Research Report

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General Officers, Career Field Sustainability, Training Pipelines, and the Civilian Workforce of the U.S. Space Force

Considered Options to Enhance Structure and Configuration

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About This Report

As threats in space from adversaries have continued to escalate, it has become clear that the United States must position itself to prevail in an increasingly contested space environment now and into the future. In recognition of this changing space environment, the National Defense Authorization Act for Fiscal Year (FY) 2020 officially redesignated the Air Force Space Command as the U.S. Space Force, an independent military service within the Department of the Air Force.[1]

This project was commissioned to support the Space Force. Within this project, RAND Project AIR FORCE assisted the Space Force with several sets of analyses, such as determining the number of general officers (GOs) that the Space Force can internally generate versus the GO structure that the Space Force was considering at the start of this research and the selectivity associated with the Space Force–proposed structure; career field sustainability for officers in the five primary career fields within the Space Force (Space Operations, Intelligence, Cyberspace Operations, and two Acquisitions-related fields, Developmental Engineering and Acquisition Management); the training pipelines of both officers and enlisted personnel in these five career fields; and key considerations regarding the civilian workforce transitioning to the Space Force.

This project and report drew on previous work conducted by RAND Project AIR FORCE and reported in *A Separate Space: Creating a Military Service for Space*.[2]

The research reported here was commissioned by the Air Force Deputy Chief of Staff for Strategy, Integration, and Requirements and conducted within the Workforce, Development, and Health Program of RAND Project AIR FORCE as part of a FY 2020 project, "Organizing and Training for the Contested, Degraded, and Operationally Limited Space Force."

RAND Project AIR FORCE

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[1] Public Law 116-92, National Defense Authorization Act for Fiscal Year 2020; Subtitle D, United States Space Force; Sections 951–961, December 20, 2019.

[2] Michael Spirtas, Yool Kim, Frank Camm, Shirley M. Ross, Debra Knopman, Forrest E. Morgan, Sebastian Joon Bae, M. Scott Bond, John S. Crown, and Elaine Simmons, *A Separate Space: Creating a Military Service for Space*, RAND Corporation, RR-4263-AF, 2020.

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Summary

Issue

With the U.S. Space Force rapidly standing up as a separate service as established by the National Defense Authorization Act for Fiscal Year (FY) 2020, it was imperative to determine the appropriate workforce alignment and training for the space cadre. Within this FY 2020 project, our analysis, conducted in real time and on a rolling basis, addressed several issues of high importance to the Space Force:

- Can the Space Force organically generate a sufficient number of general officers (GOs)?
- Is the GO structure that was under consideration in FY 2020 sustainable?
- Are the five primary career fields that are transitioning from the Air Force to the Space Force—Space Operations, Intelligence, Cyberspace Operations, Developmental Engineering, and Acquisition Management—sustainable with the number of proposed officer billets?
- Can existing training pipelines for officers and enlisted personnel in these five career fields support the training needs of the Space Force?
- What are the key considerations of the civilian workforce transferring into the Space Force?

Approach

We conducted analyses using multiple methods and sources of data, which included Air Force Personnel Center data and data provided by the Space Force, on the number and placement of officer and enlisted positions being transferred from the Air Force to the Space Force as of FY 2020. Interviews with subject-matter experts in the Air Force, the Space Force, and U.S. Space Command also substantively informed this study.

Key Findings

- With an officer base of 3,032 positions, as planned in FY 2020, the Space Force would be able to organically generate only about half—or 16—of the 30 GOs that it had requested, a result replicating earlier results from RAND Project AIR FORCE analyses undertaken when transfer numbers were less precise.
- The distribution of GOs from O7 to O10 that was under consideration in FY 2020 (six O7s, eight O8s, five O9s, and two O10s) would be untenable because the necessary officer base would need to be nearly 4,000 instead of the estimated base of 3,032.
- GO selectivity (or promotion) ratios associated with the GO distribution under consideration in FY 2020 would not be aligned with those in the Air Force and would likely be unacceptably high.

  - Selection ratios for this distribution would result in every O7 being promoted to O8, with a high probability of promotion to O9—a dearth of competition significantly different from the Air Force's selectivity.
  - This long GO trajectory, based in effect on one selection decision at the O6 level, poses risk for the Space Force.
- A wider role for senior civilian executives could address the gap resulting from the shortage of GOs organically generated within the Space Force and bring the Space Force into closer alignment with other space-related organizations.
- Updated sustainability analyses of officers in the five career fields transitioning to the Space Force, using the analytic framework of the FY 2019 Space Force study, revealed the following:
  - The Space Operations, Intelligence, and Cyberspace Operations career fields require only minor changes to the billet structure.
  - The authorization structures for the two acquisition career fields, however, require a significant adjustment of billets.
- The overarching issue in training for the Space Force is the dearth of space-specific training available, particularly in Intelligence and Cyberspace Operations.
- The generalist space operator model, in which all Space Force professionals would begin as space operators and move several years later into their respective disciplines (Intelligence, Cyberspace Operations), could result in a decline in expertise and experience that may affect readiness and result in an inability to grow senior leaders with sufficient depth of expertise and experience to hold their own in the larger space community.

Recommendations

Each report chapter concludes with recommendations specific to each topic, and the final chapter includes a list of 20 synthesized recommendations. A few of our key recommendations for the Space Force were as follows:

- Implement best-in-class executive selection models from industry to identify and select high-potential GOs when promoting Space Force officers from O6 into the GO ranks and any incoming GOs from sister services.
- Leverage civilian senior executives for leadership roles in the Space Force to mitigate challenges with the small number of GOs that the Space Force can generate and to move the Space Force toward a mix of military and civilian leaders comparable with other space-related organizations.
- Adjust the billet structure based on the pyramid health sustainability analysis provided in the individual career field chapters of this report, particularly for the acquisition-related career fields.
- Redesign the early training pipeline to ensure adequate space-specific training for Space Force officers and enlisted personnel, prior to arriving at their first assignments.
- Maintain distinct career fields for those personnel transitioning to the Space Force instead of combining them into one group of "generalist space operators" to preserve the

Intelligence and Cyberspace Operations developmental pipelines that produce deep expertise and experience for the benefit of the Space Force and to ensure parity of expertise with like organizations.

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Chapter 1. Introduction

U.S. space assets ensure Americans their way of life. The requirements for these assets come not just from the U.S. Department of Defense (DoD) but also from the U.S. government and private sector at large, with many of these requirements being directly related to the economy, including supporting and protecting the Global Positioning System (GPS), encrypted banking data, market data, the electrical power grid, telecommunications, and the internet. As U.S. adversaries continue to build their own capabilities, the capacity of the U.S. government to maintain and enhance its technical capabilities in space will be critical to the national security and economy in the coming years.

In fiscal year (FY) 2019, the Executive Office of the President released Space Policy Directive-4, which called for the establishment of the U.S. Space Force as the sixth branch of the U.S. Armed Forces.[3] It authorized the Space Force to "organize, train, and equip military space forces of the U.S. to ensure unfettered access to, and freedom to operate in, space, and to provide vital capabilities to joint and coalition forces in peacetime and across the spectrum of conflict."[4] This proposal came to fruition with the signing of the National Defense Authorization Act (NDAA) for Fiscal Year 2020 in December 2019, in which the Air Force Space Command (AFSPC) was redesignated as the U.S. Space Force.[5] The FY 2020 NDAA assigned three main duties to the Space Force: "(1) protect the interests of the U.S. in space, (2) deter aggression in, from, and to space, and (3) conduct space operations."[6]

To fulfill these duties, the Space Force was aligned under the Department of the Air Force (DAF), assigning overall responsibility to the Secretary of the Air Force (SecAF) and the Chief of Space Operations (CSO), a four-star general officer (GO).[7] Because the FY 2020 NDAA did not authorize any additional military billets for the establishment of the Space Force,[8] the DAF remains responsible for providing more than 75 percent of the Space Force's supporting

[3] Space Policy Directive-4, *Establishment of the United States Space Force*, Executive Office of the President, memorandum, 84 FR 6049, February 19, 2019.

[4] Space Policy Directive-4, 2019.

[5] Public Law 116-92, National Defense Authorization Act for Fiscal Year 2020; Subtitle D, United States Space Force; Sections 951–961, December 20, 2019.

[6] U.S. House of Representatives, *National Defense Authorization Act for Fiscal Year 2020*, Conference Report, U.S. Government Printing Office, 2019, p. 904.

[7] U.S. Space Force, "About the Space Force," webpage, undated-a.

