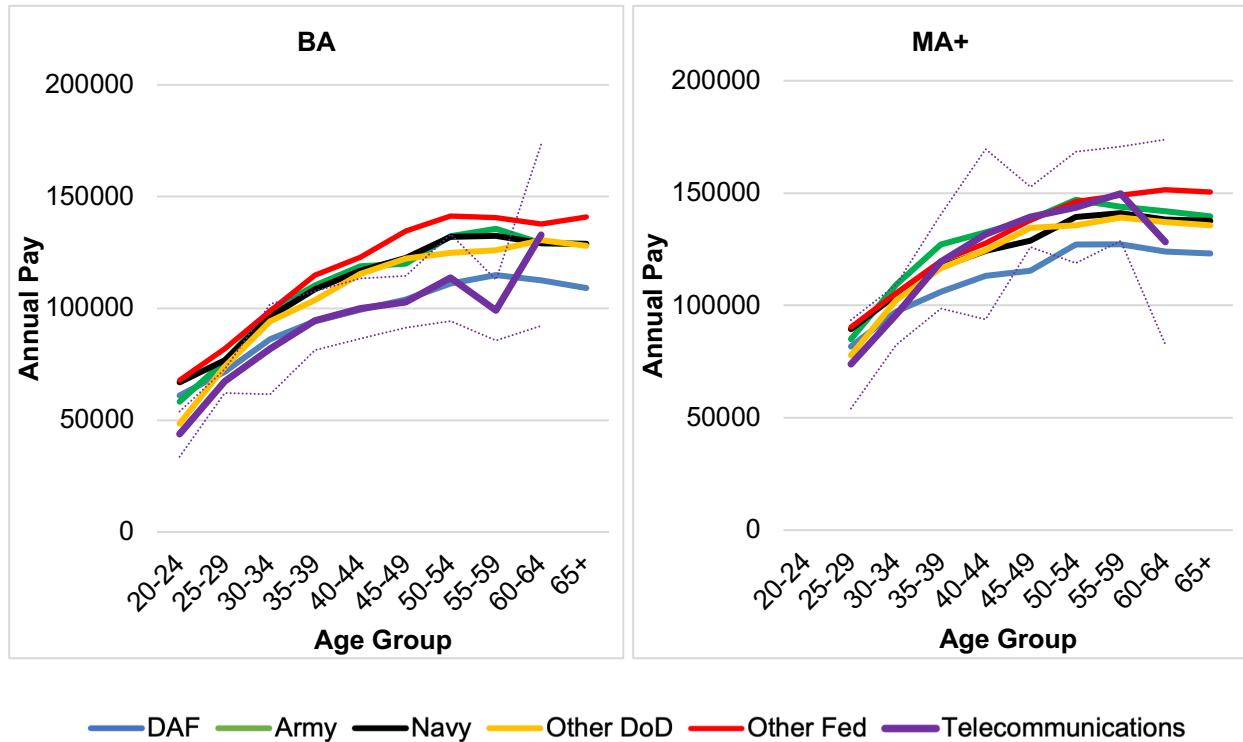
	DAF	Army	Navy	Other DoD
0–4	99,957	104,579	101,045	104,023
5–9	109,255	118,397	123,319	132,426
10–14	122,501	128,907	134,663	143,342
15–19	130,484	137,923	143,427	160,924
20–24	129,981	143,421	147,233	150,415
25–29	129,194	149,838	151,609	148,288
30+	134,423	152,477	151,574	161,701

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Electronics Engineer

We begin this section by reproducing Figure 5.3, but with the inclusion of 95 percent confidence intervals for mean private-sector pay by education and age in Figure E.3, which provides insight as to the uncertainty around estimated average pay for Electronics Engineer workers in the telecommunications industry.

Figure E.3. Average Annual Pay (\$), by Service, Agency, or Industry, Electronics Engineer Personnel, BA and MA+, 2017–2020



NOTE: DAF, Army, Navy (includes Marine Corps), other DoD, and other federal employee pay based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors. Telecommunications industry Electronics Engineer employee pay calculated from ACS 2017–2019 samples, adjusted for misreporting as described in Appendix A, with 95% confidence intervals for means shown with dotted lines. All pay adjusted to 2020 dollars with the CPI-U-RS.

We next examine how different DoD services, other DoD, and federal agencies use the pay plans, how pay within the GS system varies across federal agencies, and how pay among the AcqDemo and Lab Demo workforces varies by DoD service.

In All DoD Services, a Minority of Electronics Engineers Are Under the GS Pay Plan

Table E.27 shows the overall 2020 employment of Electronics Engineering personnel with bachelor's degrees across DoD services, the rest of DoD, the three non-DoD departments that have the highest-level Electronics Engineering personnel employed, and the rest of the federal government. Overall number of employees is shown, as well as the percentage in the GS system, AcqDemo or Lab Demo ("demonstration authority"), and those in other alternative personnel systems. Table E.28 shows the corresponding counts for personnel with graduate degrees.

Table E.27. Employment, by Agency and Type of Pay Plan, Electronics Engineer Personnel with a BA, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	2,560	29%	65%	5%
Army	1,086	32%	67%	2%
Navy	4,545	20%	80%	0%
Other DoD	319	71%	27%	3%
DoT	540	3%	0%	97%
NASA	297	100%	0%	0%
Federal Communications Commission	108	99%	0%	1%
Rest of federal government	282	77%	0%	23%
Total federal government	9,737	30%	63%	8%

SOURCE: FedScope data.

NOTE: Navy includes Marine Corps.

Among DoD services, Electronics Engineers are most likely to be employed under demonstration project authorities. However, the Army and the Navy are consistently more likely to use these authorities.

The vast majority of Electronics Engineers employed in the rest of the federal government are GS employees, although with two notable exceptions: DoT and Commerce. The vast majority of non-GS employment within DoT is in the FAA, while non-GS employment in the Department of Commerce is accounted for by the National Institute of Standards and Technology and the National Telecommunications and Information Administration.