[8] U.S. House of Representatives, 2019, p. 905.

functions, "including logistics, base operating support, civilian personnel management, business systems, IT support, audit agencies, etc."[9]

Billets from five career fields were selected to transition from the Air Force to the Space Force: Space Operations, Intelligence, Cyberspace Operations, Developmental Engineering, and Acquisition Management.[10] The officer, enlisted, and civilian personnel working in these career fields are responsible for "protect[ing], defend[ing], and project[ing] spacepower."[11] Although formal space-specific training may not have been required for personnel in career fields outside Space Operations in their previous Air Force careers, many of those personnel who transferred to the Space Force had either been primarily assigned to AFSPC or had one or two rotations at AFSPC, and thus had hands-on space-related experience. With the creation of the Space Force as an independent military service, it became critical to ensure appropriate workforce alignment, the health of Space Force career fields, and training of the space cadre as it prepares to face the challenges of the modern space environment. Regarding the five career fields selected to transition to the Space Force, the first official publication of the Space Force, the Space Capstone Publication on *Spacepower*, states,

> Successful integration of these disciplines requires a deliberate process that cultivates a common knowledge base, incorporates skill sets across the core competencies, and allows a range of opportunities for leadership advancement. . . . Space Force assets and space professionals must be sufficiently agile to leverage other interagency, Allied, civil, and/or commercial resources as required. This process begins with the recognition that personnel conducting space operations, engineering, acquisitions, intelligence, and cyber comprise the space warfighting community and must therefore master the art and science of warfare—they are the Nation's space warfighters.[12]

Understandably, the stand-up of the Space Force has been a fast-moving and quickly evolving process. RAND Project AIR FORCE (PAF) was asked by Space Force leadership to advise and provide ongoing analysis throughout FY 2020 on issues related to the number and selectivity of GOs, career field sustainability,[13] training, and the civilian workforce as new requirements arose from senior leaders in the new service.

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[9] U.S. Space Force, undated-a.

[10] At the time of the study, the Space Force was a single component. In a departure from other services' active-duty and reservist components, the Space Force envisioned and was moving toward a single component with both full-time and part-time Space Force members.

[11] U.S. Space Force, *Spacepower: Doctrine for Space Forces*, Space Capstone Publication, June 2020, p. vi.

[12] U.S. Space Force, 2020, p. 47.

[13] At the time of this writing, the U.S. Space Force (2020, p. 50) used the term *disciplines* and not *career fields* when describing "the skills the United States Space Force needs when developing its personnel to become the masters of space warfare."

Context and Motivation for This Study

With the stand-up of the Space Force in FY 2020, one of the overarching challenges that the service has been facing is the development and sustainment of a highly technical, proficient workforce. Given the small size of the Space Force, which was projected to include some 16,000 people,[14] its approach to workforce structure must be guided by sound analysis, engagement in innovative design, and commitment to excellent execution for its workforce to thrive and maintain readiness.

The estimated number of GOs needed to lead the Space Force is a topic of great concern because the projected officer base of 3,032,[15] at the time of our analysis, was not expected to be able to generate the number of GOs necessary to lead the Space Force and represent the Space Force at the combatant commands.

The analyses that we carried out in this project focused on the capacity of the Space Force to organically generate its estimated number of GOs, the sustainability of the five core career fields transferring to the Space Force, the extent to which existing training pipelines for officers and enlisted personnel could support new space-specific training needs, and a brief overview of the civilian workforce that will become an integral part of the new service.

Regarding the Space Force's capacity to internally generate the number of GOs it will need, this study builds on PAF's initial FY 2019 work on the establishment of the U.S. Space Force.[16] In that initial work, PAF was asked to evaluate the sustainability of two models for the GO corps, using an officer base of 4,072 officers: a "lean" model, under which the Space Force would require 41 GOs, and a "demanding" model, under which the Space Force would require 45 GOs. Our analysis revealed that the Space Force did not have the ability to organically generate more than half of the number of GOs required under either model. This finding led to continued analyses in FY 2020 conducted within this study; the results of those analyses are presented in this report.

In this FY 2020 study, we reexamined the number of GOs that the Space Force could organically generate with an updated officer base estimate of 3,032. We also examined the Space Force's proposed GO distribution of six O7s, eight O8s, five O9s, and two O10s for sustainability and selection ratios—based on a 3,032-member officer corps. We again found that the Space Force would not be able to organically generate its new estimate of 21 GOs to lead the Space Force plus an additional nine joint GO positions. Our analyses also revealed that the

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[14] Sandra Erwin, "U.S. Space Force Has Lifted Off, Now the Journey Begins," *SpaceNews*, January 24, 2020a.

[15] According to the FY 2021–2025 Future Years Defense Program (FYDP), the Space Force officer base could reach 3,578 by FY 2025 if DoD's budget plans for the respective FYs were to remain constant and be approved.

[16] This initial analysis found that with a proposed officer base of 4,072 positions, the Space Force could generate only 21 GOs out of 41 requested under a "lean model" or 22 GOs out of 45 requested under a "demanding model" (Michael Spirtas, Yool Kim, Frank Camm, Shirley M. Ross, Debra Knopman, Forrest E. Morgan, Sebastian Joon Bae, M. Scott Bond, John S. Crown, and Elaine Simmons, *A Separate Space: Creating a Military Service for Space*, RAND Corporation, RR-4263-AF, 2020).

proposed Space Force GO distribution was not sustainable and resulted in highly problematic promotion issues. This report presents several recommendations to address and mitigate the issues identified related to GO generation and selectivity.

PAF's FY 2019 work also included career field sustainment analyses for officers in the 13S (Space Operations) and 14N (Intelligence) career fields. To assess sustainability in these two career fields in this initial work, PAF researchers developed a conceptual model based on three criteria:

- *Pyramid health* examines the estimated numbers of members and evaluates promotion (or grade-over-grade) ratios for officers in each career field considered for transfer to the Space Force and determines whether projected promotion ratios and promotion opportunities "would be equitable between the Air Force and the Space Force."[17] This criterion provides important insight into pyramid health.
- *Career path viability* examines whether enough variability in assignments exists within the Space Force to fully develop a member over the course of their career by using the career field Talent Management framework.[18] Included in this determination are typical assignments, in the respective disciplines, to outside organizations and agencies (e.g., the National Reconnaissance Office [NRO]).
- *Senior leadership opportunities* examines the availability of O6 and command billets at the squadron, group, and wing levels, as well as equivalent senior leadership opportunities in outside agencies (e.g., directorships in NRO, the Defense Intelligence Agency, the National Security Agency), where applicable.[19]

For the purposes of our study, the sponsor requested that we extend the FY 2019 analyses to include one additional officer career field, 17X (Cyber Operations), and that the earlier analyses of the Space Operations and Intelligence career fields be replicated using updated, more-precise data on the number of officers expected to transfer to the Space Force. For the Space Operations and Intelligence fields, the career field sustainability analysis carried out in FY 2020 mainly focused on the billet structure and its implications for the first and third criteria of pyramid health and senior leadership opportunities. The analysis using the second criterion, career path viability, in both these career fields was unaffected by the refined numbers and, thus, was not repeated.

For Cyber Operations, we analyzed the pyramid health and career path viability criteria, but the information available at the time of writing did not permit us to analyze the third criterion, the availability of senior leadership opportunities. Because of the unique management of the intertwined Development Engineer (62E) and Acquisition Manager (63A) career fields, as well as many unknowns at the time of our analysis associated with the billets that would transfer to the Space Force, we limited our analysis to the pyramid health criterion. Future work will be needed on career path viability and the availability of senior leader opportunities.

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[17] Spirtas et al., 2020, p. 58.

[18] Spirtas et al., 2020, p. 58.

[19] Spirtas et al., 2020, p. 58.

The Space Force also asked PAF to evaluate the training pipelines of its five organic career fields to determine whether the space-specific training available in FY 2020 was sufficient. Design and delivery of new space-specific training within the Space Force might be complicated by its changing relationship with Air Education and Training Command (AETC), the primary provider for Initial Skills Training (IST),[20] as the DAF moved to a two-service model.

We have also included a brief descriptive chapter in this report on the civilian workforce transferring to the Space Force. The numbers and grades of this large portion of the Space Force's workforce, estimated to be 50–55 percent of the total workforce, become especially salient in the discussion of the shortfall of senior leaders that can be generated within the Space Force.

Although we were asked to work on discrete pieces of analysis—as the discussion in this section illustrates—the overall results paint a picture of intertwined causes and effects, a picture that underscores the need for continuing thoughtful and targeted analyses as the Space Force moves forward with carrying out its critical national security missions.

Methodology

In this study, we combined quantitative and qualitative methodologies and relied on various Air Force and Space Force–provided data and a wide set of interviews conducted with key personnel in the two services. Our GO and career field sustainability analyses involved a mixed-methods approach that used the Line of the Air Force (LAF) authorization structure as a baseline, which we explain further in the next section. This approach was consistent with methodology developed in the FY 2019 project, during which PAF researchers initially developed analytical approaches for GO generation and the three-criteria conceptual model of career field sustainability. Our analyses of the training pipeline and of the civilian workforce transferring to the Space Force were qualitative in nature. The organizational and fiscal processes necessary to stand up a new service are many.