Table E.28. Employment, by Agency and Type of Pay Plan, Electronics Engineer Personnel with MA+, 2020

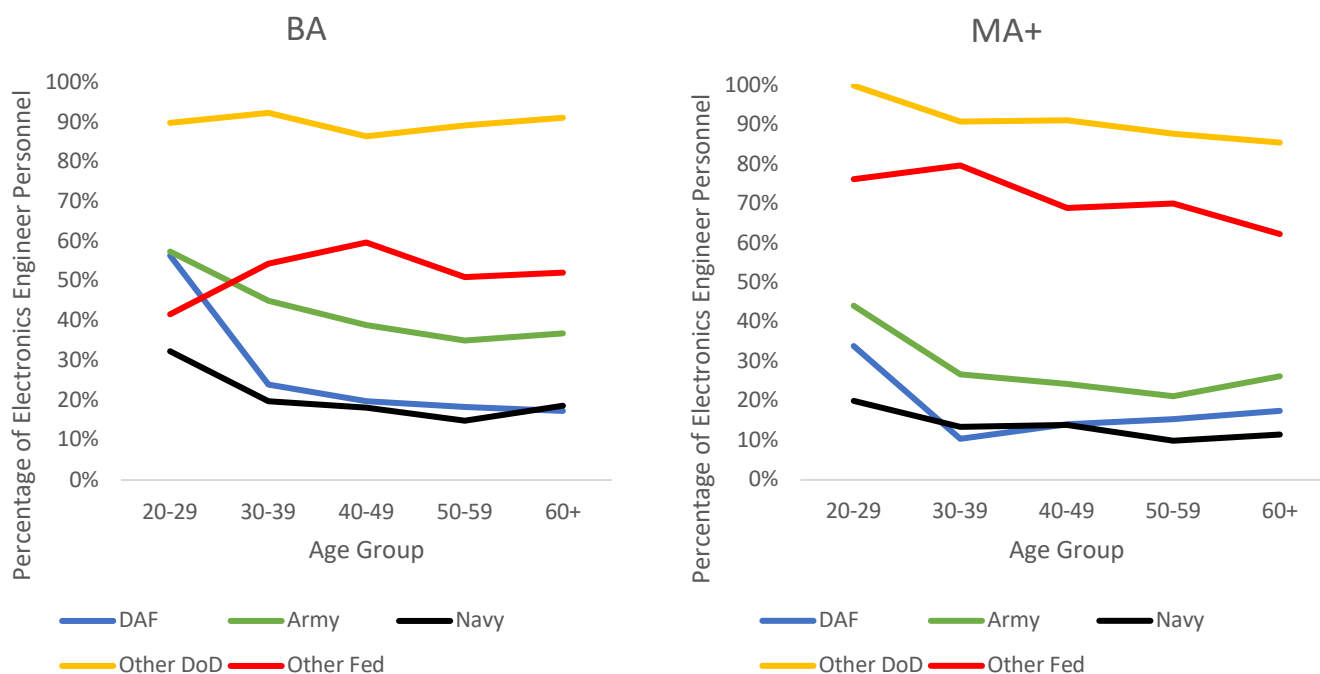
	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	2,451	14%	78%	8%
Army	1,066	17%	80%	3%
Navy	2,844	12%	87%	1%
Other DoD	297	76%	17%	7%
NASA	504	98%	0%	2%
U.S. Department of Commerce	174	18%	0%	82%
DoT	165	11%	0%	89%
Rest of federal government	216	89%	0%	11%
Total federal government	7,717	24%	69%	8%

SOURCE: FedScope data.

NOTE: Navy includes Marine Corps.

Figure E.4 shows these percentages broken down by age group. All three services employ a minority of Electronics Engineer personnel in the GS system, with the exception of employees in their 20s without graduate degrees, 56 percent of whom are employed as GS employees. For employees older than 30 without graduate degrees, both the DAF and the Navy employ approximately 20 percent in the GS system, whereas the Army employs over a third of its employees in the GS system. For employees over 30 with graduate degrees, these rates are even lower: The DAF employs 10 to 18 percent in the GS system, the Navy employs 10 to 14 percent in the GS system, and the Army employs 21 to 27 percent in the GS system.

Figure E.4. Percentage of Electronics Engineer Personnel in GS Pay Plan, by Age Group and Service or Agency, BA and MA+



SOURCE: FedScope data, 2017–2020.

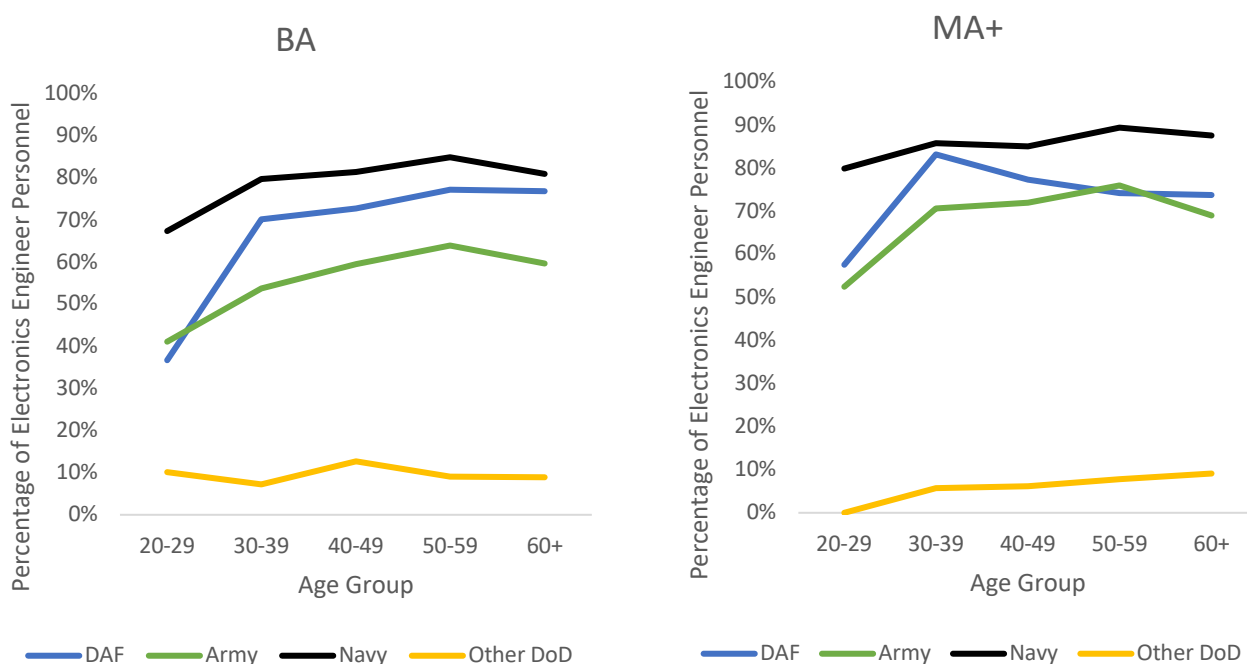
In stark contrast, the rest of DoD employs over 85 percent of Electronics Engineer personnel in the GS system. Non-DoD federal agencies are in between, employing approximately half of their Electronics Engineer personnel without graduate degrees in the GS system and 62 to 80 percent of their personnel with graduate degrees in the GS system.

Use of Demonstration Authorities Accounts for Lower GS System Employment in DoD Services

The lack of employment in the GS system for the other DoD services is accounted for by substantial use of demonstration project authorities across age groups. As shown in Figure E.5, both the DAF and the Navy employ a majority of their Electronics Engineer personnel in AcqDemo or Lab Demo. As discussed in Chapters 3 and 4, the Navy is the most likely to use

these authorities; the DAF's use of demonstration project authorities for Electronic Engineer personnel is lower, especially for employees with graduate degrees over 40, although this difference (8 to 13 percentage points) is substantially narrower than for Computer Science and Operations Research personnel.