We recognize the need for continued quantitative analyses focused on the stand-up of the Space Force. In addition to the topic areas covered in this report, a comprehensive analysis of the monetary and workforce costs to design and deliver all space-specific training, which is vital for a highly technical organization, will be especially important going forward.

Quantitative Analysis Data Sources

For the quantitative analysis of the GO numbers and career field sustainability, we used three data sources, current as of September 30, 2019: (1) authorization data, or the total number of authorizations and the number of authorizations by rank and career field, from the Air Force

[20] However, the Space Force will provide IST to Space Operations officers, and the Defense Acquisition University (DAU) will continue playing an important IST role for the two acquisitions-related career fields.

Personnel Center (AFPC), henceforth referred to as *AFPC manpower data*; (2) AFPC inventory and manning rates, henceforth referred to as *AFPC personnel data*; and (3) Space Force transfer authorizations for officers, which Space Force leadership provided to the research team directly, henceforth referred to as either *Space Force transfer data* or the *Space Force transfer spreadsheet*.

We used end-of-FY 2019 data snapshots taken prior to the establishment of the Space Force because the Air Force is required to have personnel inventory match end strength at year end. The inventory charts included in our analysis for the five career fields display how many officers are included in the core Air Force Specialty Code (AFSC), how many serve in a duty AFSC (DAFSC) that is inside the core, and how many officers serve outside the core AFSC.[21] We can also determine how many personnel are considered to be student, transient, and personnel (STP).

Qualitative Analysis Data Sources

Interviews with subject-matter experts and career field managers (CFMs) informed the qualitative portion of our career field sustainability analysis for the Cyberspace Operations career field and, more specifically, the career path viability criterion. This analysis relied on a similar methodological approach to that used in the FY 2019 analysis for the Space Operations and Intelligence career fields, as mentioned in the previous section.

For our exclusively qualitative analysis of the training pipeline, we conducted an extensive set of interviews with career field training leads at the 319th and 533rd Air Force training squadrons, training and curricula development professionals at AETC, and faculty at Air University (AU) and DAU, as well as senior materiel leaders at the Space and Missile Systems Center.[22] In addition, we reviewed a wide variety of both internal and publicly available Air Force training documents.

For our analysis of the civilian workforce transferring to the Space Force, we relied on data from AFPC's Strategic Research and Assessment branch (AFPC/DSYA). We also drew on the RAND Corporation's internal expertise on the DoD civilian workforce, as well as expertise developed from previous DoD civilian manpower and staffing studies, to carry out a comparative analysis of the Air Force and Space Force civilian workforce and leadership with those of other space organizations.

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[21] Core officers can serve in jobs that match their core AFSCs, or they can serve in jobs that are outside their core AFSCs. We show the data for how many core officers are serving in DAFSCs or jobs inside their core AFSCs and another column of data for officers serving outside their core AFSCs.

[22] Our interviews with subject-matter experts in the Air Force, the Space Force, and U.S. Space Command (USSPACECOM) took place primarily in teleconferences, with detailed data relayed in follow-up emails. The interviews were not for attribution, so no names are provided. Where appropriate, however, we include information on the interviewee's affiliation or role.

Quantitative Analytical Approach

LAF Authorization Structure

The GO and career field sustainment analyses examined LAF authorization (or billet) structure and the degree to which the grade structure for the GO and officer billets expected to transfer to the Space Force matched the LAF structure in promotions or grade-over-grade ratios prior to the separation of the Space Force. This approach is rooted in the methodology and analytical approach that RAND researchers developed for the initial Space Force project *A Separate Space: Creating a Military Service for Space*,[23] as well as the DAF approach used in the stand-up of the Space Force. As the Space Force prepared for stand-up, the DAF reiterated that the existing Air Force policies associated with promotion opportunities and advancement "will remain in effect until the Space Force determines and makes adjustments."[24]

The LAF grade structure and *grade ratio* (or how many officers of a certain grade support one officer at the immediate upper grade) drive promotion rates and the speed at which officers are promoted within the Air Force. As the authors argued in the FY 2019 RAND report on the establishment of the Space Force, it is important for the Space Force grade structure to be closely aligned to the Air Force grade structure to avoid having Space Force officers promoted at a different rate from that of Air Force officers.[25]

If Space Force officers were to be promoted at slower rates than Air Force officers, the Space Force might not be able to attract the number and quality of officers that it needs, because individuals would be more likely to remain in or join the Air Force instead. On the other hand, if the Space Force were to promote its officers at a faster rate than the Air Force, a field grade officer (FGO) who moved up the ranks at a too rapid pace would be unlikely to have the leadership experience and assignment exposure needed to be successful at higher grades. Too rapid advancement has the potential for detrimental organizational outcomes both within the Space Force and in representation of the Space Force within the larger DoD community.

Therefore, we have used the LAF authorization structure and promotion ratios as benchmarks in our analyses regarding the number of GOs that the Space Force can organically generate. We also used the LAF authorization structure and promotion ratios to determine the necessary adjustments to the billet structures of the five career fields that will be organic to the Space Force, so they can be sustainable.

Limitations

Limitations within this study first include the rapidly evolving determination of requirements for the Space Force since its inception. We replicated analyses at different junctures in the

[23] Spirtas et al., 2020.

[24] U.S. Space Force, "Transferring to the U.S. Space Force FAQ," webpage, undated-b.

[25] Spirtas et al., 2020, pp. 58, 68.

project to incorporate the latest projections associated with the size of the GO corps and the number of officers transferring to the Space Force. However, despite best efforts from all parties, discrepancies remain between some numbers directly provided to us by the Space Force and Air Force and other sources of data from the two services. Where we have encountered discrepancies or gaps in the data, we have defaulted to AFPC data and the Space Force transfer data,[26] citing in footnotes the alternative data that emerged from other sources, such as our interviews with Space Force and Air Force leadership. In most cases, the discrepancies were negligible, with little to no impact on our analyses, but we acknowledge that there may be potential analytical ramifications of not having complete fidelity in the data, especially given the small size of the Space Force.[27]

The FY 2021–2025 FYDP requested 3,578 Space Force officer authorizations. If DoD's yearly proposed budgets advance according to plan and are approved, the Space Force will likely expand its officer base to 3,578 by FY 2025. However, given the uncertainty related to whether the Space Force could actually obtain the requested number of authorizations for its officer corps by FY 2025, we based our analysis on the number of authorizations that the Space Force provided and requested that we use as its officer base (3,032).

Furthermore, some information remained unknown at the time of our analysis, such as when 14N Intelligence officers were expected to transfer to the Space Force and which 14N officers were to remain in the Air Force. Along similar lines, at the time of writing, the availability of command billets for Cyber Operations at other agencies outside the Space Force was still to be determined. Additionally, several unknowns hindered a full assessment of the two Acquisition career fields. These shortfalls prevented our team from conducting a complete career field sustainability analysis across the three criteria previously mentioned—pyramid health, career path viability, and senior leadership opportunities—for the Cyberspace Operations and the two Acquisitions career fields using the most recent number of officers transferring into the Space Force. As a result, for Cyberspace Operations, we were able to assess only the first two criteria (pyramid health and career path viability) and for Acquisitions, only the pyramid health criterion.

In our training analysis, we focused primarily on the extent to which the existing technical training pipelines could support additional, space-specific training for Intelligence, Cyberspace Operations, and Acquisition officers and for Intelligence and Cyberspace Operations enlisted personnel.[28] We also evaluated how and where this additional training could be accommodated. We further evaluated the state of education on space power and space policy that will be needed by the new generation of space professionals.

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[26] U.S. Space Force, "Authorizations for Officers Transferring to the Space Force," internal document shared with the RAND team, September 30, 2019.

[27] Given its small size, the Space Force would be unlikely to have the flexibility to move resources to fix shortfalls, so these needed to be identified accurately and in a timely fashion.

[28] Training for officers in the Space Operations career field was evaluated as having a robust curriculum and a strong set of developmental training experiences. No Acquisitions enlisted personnel were expected to transfer to the Space Force at the time of writing.