Figure E.5. Percentage of Electronics Engineer Personnel in AcqDemo or Lab Demo, by Age Group and Service or Agency, BA and MA+

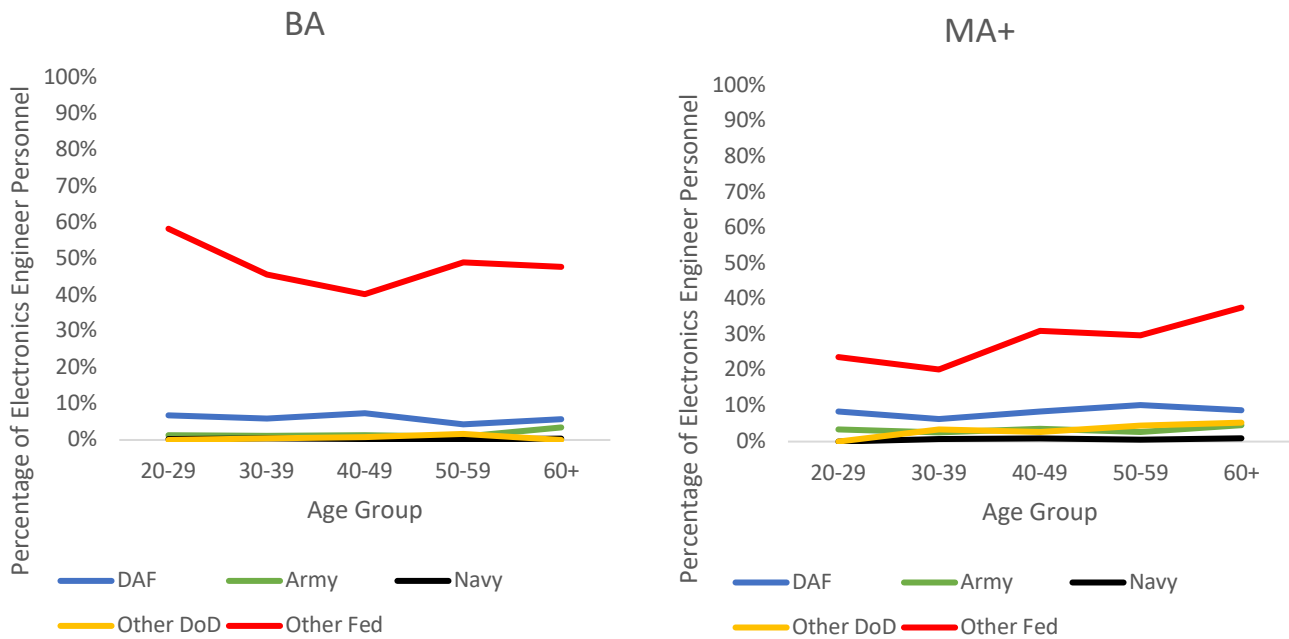


SOURCE: FedScope Data, 2017–2020.

DoD Employs Few Electronic Engineer Personnel in the Excepted Service

Excepted service employment of this occupation is rare, with one exception: non-DoD federal agencies, in which 43 to 55 percent of Electronics Engineer employees without graduate degrees are in the excepted service. As Figure E.6 shows, the DAF is the next highest, with 4 to 8 percent of the personnel in this occupation in the excepted service. For employees with graduate degrees, placement in the excepted service is less common among non-DoD federal agencies, with only 12 to 19 percent employed in excepted service. For the DAF, 7 to 11 percent of Electronics Engineer personnel are employed in the excepted service.

Figure E.6. Percentage of Electronics Engineer Personnel in the Excepted Service, by Age Group and Service, by Age Group and Service or Agency, BA and MA+



SOURCE: FedScope data, 2017–2020.

GS Electronics Engineer Personnel Earn Substantially Less in the DAF Than in Other Services and Federal Agencies

Tables E.29 and E.30 show that DAF pay is below other DoD services and other federal agencies even when focusing on GS Electronics Engineer personnel. Other DoD and non-DoD federal agencies tend to pay substantially more for Electronics Engineers within educational group at a given age, and the DAF lags behind other services in mid-career pay for Electronics Engineer personnel with bachelor's degrees. Although the DAF pays late-career employees comparably to the Navy, the Army tends to pay more.

Table E.29. Annual Pay (\$), Overall and by Age Group, GS Electronics Engineer Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD	DOT	NASA	Federal Communications Commission	Rest of Federal Government
Overall	80,414	103,551	95,651	115,597	124,649	124,513	153,947	131,351
20–29	58,917	64,089	67,157	68,324	82,680	80,336	97,887	77,447
30–39	76,977	94,473	90,795	99,067	109,604	108,335	130,844	118,495
40–49	94,813	106,136	101,664	117,815	123,086	127,982	155,859	125,664
50–59	115,990	119,751	116,258	124,720	144,615	139,166	160,162	136,487
60+	115,496	118,763	115,621	129,825	NA	136,545	153,701	139,251

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

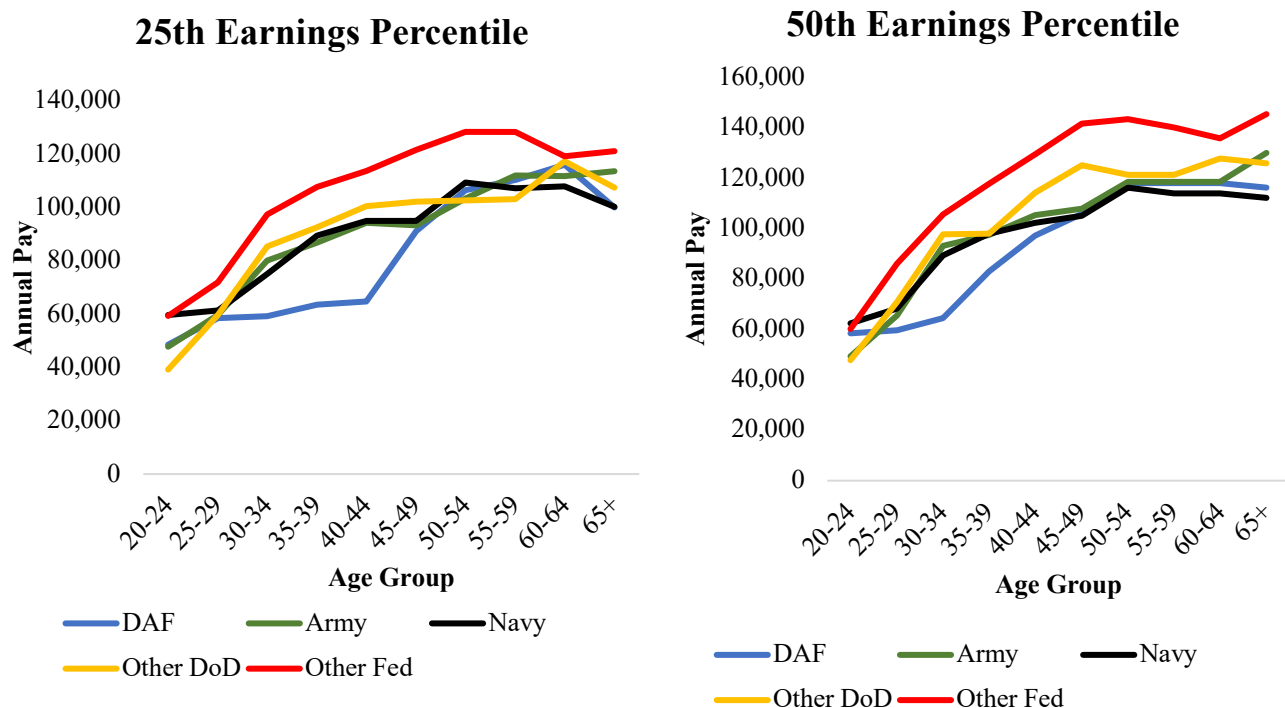
Table E.30. Annual Pay (\$), Overall and by Age Group, GS Electronics Engineer GS with MA+, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD	NASA	Commerce	DoT	Rest of Federal Government
Overall	105,466	116,496	106,321	129,459	134,574	136,894	144,358	148,147
20–29	70,584	75,097	82,158	77,761	86,734	NA	NA	111,621
30–39	93,200	108,310	96,797	111,144	109,477	111,746	122,711	134,303
40–49	107,386	111,298	104,896	127,889	129,533	117,429	133,428	137,735
50–59	120,890	126,842	118,999	136,795	146,099	145,050	148,985	148,763
60+	123,614	125,673	111,502	133,493	148,623	145,458	156,476	162,527

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

To determine the potential drivers of these differences within the GS system across DoD services and other federal agencies for these mid-career Electronics Engineer personnel with bachelor’s degrees, we calculated pay for each age group at specific points in the pay distribution. Figure E.7 illustrates these comparisons at the 25th and 50th percentile of pay by age for this educational group.

Figure E.7. 25th and 50th Percentile Annual Pay for Electronics Engineer with a BA, by Age and Service or Agency



NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020; means therefore represent the population average and do not have standard errors.

As these comparisons show, although the DAF hires Electronics Engineer personnel without graduate degrees at a similar pay level at younger ages, personnel in the bottom half of the pay distribution do not see the same growth in grade level and thus annual pay as Electronics Engineer personnel in the other DoD services. This pattern is most striking at the 25th percentile of pay within each DoD service: DAF Electronics Engineer personnel in their early 40s are earning approximately 10 percent more than those in their late 20s, whereas this pay difference for other DoD services and federal agencies is 50 to 60 percent. Advancement through the GS system appears to be slower for DAF Electronics Engineer personnel than for similar personnel working for other DoD services and federal agencies.

DAF Employs More GS Electronics Engineer Personnel in Lower Grade Levels Than Other Services and Federal Agencies

Finally, we examine the distribution of GS grade levels across DoD services and the federal government (Table E.31). Consistent with the pay analysis above, we find that the DAF is substantially more likely to employ GS Electronics Engineer personnel at the GS-7, GS-9, and GS-11 grade levels. The other DoD services are much more likely to employ personnel at the GS-12 level, but employment at grade levels at and above GS-13 are similar across services.

Table E.31. Distribution of Grade Levels Among GS Electronics Engineer Personnel, by Agency, 2020

	DAF	Army	Navy	Other DoD	Rest of Federal Government	Total Federal Government
GS-05	1.6%	0.9%	0.5%	0.6%	0.0%	0.7%
GS-07	9.4%	2.5%	4.3%	1.0%	0.4%	4.1%
GS-09	15.1%	5.2%	8.8%	0.8%	1.1%	7.3%
GS-11	13.3%	9.1%	9.5%	0.8%	1.9%	7.6%
GS-12	9.0%	33.1%	39.8%	29.3%	7.6%	20.8%
GS-13	39.0%	39.9%	31.7%	26.2%	31.2%	33.9%
GS-14	11.2%	7.7%	4.1%	26.6%	34.0%	16.7%
GS-15	1.5%	1.6%	1.4%	14.6%	23.8%	8.8%

SOURCE: FedScope data, 2020.

Pay Rises Substantially Faster in Other DoD Services' Pay-Banded Plans Than in the DAF

As noted previously, the DAF employs a substantial portion of its Electronics Engineer workforce using demonstration project authorities. We thus examine how pay compares by age and education for Electronics Engineer personnel working for the DAF and the sister services in Tables E.32 and E.33.

Table E.32. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Electronics Engineer Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
Overall	101,957	127,672	118,720	120,264
20–29	81,895	79,266	76,417	69,545
30–39	94,012	113,728	105,404	106,804
40–49	103,008	128,796	123,625	124,688
50–59	112,043	141,932	134,978	128,463
60+	109,818	136,616	132,097	129,683

NOTE: DAF, Army, Navy, and other DoD pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.33. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Electronics Engineer Personnel with MA+, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
Overall	115,036	140,479	130,927	134,320
20–29	86,019	91,652	89,728	NA
30–39	103,311	125,029	113,689	113,609
40–49	115,101	142,661	130,106	126,653
50–59	128,587	150,221	142,595	134,154
60+	123,663	146,949	141,091	149,452

NOTE: DAF, Army, Navy, and other DoD pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

We see a similar pattern as the overall comparisons across both educational attainment groups: Although the DAF pays younger Electronics Engineer employees at a similar—or, for those with a bachelor’s degree, higher level—than the sister services, pay for mid- and late-career employees rises substantially faster in pay band pay plans in the sister services. As a result, DAF AcqDemo and Lab Demo Electronics Engineer employees with a bachelor’s degree are earning \$20,000 less per year than comparable employees in the Army and Navy, and employees with at least a master’s degree in their late 40s are earning \$25,000 to \$30,000 less.

Pay Disparities Increase with Age in Alternative Personnel Systems

Finally, we examine pay differences between the DAF and non-DoD federal agencies for Electronics Engineer personnel employed in alternative personnel systems, recalling that approximately half of Electronics Engineer employees in non-DoD federal agencies without graduate degrees work in these alternatives systems. Tables E.34 and E.35 shows that although younger employees are paid similarly in the DAF and non-DoD federal agencies, mid- and late-career Electronic Engineers employees have higher pay in these other agencies the older they are. For 50–54-year-old employees, the DAF pays at least \$20,000 less per year, on average, across both educational groups.