In terms of the ability of existing training pipelines to develop space-focused warfighting proficiency, although much has been written about the need for the greater development of such warfighting proficiency, our qualitative work and interviews across a broad swath of Space Force subject-matter experts and leaders did not reveal much about this issue. Several reasons might account for this, and we will note that we ourselves raised this issue universally in our interviews. Of these potential reasons, the first is likely that the Space Force must put in place professionals in all five career fields, which will entail many moving pieces. Second, the highest concern that arose from our analysis was to get basic, fundamental space content into the training infrastructure. Intelligence and cyber officers, in particular, have had limited exposure to basic space-specific content before arriving at their first space assignments until recently, and this presents challenges. These two career fields have extensive initial training in their disciplines, but an intelligence graduate from IST does not have even the fundamentals in space that they will need on the job in the Space Force. Therefore, this concern should be addressed first. And third, there appeared to be high confidence among training professionals and senior leaders in the training functions that new warfighting proficiencies could be straightforwardly absorbed in the existing Space Force training infrastructure. Chapter 3 on the Space Operations training pipeline offers an overview of these training and development experiences: multiple Space Flag exercises per year, the U.S. Air Force (USAF) Weapons School, simulations, continuing and advanced training (AT), and, importantly, an operational-garrison cycle that allows those developmental experiences to take place. In sum, the initial challenge of concern to the Space Force appears to be related to the basics of space content for professionals—especially for those in career fields outside Space Operations—entering the Space Force for the first time. Importantly, our assessment of the training function shows it to be capable of incorporating new warfighting capabilities as such skills and training needs arise.

In Chapter 4, in the context of our assessment of the training pipeline for the Intelligence career field, we introduce the generalist space operator model, which is an option that the Space Force considered during the time frame in which this project unfolded. Under this model, intelligence and cyberspace officers and enlisted personnel would be brought into the Space Force initially in generalist operator roles and transitioned at a later point in their careers into Intelligence and Cyberspace Operations. The challenges associated with this generalist model were brought to our attention in the context of the interviews that we conducted for the Intelligence and Cyberspace Operations career fields, and we discuss these challenges in Chapter 4 on the Intelligence career field. Because the challenges expressed for Cyberspace Operations are similar to those encountered in the Intelligence career field (i.e., extremely lengthy and specialized training pipelines), we do not repeat the discussion in Chapter 5 on Cyberspace Operations. For the two Acquisitions-related career fields, we do not have the same concerns associated with the generalist operator model because they do not have extensive IST pipelines and they do not require the same in-depth level of functional specialization throughout a full career as the Intelligence and Cyberspace Operations career fields do. An in-depth analysis of the pros and cons associated with this model was outside the scope of this project.

Structure of This Report

This report is structured around the lines of effort and analyses, as requested by the project's sponsors. In Chapter 2, we focus on considerations related to the number of GOs the Space Force is able to generate organically and the projected selectivity challenges of GOs in grades O7 to O10. We also discuss senior leadership options for civilians that may mitigate some standing challenges with the proposed Space Force GO structure. In Chapters 3 through 6, we discuss the transitioning career fields of Space Operations, Intelligence, Cyberspace Operations, and the Acquisitions-related fields of Developmental Engineering and Acquisition Management. Each of these four chapters presents both discussions of officer career field sustainability and evaluations of the officer and enlisted training pipelines. Chapters 2 through 6 include conclusions and recommendations for each area of investigation. In Chapter 7, we examine the demographics and categories of the DAF civilian workforce transferring to the Space Force and offer recommendations germane to this civilian workforce. Finally, in Chapter 8, we lay out our overarching conclusions and recommendations for the Space Force's leadership structure, including GO numbers and selectivity, career field sustainability, training pipelines for officers and enlisted personnel, and the civilian workforce transferring into the Space Force. Appendixes A–G provide supporting detail for the analysis presented in the report chapters.

Chapter 2. Space Force Senior Leadership Structure: GO Numbers and Selectivity and the Role of Civilian Leadership

The proposed senior leadership structure of the Space Force has, understandably, received considerable attention and extensive scrutiny. Previous RAND analyses examined whether the Space Force could internally generate the number of GOs that it needs to lead the Space Force, and those results demonstrated that the Space Force could generate only about half of the GOs that it will need.[29] In our FY 2020 analysis, we dove more deeply into the issues surrounding the senior leadership structure of the Space Force.

In this chapter, we present (1) a replication of the FY 2019 analyses referenced above with updated Space Force officer population numbers and updated results, (2) an examination of selection ratios and a discussion of serious selectivity issues that will arise with the Space Force–proposed GO structure, (3) lessons from industry that could help increase predictive success for selection into the GO ranks, and (4) a discussion of the role of senior civilian leaders in the Space Force and a comparison of the ratio of senior civilian leaders to the size of the civilian workforce figures in comparable technical organizations.

We will briefly describe each of these efforts below, in this section, before launching into the full analysis and discussion of each effort in later sections of this chapter. The chapter concludes with a discussion of findings and specific recommendations.[30]

In the first effort, we replicated earlier analysis examining the number of GOs that the Space Force may be able to generate internally and evaluated whether that number will be sufficient. This new analysis uses updated officer population figures and relevant LAF promotion ratios at the time of writing. We examined the number of GOs that the Space Force requested to lead the new service compared with the number of GOs that can be internally generated based on the updated officer population numbers provided by the Space Force. We focused our analyses on the generation of the number of GOs that will be required to lead the Space Force itself. Our findings were consistent with all prior analyses: Even as the Space Force officer population numbers became more and more refined, the Space Force will be able to internally generate only about half of the GOs that it needs to lead the new service.

In the second effort, we analyzed resulting selectivity ratios based on the number and, importantly, the distribution of GO grades requested by the Space Force at the time of our

[29] For more details on the findings of the previous RAND work conducted in FY 2019, please see Spirtas et al., 2020, p. 71.

[30] For a discussion of the DoD criteria for determining whether a position is to be filled by a GO or flag officer, see Appendix A, and for a brief review of the literature on the main lessons from the private sector regarding the size of headquarters, please see Appendix B.

analysis. Again, we used the updated figures of planned force size and the requested number and distribution across ranks of Space Force GOs, and we present our findings on selectivity of Space Force GOs at the O7, O8, O9, and O10 levels.[31] We also provide comparisons with traditional LAF GO selection ratios from grade to grade. Space Force selection ratios of GO grade-to-grade promotions that would result from the proposed Space Force GO structure at the time of writing have several serious issues, among which is automatic promotion from O7 to O8. We discuss the risks that would ensue.

Given the risks arising from the selection ratios that surfaced in the findings from our second effort, in our third effort, we discuss some lessons from industry on predictive selection of senior leaders. The sophisticated models and simulations that have been used over decades in private industry have high levels of prediction for success at two, three, and four levels up the organization. We briefly describe these executive selection processes and discuss their potential relevance for selection of Space Force GOs.

In our fourth effort, we discuss the potential benefits of the expanded use of senior civilian leaders in the Space Force, and we offer a set of comparative ratios of Senior Executive Service (SES) positions to total civilian workforces, first within the Space Force and the Air Force and then in comparable, successful technical and space-oriented organizations. Both the Air Force and the Space Force have very small ratios of SES positions to total civilian workforces, as contrasted with those of comparable technical and space-focused organizations. We briefly discuss the set of available civilian executive position categories available to the Space Force.

The Space Force's Ability to Organically Generate Sufficient Numbers of GOs

As mentioned in the introduction, PAF researchers conducted analyses in FY 2019 to determine whether the Space Force would be able to generate sufficient numbers of GOs to lead the Space Force enterprise and represent the service at USSPACECOM. In FY 2019, the officer base of the Space Force was projected to be 4,072. Analyses in that time frame demonstrated that with a grade structure similar to the Air Force's, the Space Force would not be able to organically produce the number of GOs that it needed under its two proposed models: a "lean" model, under which the Space Force required 41 GOs, and a "demanding" model, under which the Space Force needed 45 GOs. Findings from the FY 2019 analysis revealed that under both models, the Space Force could organically produce only about half of the number of GOs needed (21 and 22 GOs, respectively), which implied that the Space Force would need to draw the

[31] For the reader unfamiliar with the Air Force's GO corps, the O7 rank corresponds to a brigadier general (or one-star general); the O8 rank to a major general (or two-star general); the O9 rank to a lieutenant general (or three-star general); and the O10 rank to a full general (or four-star general).

remaining number of GOs from the Air Force and the other services.[32] To generate between 41 and 45 Space Force GOs, PAF researchers found that a larger Space Force officer corps would be required than the original estimated end strength of 4,072.

In FY 2020, as Space Force numbers were refined, we were asked to replicate the earlier analyses with these newer numbers. Using the updated Space Force officer corps of 3,032 and a requirement for 30 GOs, of which 21 would lead the Space Force and nine would be assigned to joint positions, we found that the Space Force will still be able to internally generate only about half the GOs that it needs (16 out of a required 30). Logic suggests that the remaining half of the needed GO inventory would be sourced from other services, particularly the Air Force. These updated analyses also found that the GO requirements would result in promotion patterns that differ from the existing LAF—the details and consequences of which are discussed in the next section.