Table E.34. Average Annual Pay (\$), Overall and by Age Group, Alternative Personnel System, Electronics Engineer Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD	DoT	Rest of Federal Government
Overall	99,746	106,468	125,213	146,236	122,900	138,158
20–29	74,497	59,038	68,423	NA	76,920	80,335
30–39	93,095	90,324	107,778	116,353	98,065	116,675
40–49	106,567	105,315	129,381	142,840	118,449	141,233
50–59	122,381	131,287	160,809	149,904	138,735	144,355
60+	121,267	110,041	159,531	NA	137,143	142,929

NOTE: DAF, Army, Navy, and other DoD pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

Table E.35. Average Annual Pay (\$), Alternative Personnel System Electronics Engineer Personnel with MA+, by DoD Agency, 2017–2020

	DAF	Army	Navy	Other DoD	DoT	NASA	FCC	Rest of Federal Government
Overall	115,219	137,295	145,317	157,120	179,218	147,766	140,663	172,412
20–29	83,195	92,640	NA	NA	NA	100,041	85,376	NA
30–39	98,907	111,593	129,760	127,017	NA	114,872	110,103	NA
40–49	116,588	136,693	128,697	159,285	173,816	143,363	129,559	NA
50–59	126,494	148,624	156,986	161,428	179,487	157,063	148,500	173,828
60+	124,330	147,606	168,185	162,689	181,188	160,342	147,777	171,468

NOTE: DAF, Army, Navy, and other DoD pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

Finally, we provide similar comparisons, but in lieu of average pay by age range and education—which allowed for comparisons to private sector workers, for which in-occupation experience is generally unobserved in datasets of sufficient size to conduct reliable analyses—we provide comparisons by *years of service* and education to attempt to address any variation in pay that may arise due to systematic differences in years of service within age ranges across services or agencies. We caution the reader, however, that although years of service is a measure of experience within the federal government, it does not include any experience that workers may have accrued outside of federal employment. As noted in the report, if there are systematic differences in nonfederal employment across services or agencies, then any difference in pay may be partially attributable to these workforce-level differences.

However, as Tables E.36 through E.39 show, a similar narrative arises when making years-of-service comparisons as with age-group comparisons: Although DAF GS pay is broadly similar to GS personnel in the Navy, but slightly below the Army and other DoD agencies, other services’ pay in demonstration authorities rises faster with more experienced personnel than the

DAF's demonstration authority pay. Thus, the combination of other services' greater employment of Electronics Engineer personnel in demonstration authorities and higher pay in these authorities accounts for the DAF's less competitive pay in this occupation.

Table E.36. Average Annual Pay (\$), by Years of Service, GS Electronics Engineer Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	61,470	67,064	69,641	82,109
5–9	98,007	97,717	95,337	110,048
10–14	105,069	101,593	101,305	116,565
15–19	109,376	111,198	108,225	127,105
20–24	115,288	123,271	117,821	134,164
25–29	118,819	124,960	118,154	125,344
30+	120,032	125,774	118,918	128,844

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.37. Average Annual Pay (\$), by Years of Service, GS Electronics Engineer Personnel with MA+, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	74,607	81,591	85,239	100,815
5–9	103,925	110,475	99,142	121,168
10–14	109,827	112,652	105,172	127,936
15–19	112,623	122,237	110,650	133,384
20–24	121,815	125,628	117,651	146,558
25–29	125,754	130,198	124,727	140,860
30+	128,931	129,395	126,563	138,894

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.38. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Electronics Engineer Personnel with BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	85,722	86,646	81,813	95,229
5–9	95,138	111,261	102,988	117,886
10–14	104,287	121,772	115,841	126,645
15–19	107,601	134,665	126,446	131,271
20–24	109,223	137,743	134,387	135,676
25–29	112,738	139,249	135,034	127,028
30+	116,797	145,780	138,311	138,484

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.39. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Electronics Engineer Personnel with MA+, by Agency, 2017–2020

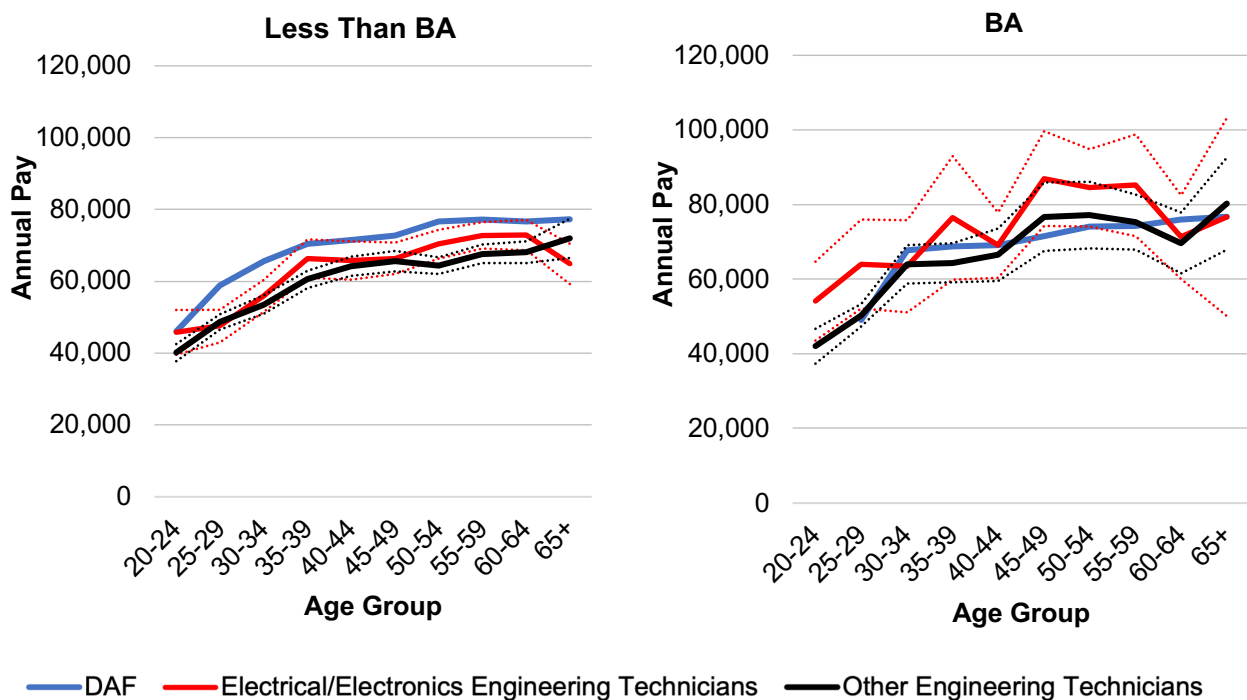
	DAF	Army	Navy	Other DoD
0–4	97,768	112,870	104,669	114,785
5–9	104,435	129,645	114,941	121,092
10–14	112,816	133,247	126,490	138,411
15–19	121,527	146,881	132,035	138,842
20–24	126,098	148,842	143,494	151,391
25–29	130,375	149,184	143,160	132,395
30+	134,907	152,677	147,558	151,070

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Engineering Technician

We begin this section by reproducing Figure 6.4, but with the inclusion of 95 percent confidence intervals for mean private sector pay by education and age in Figure E.8, which provides insight as to the uncertainty around estimated average pay for private-sector Electrical/Engineering Technicians and other private-sector Engineering Technicians.

Figure E.8. Average Annual Pay (\$), DAF Versus Private Sector, Engineering Technicians, by Education



SOURCES: Pay for DAF calculated from FedScope data; private-sector engineering technician pay from ACS.
NOTE: Dotted lines represent 95 percent confidence intervals for the age-specific pay means.

To examine how use of pay plans in the DAF, the sister services, and other agencies throughout the federal government contributes to overall differences in pay, we examine employment and pay across these pay plans below.

DAF Employs Nearly All of Its Engineering Technician Personnel in GS System; Other Services Employ a Majority in the GS System but Substantial Minorities Under Demonstration Project Authorities

Tables E.40 and E.41 show the total employment of Engineering Technician personnel across the sister services, the rest of DoD, the three non-DoD federal agencies that account for the highest employment level of this series, and the rest of the federal government. They also show the percentage of this employment in the GS system, AcqDemo, or Lab Demo (“Demonstration Authority”), and other alternative personnel systems. Table E.40 provides these statistics for personnel without bachelor’s degrees, while Table E.41 provides these statistics for personnel with bachelor’s degrees.

Table E.40. Employment, by Agency and Type of Pay Plan, Engineering Technician Personnel, Less Than BA, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	839	92%	8%	0%
Army	2,464	78%	21%	0%
Navy	5,827	78%	22%	0%
Other DoD	67	99%	1%	0%
USDA	531	100%	0%	0%
DoT	514	14%	0%	86%
Interior	325	100%	0%	0%
Rest of federal government	1,171	91%	0%	9%
Total federal government	11,738	79%	16%	5%

SOURCE: FedScope data, 2020.

Table E.41. Employment, by Agency and Type of Pay Plan, Engineering Technician Personnel with BA, 2020

	2020 Employment	GS	Demonstration Authority	Alternative Personnel System
DAF	224	94%	4%	1%
Army	739	85%	15%	0%
Navy	1,454	75%	25%	0%
Other DoD	15	100%	0%	0%
USDA	226	100%	0%	0%
Interior	142	100%	0%	0%
VA	59	100%	0%	0%
Rest of federal government	235	69%	0%	31%
Total federal government	3,094	82%	16%	3%

SOURCE: FedScope data, 2020.

Among the technical occupations we examine in this report, civilian Engineering Technician personnel working for DoD services are the least likely to be employed using demonstration project authorities. Compared with the sister services, the DAF is the least likely to employ its personnel in this series in demonstration projects, with 92 percent of Engineering Technician personnel employed in the GS system. Depending on the education group, 15 to 25 percent of Army and Navy Engineering Technician personnel are employed in demonstration authorities.

In the rest of the federal government, Operations Research personnel are generally employed in the GS system, with the exception of DoT, which employs the majority of its personnel in an alternative personnel system, again, consistent with the other technical occupations under study.

Given that the vast majority of DAF employment is in the GS system, we next turn to the distribution of grade levels within the GS system across DoD services and the federal government in Table E.42.

Table E.42. Distribution of Grade Levels Among GS Engineering Technician Personnel, by Service or Agency, 2020

	DAF	Army	Navy	Other DoD	Rest of Federal Government
GS-05	0.1%	0.8%	0.2%	0.0%	1.9%
GS-07	1.7%	7.1%	1.0%	2.5%	7.1%
GS-09	23.0%	21.8%	5.0%	11.3%	27.0%
GS-11	59.2%	44.2%	31.2%	41.3%	32.6%
GS-12	15.8%	24.5%	52.8%	43.8%	24.4%
GS-13	0.2%	1.7%	8.6%	1.3%	6.1%
GS-14	0.0%	0.0%	1.2%	0.0%	0.9%
GS-15	0.0%	0.0%	0.0%	0.0%	0.0%

SOURCE: FedScope Data, 2020

The DAF has fewer GS Engineering Technician personnel at higher grade levels than the sister services and the rest of the federal government. Only 16 percent of DAF GS personnel in this series are at least GS-12 grade level, whereas over 26 percent of Army GS personnel are GS-12 or higher. This proportion is 31 percent for the rest of the federal government, 45 percent for DoD agencies outside of DoD services, and 62 percent for the Navy. Since the bulk of DAF Engineering Technician personnel are not over GS-11 grade level, we see below that average GS pay in the DAF, especially for older personnel, lags behind that of the sister services and federal agencies.

Flexibilities Within Pay Plans Contributes to the DAF's Lagging Pay

In addition to DAF Engineering Technician personnel being less likely to be employed under demonstration project authorities than for personnel in the sister services, there are differences in how agencies use each pay plan's pay flexibilities. The next set of tables explores these differences by examining pay among agencies and DoD services *within* pay plan.

Tables E.43 and E.44 show overall and age-group-specific pay for GS Operations Research personnel across DoD services and federal agencies. Table E.43 provides these statistics for personnel without bachelor's degrees, while Table E.44 provides these statistics for personnel with bachelor's degrees.

Table E.43. Average Annual Pay (\$), Overall and by Age Group, GS Engineering Technician Personnel, Less Than BA, by Agency, 2017–2020

	DAF	Army	Navy	Other DoD	USDA	DoT	Department of the Interior	Rest of Federal Government
Overall	73,140	75,911	86,712	85,401	63,050	80,965	69,911	98,529
20–29	55,855	54,906	64,024	NA	41,263	58,006	50,730	60,939
30–39	67,150	67,876	78,201	76,192	56,943	66,578	64,267	75,419
40–49	71,341	74,065	84,049	78,133	61,254	77,073	68,285	96,403
50–59	76,085	78,904	90,748	88,451	66,425	85,557	71,890	101,279
60+	76,081	81,664	91,827	89,490	66,802	86,510	76,533	105,601

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

Within age group and educational level among GS personnel, DAF pay tends to lag behind the Navy, and, to a lesser extent, the Army. Other DoD agencies pay Engineering Technician personnel substantially more, as does the rest of the federal government, with the exception of the three agencies that represent the largest non-DoD federal agency employers in this series. That is, DAF pay is roughly competitive with the USDA, the Department of the Interior, and VA in its pay for GS Engineering Technician personnel, although it lags behind GS pay for DoT for most age groups.

Table E.44. Average Annual Pay (\$), Overall and by Age Group, GS Engineering Technician Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD	USDA	Department of the Interior	VA	Rest of Federal Government
Overall	71,936	74,550	86,530	76,368	63,226	67,053	71,913	84,354
20–29	47,054	53,074	63,502	72,474	42,418	48,146	46,947	47,890
30–39	66,600	68,879	80,808	79,376	57,845	61,379	70,171	82,864
40–49	70,233	74,148	85,096	69,383	63,973	67,527	65,375	88,873
50–59	72,927	78,075	90,101	79,771	67,374	73,864	76,444	90,708
60+	78,264	82,680	92,695	79,618	68,467	79,691	71,624	83,677

NOTE: DAF, Army, Navy, other DoD, and other federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Given the rarity of alternative personnel system employment for this series across the federal government with the exception of DoT, we include Table E.45 for comparison with DAF GS pay from Tables E.43 and E.44. The contrast is stark: Engineering Technician personnel working for DoT under an alternative personnel system are paid substantially more than DAF GS system personnel in this series, overall, in each education group, and in each age group under study.