GO Sustainability and Selectivity Resulting from the Space Force–Proposed GO Distribution Option

The second effort came about as the Space Force asked the research team to perform related analyses, using a very specific distribution for the GOs based on the needs that the service had identified at headquarters and field commands: six O7s, eight O8s, five O9s, and two O10s—for a total of 21 GOs. This distribution reflects the leadership structure of the Space Force itself and not joint GO positions. This section details the results of our analyses based on this specific distribution (see Table 2.1), and it reveals issues of both total numbers and selection ratios among the GO ranks.

[32] Spirtas et al., 2020, p. 71.

Table 2.1. Count of Personnel in Each Rank in LAF and Grade Ratios, as of September 30, 2019

A	B	C	D	E	F	G
Rank	**Grade**	**LAF Inventory[a]**	**LAF Ratio of Lower to Upper Rank**	**Matching Space Force 3,032 to LAF Grade Ratios**	**Matching Space Force 3,921 to a Specific Distribution of 21 GOs**	**Grade Ratios for Specific GO Distribution**
2nd Lt	O1	7,451	1.1	446.0	577.0	1.10
1st Lt	O2	6,857	0.4	410.5	531.0	0.40
Capt	O3	15,514	1.5	928.7	1,201.0	1.50
Maj	O4	10,393	1.3	622.1	804.0	1.30
Lt Col	O5	7,722	3.2	462.3	460.1	3.20
Col	O6	2,442	18.1	146.2	189.0	**31.50**
Brig Gen	O7	135	1.6	8.1	**6.0**	**0.75**
Maj Gen	O8	84	2.1	5.0	**8.0**	**1.60**
Lt Gen	O9	40	3.3	2.4	**5.0**	**2.50**
Gen	O10	12		0.7	**2.0**	
Total		50,650		3,032	3,921	

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 30, 2019.

NOTE: The numbers in bold red show the divergence in Space Force GO numbers and grade ratios from those of the Air Force, which are presented in columns D and E. In the following chapters, we include only the "grade" column and not both the "rank" and "grade" columns to simplify the visual presentation of the tables.

[a] The counts in column C reflect Air Force headspace and joint headspace held by Air Force officers as of September 30, 2019. They include positions held by active-duty officers, as well as a few guard and reserve officers. Additionally, they include officers who may or may not be appropriate for future promotion based on time-in-grade eligibility constraints, retirement decisions, current assignments, or career expertise.

To understand these two issues requires a close reading of Table 2.1. Historically, LAF ratios have ensured an adequate flow of personnel through the ranks of the Air Force and provided an appropriate level of selectivity for officer promotions. Column C is a snapshot of the officer personnel inventory in each rank in the LAF as of September 30, 2019. Column D shows the promotion or selectivity ratios within the Air Force using the inventory numbers in column C. Although not a set threshold, a ratio that allows selection among an appropriate number of candidates is needed to preserve reasonable promotion selectivity. In the short term at least, the Space Force will likely need to match the LAF promotion ratios to encourage the needed volunteers and to foster equity among those officers and enlisted personnel who must transfer from the Air Force to the Space Force. In column E, the figures result from the application of LAF promotion ratios for all grades to the Space Force's projected officer corps of 3,032. These projected numbers of Space Force officers include 446 second lieutenants; thus, we can see the projected distribution of officers across the Space Force's ranks.

Importantly, as seen in the bottom four rows of column E, the results of the application of the Air Force's promotion ratios to the Space Force's officer population would result in (with rounding) eight O7s, five O8s, two O9s, and one O10, for a total of 16 GOs. However, as seen in the four bold numbers shown in column F of Table 2.1, the Space Force's proposed distribution is six O7s, eight O8s, five O9s, and two O10s. Furthermore, as seen in the "Total" row of column F, the Space Force's proposed distribution of GOs and resulting total number of 21 GOs would require a total officer population of 3,921 to generate and sustain.

Thus, as seen in Table 2.2, given alignment with LAF promotion ratios and a projected officer population of 3,032, neither the total number of GOs nor the specific distribution preferred by the Space Force is supported by our analyses, and both are likely not sustainable.

Table 2.2. Space Force–Preferred Total Number of GOs and GO Distribution Compared with Projected Total Number of GOs and Distribution

A	B	C
Grade	Space Force–Preferred Distribution	RAND Results
O7	6	8
O8	8	5
O9	5	2
O10	2	1
Total	21	16

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data, as of September 30, 2019.
NOTE: In this table, RAND results represent the number and distribution of GOs that can be sustained with a 3,032-member Space Force officer corps.

The second serious issue arises from the Space Force's proposed GO distribution: The selection ratios of GOs diverge significantly from LAF ratios, and what is likely to be untenable selectivity (or untenable selection ratios) follows. The lesser undesirable effect of the divergence in Space Force selectivity or promotion ratios from the LAF is that Space Force GOs would have slightly less time-in-grade, less time-in-service, and less experience than their Air Force counterparts. But a greater effect would be that selection rates from GO rank to next GO rank would be unrealistically high.

In Table 2.1, columns F and G represent the projected numbers of officers by grade and the promotion ratios grade to grade, respectively. A comparison of the first five figures in column D and in column F demonstrates that the promotion ratios can be maintained in grades O1 through O6. In other words, projected Space Force numbers by grade work well through the O6 level using the LAF ratios.[33]

However, once we use the Space Force–proposed GO distribution for ranks from O7 to O10 (shown in column F in bold), the resulting Space Force promotion ratios for O7 to O10 (the bottom four numbers shown in column G in red) diverge significantly from LAF ratios that are

[33] In column F of Table 2.1, we are using an officer population of 3,921, which would be needed to meaningfully sustain a base of 21 GOs.

shown in Column D. Selection to O7 has an LAF ratio of 18.1, but the Space Force selection ratio to O7 is 31.5, meaning that about 18 Air Force O6s (or colonels) are needed to produce one O7, but nearly 32 Space Force O6s would be needed to produce a Space Force O7. At the next rank for promotion in the Space Force–preferred GO distribution, the projections veer to the other extreme: The LAF promotion ratio (shown in column D) to O8 is 1.6, but the Space Force promotion ratio (shown in column G) to O8 is 0.75. Any ratio at or below 1.0 would result in virtually every O7 being promoted to O8.

At the O8 to O9 juncture, LAF ratios are 2.1, and the Space Force–proposed distribution is at 1.6, again meaning that more O8s would be promoted to O9 than is currently the case in the Air Force. Finally, at the O9 to O10 juncture, or promotion to a four-star general, the LAF ratio is 3.3, and the Space Force–proposed distribution ratio would be 2.5, again resulting in more Space Force three-star GOs promoted to four-star GOs than there would be in the Air Force.

Therefore, at each GO grade after the selection to one-star general, the Space Force would have fewer officers from which to choose compared with the Air Force GO promotion decision. In our model, once a Space Force O6 is selected for the one-star GO level, they would be statistically guaranteed to move up to a two-star GO level, and the probabilities are high that they would also move to the three-star GO level (with a 1.6 promotion ratio, only 1.6 two-star generals are needed to produce one three-star general). Thus, the selection decision from O6 to O7 becomes crucial: When the Space Force selects an O7, it is also selecting that individual not only for promotion to O8, at minimum, but also with a high probability of that individual being promoted to O9.[34]

This scenario diverges strongly from the Air Force's GO selectivity, in which approximately half of the one-star generals are promoted again, and selectivity for three- and four-star generals becomes even more rigorous. One partial mitigation may be to have Space Force GOs serve for longer periods in each rank. But overall, the Space Force is proposing a distribution across its GO structure that will be challenging to sustain and will involve a dearth of competition for promotion between the one-, two-, and three-star ranks. Such limited competition would be disadvantageous and result in higher risk associated with promoting GOs compared with the other services. The Space Force, in effect, will need to select up front, from the ranks of O6s, those individuals who have the highest potential of becoming two-, three- or four-star generals at greater probabilities than with similar Air Force promotion decisions. Therefore, under the Space Force's proposed GO distribution, the selection to O7 within the Space Force presents higher levels of inherent risk than in other services and would be a crucial decision.

In the following sections, we present two potential solutions that would mitigate this risk. The first is a best-in-class executive selection derived from private industry that could be adapted for the Space Force. The second solution could lie in greater use of civilian leaders. We will also

[34] GO promotions are, of course, never guaranteed in practice because each GO promotion requires Senate confirmation.

discuss other space-related and highly technical organizations that make significantly greater use of SES, scientific and technical (ST), and senior-level (SL) professionals than does either the Air Force or the FY 2020 projections for the Space Force. The leveraging of civilian leaders—especially in the Space Force, whose workforce was projected to be more than 50-percent civilian as of this writing—would remove the pressure of having to reach the projected high numbers of required GOs, relative to the officer pyramid. Selection rates for GOs could approach LAF ratios, ensuring a long-term pipeline of rigorously selected military leadership talent.

Lessons from Industry to Improve the Selection Process Within the Space Force

For more than 50 years, industry has developed and employed executive selection methods to improve the odds and heighten the predictive power for long-term success of individuals selected in succession plans for C-suite roles, such as CEOs. The sophisticated models on which industry relies aim to predict which executives are likely to be successful at two, three, and four levels up in the organization; these models allow measurement with great specificity for growth potential in particular individuals. One example of the many predictive factors that these models measure is the mastery of complexity, which includes conceptual skills, tolerance and navigation of ambiguity, and adaptability. Learning agility is another measurable predictive factor included in the industry models.

These assessment center methodologies use sophisticated simulations with high complexity and high pressure to yield impartial, objective measures of an individual's potential for assuming higher levels of senior leadership. These assessments also involve instrumentation and in-depth interviews to measure emotional intelligence and derailers. The resulting candidate readiness profiles are then matched to the predetermined success profiles of roles at higher levels in their organizations. These predictive models also result in a rank-ordered set of candidates, in terms of fitness and readiness, for the next levels in the organization.

In light of the particular GO structure that the Space Force envisioned in FY 2020, the daunting responsibilities of standing up a new service, and the selection ratio constraints discussed above, as well as the Space Force's need to bring in GOs from other services, especially the Air Force, such a rigorous approach to selection would likely be highly beneficial. It would offer innovative, enhanced predictions of GO success in the Space Force, not only for the next promotion but also over the course of the GO leader's long-term career. An additional likely advantage of such an approach to the Space Force would be the ability to gain a deep understanding of the potential long-term success of lesser-known candidates, such as those who may come from the Army or Navy, either as GOs or in contention to become Space Force GOs.

In industry, the assessment process is typically outsourced to a leading assessment firm, and the organization works closely with the assessment firm to determine optimal success profiles for specific senior leadership roles, customizing criteria and approach to the specific organization.

Although a great departure from traditional methods of promotion, the assessment center methodologies would likely result in greater predictability of long-term success for senior leaders within the Space Force GO ranks as the DAF continues to undertake this rare and extremely challenging stand-up of a new service.

Role of Civilian Leadership in the Space Force

Within the timeline of this study, the projected workforce percentage of civilians in the Space Force was estimated to be between 50 and 55 percent. Because of this high percentage, we sought to understand the role of civilian leadership in other technical and space-focused organizations that employ large numbers of civilians.

Senior civilian leadership positions within DoD have some significant differences beyond the obvious military-civilian distinction. One difference is that although the number of GOs in the military services is managed to limits provided in Title 10 of the U.S. Code, the number of civilian leadership positions is managed by allocations from the U.S. Office of Personnel Management (OPM).

Senior civilian leadership positions also include more than one category of position: (1) Defense Intelligence Senior Executive Service (DISES) positions, which are the DoD intelligence community equivalent to SES positions;[35] (2) SES positions, which are those classified above the General Schedule (GS)-15 level that involve executive and management responsibilities; (3) ST positions, which include those classified above the GS-15 level that are not SES positions (i.e., that do not involve executive and management responsibilities) and are engaged in research and development in the physical, biological, medical, or engineering sciences or a closely related field; and (4) SL positions, which include those that are not SES positions and are classified above the GS-15 level based on other factors. These four categories of senior civilian leadership positions are of great use to research and technical organizations.

In this section, we explore the use of civilian leaders in organizations comparable to the Space Force. Given that only approximately half of the GOs that the Space Force needs can be generated internally and, as discussed in the previous section, the proposed Space Force distribution of GOs may be untenable, it appeared logical to explore a more extensive use of senior civilian leaders.

To be clear, no organization is directly comparable to the Space Force. The Space Force was created to address expectations of greater offensive and defensive space warfighting capabilities. However, the Space Force's planned civilian technical workforce, with its strong representation in science and engineering fields, has many counterparts within the federal government and within DoD. These other organizations—with large numbers of civilian scientists and engineers and significantly large numbers of successful senior civilian leaders—have personnel practices

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35 National Geospatial-Intelligence Agency, "Senior Executive Positions," webpage, undated.

and insights that may be helpful to the nascent Space Force. Science, technology, engineering, and mathematics (STEM) workforces have been widely studied across organizations, and these studies have produced specific results that are generalizable across such workforces.[36]

Comparable Space-Related Organizations

A number of scientific and space-related organizations are successfully staffed with civilian employees who provide long-term leadership and perform critical mission functions. We assessed that it would be helpful to look at other federal organizations and Air Force organizations that have missions related to space or have highly technical workforces—organizations that could provide comparisons in terms of organizational structure, number and type of personnel, number of civilian employees and military personnel, and executive leadership. OPM looks at leadership-to-employee ratios as part of its determination of the number of executive positions authorized for agencies.

The National Aeronautics and Space Administration (NASA) defines its mission as follows: "NASA explores the unknown in air and space, innovates for the benefit of humanity, and inspires the world through discovery."[37] A quick comparison between NASA and the Air Force reveals that NASA has a total of 16,872 civilian positions with 398 SES positions (or 24 SES positions per 1,000 civilian positions), while the Air Force has 169,381 civilian positions with 167 SES positions (or 1 SES per 1,000 civilian positions).[38] Final numbers of civilian employees in the Space Force were unknown at the time of writing, but it is estimated that 50–55 percent of the Space Force workforce will be civilian, and the Space Force had proposed 17 SES positions. Using a 50-percent proportion of the estimated 16,000 members of the Space Force, the Space Force SES-to-civilian workforce ratio would be about 2 SES per 1,000 civilian positions.

Similarly, the Air Force has several primarily civilian-led and -operated organizations engaged in scientific research and development, which, therefore, have large science and technology workforces. For example, the Air Force Research Laboratory (AFRL) aims to lead "the discovery, development and delivery of warfighting technologies for air, space and cyberspace forces."[39] AFRL is responsible for a multibillion-dollar science and technology program that includes "basic research, applied research and advanced technology development in air, space and cyber mission areas."[40]

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[36] Shirley M. Ross, Rebecca Herman, Irina A. Chindea, Samantha E. DiNicola, and Amy Grace Donohue, *Optimizing the Contributions of Air Force Civilian STEM Workforce*, RAND Corporation, RR-4234-AF, 2020.

[37] NASA, "Life at NASA: Mission and Values," webpage, undated.

[38] OPM, "Federal Workforce Data," Fedscope, June 2019. These data do not include ST and SL positions.

[39] AFRL, "About," webpage, undated.

[40] USAF, "Air Force Research Laboratory," webpage, October 2021.

AFRL's workforce consists of about 10,000 military and civilian personnel, of which 4,446 are civilian billets.[41] With 7 SES positions, the resulting ratio for AFRL is approximately 2 SES per 1,000 civilian positions,[42] a ratio very close to the Air Force's ratio of 1 SES per 1,000 civilian employees and significantly lower than NASA's 24 SES per 1,000 civilian positions. If we were to include the ST and SL positions, however, the total number of senior leadership positions in AFRL would be 39, with a ratio of 9 SES per 1,000 civilian billets. This ratio, of course, points to a larger utilization (overall Air Force versus AFRL) of civilian technical leadership in the management of a highly technical organization, yet still within a military warfighting organization.

Given the notably higher ratios found among similar science and engineering populations in NASA and AFRL, it would appear reasonable that the Space Force has considerable latitude in adding SES positions and other senior civilian job positions to its senior leadership structure. This very preliminary look at two comparable examples demonstrates that organizations leading advancements in space and military research and development can be structured and managed by larger proportions of civilians than are found in the overall Air Force and in the FY 2020 Space Force–proposed leadership structure.

Both NASA and AFRL use a variety of civilian leadership positions allocated by the OPM to successfully manage their workforces. Unlike the DAF's process for GO authorizations, which requires congressional approval, civilian executive "spaces" are allocated by OPM to agencies across two-year periods, as required by law.[43]

Conclusions and Recommendations

Consistent with the FY 2019 analysis, but using the FY 2020 Space Force–provided number of the Space Force officer corps (3,032 billets), we found that the Space Force will be able to internally generate only half of the overall number of GOs that it has requested (or 16 out of 30 GOs, with those 30 including all joint positions). A key implication of this finding is that if the Space Force stands by the need for this number of GOs and does not leverage senior civilian leaders as recommended, about half the GO corps of the Space Force will need to be drawn from other services for the foreseeable future.

We speculate that the Air Force will remain the main source of officers and civilians to fill GO and senior civilian leadership requirements for the Space Force. How these GOs are selected from all sister services and the potential impact on the emerging culture of the Space Force as these GOs transition in at the very top are topics for further research.

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[41] Based on AFPC data as of May 2020, this number includes the AF DRUG TEST LAB and the USAF RADCHEM LAB as part of the AFRL (AFPC, email correspondence with the authors, May 2020).