Table E.45. Average Annual Pay (\$), Overall and by Age Group, Alternative Personnel System Engineering Technicians, DoT, by Educational Attainment, 2017–2020

	DoT: Less Than BA	DoT: BA
Overall	82,661	91,548
20–29	62,408	64,225
30–39	69,050	76,531
40–49	78,190	82,138
50–59	88,579	103,165
60+	92,978	103,876

NOTE: Federal employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

We next turn to pay between services for Engineering Technician personnel employed under demonstration project authorities in Tables E.46 and E.47.

Table E.46. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Engineering Technician Personnel, Less Than BA, by Service, 2017–2020

	DAF	Army	Navy
Overall	82,506	89,895	98,988
20–29	48,422	55,190	67,387
30–39	74,086	74,097	84,302
40–49	79,594	88,293	95,798
50–59	88,188	99,262	106,845
60+	83,856	100,296	107,620

NOTE: DAF, Army, and Navy pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.47. Average Annual Pay (\$), Overall and by Age Group, AcqDemo and Lab Demo Engineering Technician Personnel with BA, by Service, 2017–2020

	DAF	Army	Navy
Overall	91,541	90,890	106,676
20–29	NA	58,843	63,389
30–39	NA	76,915	95,307
40–49	89,207	96,933	104,494
50–59	92,665	99,520	114,738
60+	83,272	96,798	114,571

NOTE: DAF, Army, and Navy pay based on FedScope data 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this age range and agency or service.

DAF pay for Engineering Technician personnel in these demonstration projects lags behind the sister services for every age and education group under study. These differences can exceed

\$10,000 between the DAF and the Army, and they can exceed \$30,000 between the DAF and the Navy. Navy pay within these demonstration project authorities is greater than Navy pay in the GS system, which itself was greater than DAF GS pay. Combined with the fact that the Navy employs more of its personnel under these demonstration project authorities, the result is a substantial pay gap between Navy and DAF pay for Engineering Technician personnel. Similar patterns hold between the Army and the DAF, but with smaller magnitudes.

Finally, we provide similar comparisons, but in lieu of average pay by age range and education—which allowed for comparisons to private sector workers, for which in-occupation experience is generally unobserved in datasets of sufficient size to conduct reliable analyses—we provide comparisons by *years of service* and education to attempt to address any variation in pay that may arise due to systematic differences in years of service within age ranges across services or agencies. We caution the reader, however, that although years of service is a measure of experience within the federal government, it does not include any experience that workers may have accrued outside of federal employment. As noted in the report, if there are systematic differences in nonfederal employment across services or agencies, then any difference in pay may be partially attributable to these workforce-level differences.

However, as Tables E.48 through E.51 show, a similar narrative arises when making years-of-service comparisons as with age-group comparisons: Although DAF GS pay is broadly similar to GS personnel in the Army, but below that of GS personnel employed by the Navy and other DoD agencies, other services’ pay in demonstration authorities rises much faster with more experienced personnel than the DAF’s demonstration authority pay. Thus, the combination of the Navy and other DoD agencies’ higher GS pay, other services’ greater employment of Electronics Engineer personnel in demonstration authorities, and higher pay in these authorities accounts for the DAF’s less competitive pay in this occupation.

Table E.48. Average Annual Pay (\$), by Years of Service, GS Engineering Technician Personnel with Less Than BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	63,187	61,433	76,398	77,957
5–9	70,949	71,957	82,636	81,311
10–14	74,085	77,460	86,901	81,364
15–19	75,344	78,677	92,116	90,500
20–24	74,823	79,407	90,799	93,777
25–29	78,839	81,135	92,697	89,482
30+	80,350	86,788	95,719	94,322

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.49. Average Annual Pay (\$), by Years of Service, GS Engineering Technician Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	64,592	61,430	77,489	71,567
5–9	70,174	73,343	86,178	77,126
10–14	74,555	79,282	91,513	77,886
15–19	76,143	81,259	96,369	82,423
20–24	78,374	80,413	89,637	90,257
25–29	80,024	83,616	96,985	94,747
30+	82,981	84,840	96,745	89,210

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS.

Table E.50. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Engineering Technician Personnel with Less Than BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	71,435	74,287	87,076	NA
5–9	76,321	84,493	98,507	NA
10–14	86,147	97,944	100,561	NA
15–19	89,267	99,537	105,883	NA
20–24	88,174	108,600	114,084	NA
25–29	90,059	101,178	110,760	NA
30+	97,615	105,775	112,071	102,520

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

Table E.51. Average Annual Pay (\$), by Years of Service, AcqDemo and Lab Demo Engineering Technician Personnel with BA, by Service or Agency, 2017–2020

	DAF	Army	Navy	Other DoD
0–4	83,916	75,678	96,060	NA
5–9	89,341	87,399	109,761	NA
10–14	88,868	97,987	111,942	NA
15–19	93,915	101,645	117,556	NA
20–24	NA	102,327	117,730	NA
25–29	NA	105,664	122,057	NA
30+	NA	106,648	111,972	NA

NOTE: DAF, Army, Navy, and other DoD employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