[42] Our calculation is based on AFPC data (AFPC, email correspondence with the authors, May 2020).

[43] OPM, *Guide to the Senior Executive Service*, March 2017, p. 4.

Our second key finding is that the FY 2020 Space Force–proposed GO (i.e., six O7s, eight O8s, five O9s, and two O10s) is untenable. Selection rates between GO ranks would be inherently problematic. Not only will the selection rate from O7 to O8 be 0.75 (with every O7 eventually promoted to O8) but also a selected O7 will have a high probability of advancing to O9. This trajectory—from selection at the O6 level with a high probability of advancing to O9—would, in effect, be largely the result of a single selection decision to O7. This unprecedented expected upward mobility would be accompanied by a high level of risk: Prediction of success two, three, or four levels up the organization (or in this case, up the GO ranks) is inherently risky, particularly in the absence of established methods to predict long-term executive performance used by industry. These findings have several implications and serve as the basis for some of our recommendations.

Innovative and creative approaches to senior leadership selection are highly recommended, such as the use of predictive models from industry to determine more precisely the long-term leadership and higher rank potential of all Space Force GOs. Even if the proposed distribution under consideration in FY 2020 were not adopted, any set of selection rates with such small numbers as will be found in the Space Force GO ranks will present important decisional challenges. A secondary benefit of best-in-class selection practices from industry would be the insight provided on the GOs who may be tapped from other services to come into the Space Force—an outcome that appears to be inevitable for the foreseeable future. Given the need for the Space Force to build a space-specific culture, additional insight into the capabilities, potential, and leadership orientation of potential candidates from outside the Space Force will assist it in the selection of GOs who can align with the Space Force's culture. With more-sophisticated selection practices, the Space Force could preview candidates who would be the best fit to lead the Space Force into the future.

Civilian leadership will likely be a greater imperative in the Space Force than in the Air Force. We suggest leveraging civilian DISES and SES positions for Space Force leadership positions to mitigate the nearly 50-percent GO shortfall. Other space organizations and highly technical agencies have much higher proportions of civilian leaders, who bring not only technical depth and breadth but also continuity and organizational memory. Because technological development is often a complex, sophisticated, and lengthy process, civilian leaders who rotate less often than their military counterparts in highly technical organizations are more likely to supervise projects from design to completion. The Space Force, a small, highly technical warfighting organization, is well placed to leverage the full set of SES, SL, ST, and DISES positions—a combination that provides senior leadership, technical leadership, and technical talent at compensation rates competitive with industry.

Drawing on the results of our analysis, we recommended that the Space Force consider taking the following key steps:

A. **Strive for a fully sustainable GO pyramid when creating the Space Force's leadership structure.** A clearly sustainable number of GOs plus a GO distribution that enables healthy selection rates will yield the best outcome for the Space Force as it takes its place among its sister services.

B. **Explore best-in-class executive selection practices from industry.** GO promotions within the Space Force will likely hold higher risks than GO promotion decisions in the Air Force. These risks result in large part from solutions that will be required to address the 50-percent shortfall of GOs that can be generated internally within the Space Force. Solutions to overcome this shortfall include promotion of O7s to higher GO ranks at much greater rates than seen previously in any service. They also include bringing GOs from sister services into the Space Force—GOs whose leadership philosophy, expectations, experience, and understanding of the Space Force's culture likely differ from those GOs who will be generated internally. Risks from these solutions will be over and above the risks that the Air Force typically takes in its selection of GOs.
C. **Explore greater use of civilian leaders within the Space Force.** Fully utilize the existing DISES and Air Force SES, ST, and SL positions to balance out senior leadership of this highly technical warfighting service and to mitigate the shortfall of Space Force GOs. Use a "clean sheet" approach to help understand which senior leadership positions would be suitable for civilians, and look to the greater proportions of SES positions in other space and technical organizations to provide insight. Furthermore, the addition of ST and SL positions can result in enhanced, competitive compensation for the Space Force as it looks to bring in top-tier technical leadership and technical expertise.
D. **Set in place well-structured succession planning for the SES and senior civilian leadership cadre.** A well-structured succession planning program would assist in building the breadth of civilian senior leaders and ensuring the periodic renewal of technical expertise in the organization.

Chapter 3. Space Operations Career Fields

Space Operations career fields, which include 13S for officers and 1C6X1 (Space Systems Operations) for enlisted personnel, are the cornerstone of the Space Force. Both enlisted and officer Space Operations career fields moved over to the Space Force en masse, whereas only a subset of individuals in other career fields was identified for transition when the new service was stood up (i.e., personnel in Intelligence, Cyberspace Operations, and acquisition-related career fields). According to the Space Force transfer data as of February 2020, 1,454 13S officers and 1,016 1C6X1 enlisted personnel were in the process of transferring to the Space Force.

At our sponsor's request, we analyzed the sustainability of all transferring officer career fields, and we evaluated the space-related training available for both officers and enlisted personnel in space operations. This chapter includes updates to the sustainability analysis carried out in FY 2019 for the 13S officer career field and a discussion of training for both 13S officers and 1C6X1 enlisted personnel. We also discuss some key features of the training infrastructure that will be pertinent to the Space Force. That discussion is followed by conclusions and recommendations specific to Space Operations career fields.

Space Operations Officer (13S) Career Field Sustainability Analysis

PAF researchers had previously analyzed the sustainability of the 13S career field using earlier projected numbers of personnel.[44] However, in the course of this project, we were able to reanalyze the pyramid health and senior leadership opportunities elements of sustainability with subsequent and more-accurate counts of personnel projections of the 13S career field as it moves over to the Space Force.[45] In particular, we were able to identify and include in our analysis authorizations for 10C0 (operational commander), 91C0 (commander), and 91W0 (wing commander). At the time of the FY 2019 analysis, the insufficient number of O6 positions meant that the 13S career field did not meet the third criterion: presence of senior leadership opportunities (as laid out in Chapter 1).[46] However, the FY 2020 data mitigate, to a large extent, the previous concerns about the availability of senior leadership opportunities associated with the sustainability of the 13S career field. The 13S grade or billet structure appears to need only four

[44] Spirtas et al., 2020, pp. 61–64.

[45] For more on career path viability, please see Spirtas et al., 2020, pp. 61–62. Three elements were evaluated to ascertain career field sustainability. We reanalyzed the first and third of these, pyramid health and senior leadership opportunities, with new data. The updated data, however, did not have an impact on the second element, viability of the career path for the 13S officers in the Space Force, and therefore, we did not repeat that analysis in this study.

[46] The first and second criteria examined in Spirtas et al. (2020) are (1) a viable pyramid structure in the company grade officer (CGO) and FGO ranks and (2) sufficient depth and breadth of career field to enable comprehensive career preparation and potential of progression to O6 and GO ranks.

additional colonel or O6 authorizations to match LAF grade ratios, a distinct improvement over earlier projections.[47]

However, modifications will be needed in CGO and FGO authorizations. As seen in the differences between the values in the "Authorizations Using LAF Ratios" column in Table 3.1 and the values in the "Authorizations as of September 2019" column in Table 3.2, the latest data indicate that adjustments are needed in grades O1 to O6 to match LAF ratios. More-recent data demonstrate that shortfalls occur in the number of CGOs (39 billets), if the Space Force billet structure is to match LAF ratios. This shortfall can be filled by reallocating 37 O4 positions and six O5 billets. As noted above, only four additional O6 authorizations would be needed, and these authorizations could also be achieved in reallocation from the O4 and O5 positions.

Table 3.1. Notional 13S Authorization Options for the Space Force to Match LAF Ratios

Grade	Authorizations Using LAF Ratios	Selectivity to Next Higher Grade	Difference from Actual
O1, O2, O3	812	1.2	+39[a]
O4	326	1.6	–37
O5	239	3.1	–6
O6	77	—	+4

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.
NOTE: The values in the "Difference from Actual" column represent the difference between the values in the "Authorizations Using LAF Ratios" column in this table and the values in the "Authorizations as of September 2019" column shown in Table 3.2. We do not show the latter in this table to avoid intermixing notional authorization and actual authorization data.
[a] The "+39" denotes the number of positions that the Space Force needs to add for the CGO level to make up for the respective shortfall; it does not denote a surplus of 39 CGOs.

The misalignment of the grade structure also has implications for promotions: To fill the excess number of O4 positions, nearly every O3 needs to be promoted to O4. As shown in Table 3.2, 77.3 CGOs need to be promoted each year to sustain the 773 CGO positions in the Space Operations career field, and from those 773 CGOs, 72.6 promotions from O3 to O4 would be required each year. This high number of O4 positions would also cause a slight downward pressure on O5 and O6 promotion rates, meaning that fewer O5s and O6s would be promoted within the Space Force or promotions would be slower relative to the overall LAF rates, or both.