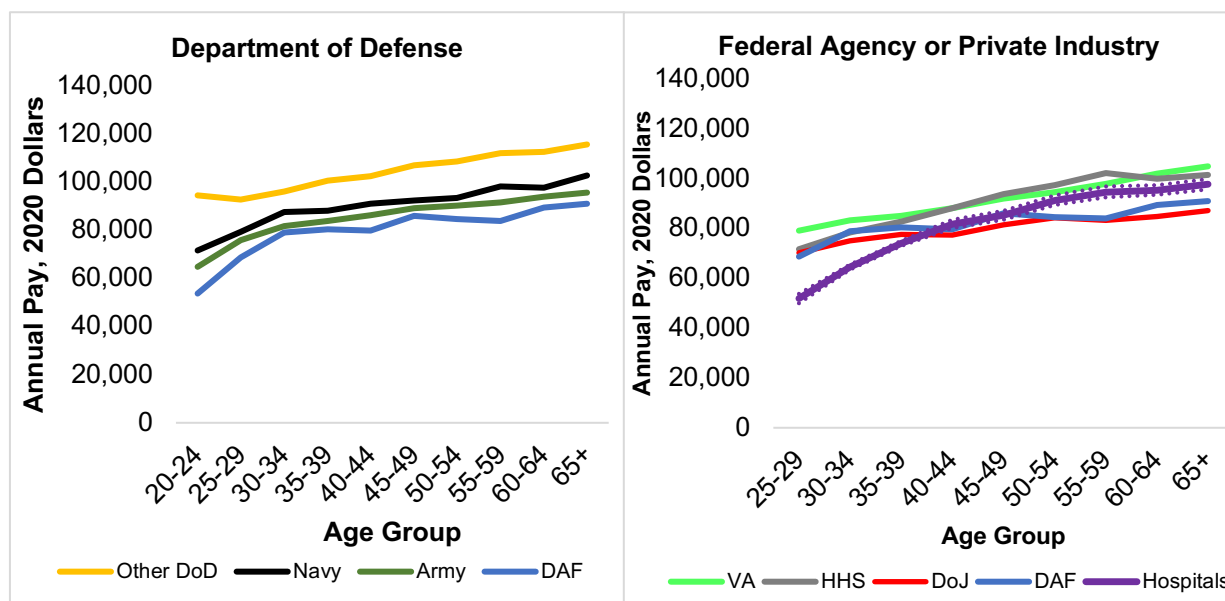
Airfield Manager

Because of the lack of occupational titles in FedScope data allowing for observation of which personnel across agencies were Airfield Managers, as well as the vast majority of DAF Airfield Managers being employed in the GS system, we did not conduct separate pay plan-based analyses of this occupation.

Nurse

We begin this section by reproducing Figure 8.3, but with the inclusion of 95 percent confidence intervals for mean private sector pay by education and age in Figure E.9, which provides insight as to the uncertainty around estimated average pay for Registered Nurses, Nurse Practitioners, and Nurse Midwives with at least a bachelor's degree in the General Medical/Surgical Hospital industry.

Figure E.9. Average Annual Pay for Nurses, by Age and Employer, 2017–2020



NOTE: DoD and federal agency comparisons from 2017–2020 FedScope data, pay inflation adjusted to 2020 dollars with CPI-U-RS. “General Medical/Surgical Hospitals” industry pay averages from 2017–2019 ACS, with dotted lines representing 95% confidence interval and self-reported earnings adjusted for misreporting using methodology discussed in Appendix A. All comparisons limited to Registered Nurses, Nurse Practitioners, and Nurse Midwives with at least a bachelor's degree.

As shown in Chapter 8, within DoD, only the DAF employs Nurse personnel under demonstration authorities, and the largest federal agency employer of Nurse personnel is the VA, which employs all such personnel under an alternative personnel system. Therefore, we do not conduct detailed pay plan-based analyses and instead present below comparisons of pay under the GS system across services as well as within DAF demonstration employment and the VA.

Consistent with the age-based analysis in Chapter 8, the DAF pays its Nurse personnel at a lower rate across years of service, with other DoD agencies and the VA paying Nurse personnel substantially more at higher years of experience (Table E.52). DAF Nurse personnel are generally paid less than DAF GS Nurse personnel.

Table E.52. Average Annual Pay (\$), by Years of Service, Nurse Personnel with BA, by Service or Agency, 2017–2020

	DAF: GS	DAF: Demo	Army: GS	Navy: GS	Other DoD: GS	VA
0–4	80,286	80,319	86,876	88,132	103,046	90,319
5–9	89,215	83,648	95,230	98,623	113,394	97,424
10–14	90,875	88,639	98,910	104,171	120,046	103,184
15–19	91,865	88,252	99,185	104,290	122,241	108,138
20–24	89,435	86,653	100,812	104,719	118,311	112,266
25–29	95,400	94,187	100,456	100,059	119,696	113,936
30+	96,656	NA	101,888	108,139	124,592	117,452

NOTE: DAF, Army, Navy, other DoD, and VA employee pay based on FedScope data for 2017–2020. Pre-2020 salary adjusted for inflation to 2020 dollars using CPI-U-RS. Cells marked with “NA” had no personnel in this years of service range and agency or service.

Abbreviations

AcqDemo	Acquisition Workforce Personnel Demonstration Project
ACS	American Community Survey
AF/A1C	Air Force Directorate of Civilian Force Management
AFB	Air Force Base
AFCS	Air Force Civilian Service
AFMC	Air Force Materiel Command
AFPC	Air Force Personnel Center
AFRL	Air Force Research Laboratory
BLS	U.S. Bureau of Labor Statistics
CES	Cyber Excepted Service
CFM	career field manager
CFR	Code of Federal Regulations
CHCO	Chief Human Capital Officer
COVID-19	coronavirus disease 2019
CPI-U-RS	Consumer Price Index for All Urban Consumers Research Series
DAF	Department of the Air Force
DAWIA	Defense Acquisition Workforce Improvement Act
DCIPS	Defense Civilian Intelligence Personnel System
DCPDS	Defense Civilian Personnel Data System
DEI	diversity, equity, and inclusion
DHA	direct hire authority
DHS	U.S. Department of Homeland Security
DMDC	Defense Manpower Data Center
DoD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DoT	U.S. Department of Transportation
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FFRDC	federally funded research and development center
FY	fiscal year
GS	General Schedule
GSA	General Services Administration
HHS	U.S. Department of Health and Human Services
HQE	highly qualified expert
IPA	Intergovernment Personnel Act
IRS	Internal Revenue Service
IT	information technology
JBSA	Joint Base San Antonio
Lab Demo	Laboratory Personnel Demonstration Project
LBGTQ	lesbian, bisexual, gay, transgender, and queer or questioning

MAJCOM	major command
MCO	mission critical occupation
MSA	metropolitan statistical area
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
OEWS	Occupational Employment and Wage Statistics
OPM	U.S. Office of Personnel Management
PCIP	Premier College Intern Program
SOC	Standard Occupation Classification
SSR	Special Salary Rate
STEM	science, technology, engineering, and mathematics
STRL	Science and Technology Research Laboratory
U.S.C.	U.S. Code
USDA	U.S. Department of Agriculture
VA	U.S. Department of Veterans Affairs

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s demand for technical talent is expected to increase across the U.S. workforce over the next decade, the Department of the Air Force (DAF) wants to ensure that it is competitive in attracting top-tier talent (e.g., highly skilled experts and promising new graduates). The authors of this report assessed the DAF's ability to attract and employ top civilian talent in six occupational series: Computer Science, Operations Research, Electronics Engineer, Engineering Technician, Airfield Manager, and Nurse.

For each occupational series, the authors highlight key recruiting and employment challenges, the use of available hiring authorities and flexibilities, and how current DAF pay compares with pay in the sister services, other federal agencies, and the private sector. They also describe findings from interviews with university career services offices and private-sector recruiting experts regarding the factors potential job candidates consider when making employment decisions, as well as findings from interviews with recruiting and hiring representatives from the sister services and other federal agencies regarding alternative employment options and practices that other federal organizations have found effective. The authors conclude by providing recommendations on actions the DAF can take to better compete for top-tier civilian technical talent.

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