The Space Force's selectivity ratio of 1.8 from O4 to O5 is higher than the selectivity ratio of 1.6 for the overall LAF. That translates into 1.8 O4s for every O5 position if the Space Force were 100-percent manned at the O4 and O5 grades, compared with 1.6 O4s for every O5 position for the LAF. With more O4s for each O5 position, that means a lower promotion rate than the LAF, or if the promotion rate were held steady, the promotion timing would need to slow to

[47] Previous estimates were 27 additional O6 billets needed to match LAF ratios. For details, see Spirtas et al., 2020, pp. 61–64.

avoid driving the O5 manning too high. The same situation is present with the selectivity numbers between O5 to O6, with 3.4 O5s for each O6 position in the Space Force compared with 3.1 O5s for each in the LAF. However, the downward pressure for O5 and O6 promotion rates could cease to be an issue if the changes seen in the last column of Table 3.1 were made to the Space Force billet structure for the 13S Space Operations career field to align it with the LAF ratios.

Table 3.2. Comparison of 13S Authorization Structure and Promotion Rates

Grade	Authorizations as of September 2019	Promotions per Year	Selectivity to Next Higher Grade
Overall LAF			
O1, O2, O3	25,199	2,519.9 (to O1, O2, and O3)	1.2 (O3 to O4)
O4	10,132	2,026.4 (O3 to O4)	1.6 (O4 to O5)
O5	7,405	1,234.2 (O4 to O5)	3.1 (O5 to O6)
O6	2,401	400.2 (O5 to O6)	—
Space Force 13S			
O1, O2, O3	773	77.3 (to O1, O2, and O3)	1.1 (O3 to O4)
O4	363	72.6 (O3 to O4)	1.8 (O4 to O5)
O5	245	40.8 (O4 to O5)	3.4 (O5 to O6)
O6	73	12.2 (O5 to O6)	—

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.
NOTE: Space Force 13S authorizations include 10C0, 91C0, and 91W0 positions.

Inventory Analysis

Table 3.3 shows the total number of LAF authorizations and the total inventory within the Air Force. The total inventory consists of LAF permanent party inventory and the numbers included in the STP account, which represent the number of students, transients, and personnel holdees (patients and prisoners). Table 3.4 shows the data for 13S authorizations included in the Space Force transfer data and the overall 13S authorizations, essentially demonstrating that the entire 13S career field is expected to move to the Space Force. The next columns present the permanent party inventory for 13S officers in the Space Force and the total core 13S inventory, which consisted of officers who were serving in a 13S job and those who were not as of September 30, 2019. According to data available at the time of this writing, more officers were assigned to the 13S DAFSC than were authorized for the Space Force; Space Operations manning (assigned and authorized) was at more than 100 percent at the end of September 2019. It is rather rare to have manning at more than 100 percent, and, similar to the LAF, some grades were undermanned and some were overmanned. However, overall, at the time of our analysis, including the nearly 300 core 13S officers serving in non-13S jobs, there were more than enough 13S core officers available (1,700+) to fill all 1,454 Space Force authorizations.

Table 3.3. 13S LAF Inventory Analysis

Grade	Authorizations	Permanent Party Inventory	Manning Permanent Party Inventory or Authorizations	STP Inventory	Total Inventory
O1, O2, O3	25,199 (56%)	24,058 (56%)	93%	5,764	29,822
O4	10,132 (22%)	9,337 (22%)	91%	1,056	10,393
O5	7,405 (16%)	7,318 (17%)	98%	404	7,722
O6	2,401 (5.3%)	2,412 (5.6%)	100%	30	2,442

SOURCE: Authors' analysis of AFPC manpower data and AFPC personnel data as of September 2019.

Table 3.4. 13S Space Force Inventory Analysis

Grade	Authorizations from Space Force Transfer Data	Overall Authorizations in September 2019	Permanent Party Inventory (Manning) DAFSC of 13S	Core AFSC of 13S	Core 13S Serving in a DAFSC of 13S or 10C0, 91C0, or 91W0 Position	Core 13S Serving Outside 13S, 10C0, 91C0, or 91W0 Positions
O1, O2, O3	773 (53%)	787 (54%)	932 (118%)	931	841	90
O4	363 (25%)	362 (25%)	290 (80%)	387	290	97
O5	245 (17%)	246 (17%)	213 (87%)	284	211	73
O6	73 (5%)	74 (5%)	75 (101%)	108	72	36
Total	1,454	1,469	1,510 (103%)	1,710	1,414	296

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.
NOTE: Overall 13S Space Force inventory includes 10C0, 91C0, and 91W0 positions.

Compared with the FY 2019 analysis, which omitted the 10C0, 91C0, and 91W0 positions that are predominantly at the O6 rank, the shortage of O6 positions had dropped to four. If four O5 authorizations were converted to O6 authorizations (see Table 3.1), an ample number of colonels (108, as shown in Table 3.4) with a 13S core AFSC would be available to meet the authorization increase, with no need for special promotions to meet demand. In addition, an extra 36 colonels in the core were not assigned to a 13S job as of September 2019, mitigating any concern regarding the availability of O6 officers.

Space Operations Officer (13S) Training

To understand and evaluate training for a particular career field, it is necessary to understand its technical requirements. In describing the 13S career field, the Air Force Officer Classification Directory (AFOCD) summarizes it as follows:

> Operates and manages space operations systems. The systems include surveillance, spacelift, space warning, and satellite command and control (C2). Performs associated battle management, command, control, and communications activities to defend and support the United States and allied forces. Serves as space operations advisor.[48]

Officers in this career field generally have degrees in engineering, mathematics, space systems, or astronomy and astrophysics. The 13S career field comprises three shreds: orbital warfare, space battle management, and electronic warfare.[49] A fourth warfighting discipline, space access and sustainment, exists but is not at entry level. It is estimated that the Space Force will have approximately 1,454 billets for 13S officers, as shown in Table 3.4.

Status of Training for Space Operators: Comprehensive and Well Designed

AFSPC, the former home of space operational units, has long-standing experience designing and planning the education and training of space operations officers. Within the past three years, AFSPC redesigned and enhanced the training for 13S officers to align with its commitment to build rigorous, space-specific capabilities for the looming contested environment. The results are impressive, and the training pipeline of the 13S career field could likely serve as a model for the other career fields organic to the Space Force, including 14N (Intelligence officers) and 17X (Cyberspace Operations officers), and it may have implications for the training pipelines for Developmental Engineer (62E) and Acquisition Manager (63A) officers as well.

The 13S training pipeline is well thought out and comprehensive. It encompasses both centralized and decentralized training, tactics and strategy, continuing emphasis on technical proficiency, simulator-based exercises and wargames, and educational opportunities specific to space. A more in-depth description of each foundational, continuing, and advanced learning opportunity for space operators is described below. At a high level, the pipeline includes Undergraduate Space Training (UST),[50] the advanced warfighter follow-on course, Initial Qualification Training (IQT) or Mission Qualification Training (MQT) for a particular weapon system,[51] certification, continuing education, advanced education, exercises and the USAF

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[48] AFPC, "Air Force Officer Classification Directory (AFOCD): The Official Guide to the Air Force Officer Classification Codes," April 30, 2020c, p. 55, Not available to the general public.

[49] Some AFSCs contain a *shred*, which is an alphabetical suffix that identifies specialization in a specific aircraft or system.

[50] In Air Force training terminology, *undergraduate* refers to IST.

[51] A *weapon system* in this context broadly refers to a system that the Space Force operates to deliver space effects.

Weapons School, professional military education (PME), professional continuing education (PCE), and the opportunity for advanced degrees.

In 2016, AFSPC instituted an innovative approach for managing *deployed* time, or time focused solely on operations, and time in which AT can take place. Mission cycles of six months each rotate between combat location and Ready Spacecrew Program (RSP). *Combat location* is the cycle in which the space operator is focused solely on operations. *RSP* is the dwell cycle, analogous to time spent in garrison, and it is during this rotation that all pre-deployment training for combat takes place. During this off cycle, officers accomplish AT, Space Flag, positional upgrades, and so forth. These cycles continue for the first two operational tours for 13S officers.[52] Figure 3.1 summarizes the 13S training pipeline.

Figure 3.1. 13S Training Pipeline

The 13S learning community continues to update its curriculum and add to it in recognition of the creation of the Space Force (e.g., updated UST and an advanced warfighter follow-on

[52] John E. Hyten, *Space Mission Force: Developing Space Warfighters for Tomorrow*, Air Force Space Command, June 29, 2016; "Details of Space Mission Force Now Available from AF Space Command," *Space Daily*, July 17, 2016.

course). As offensive space capabilities and new defensive space capabilities emerge, additional curricula will be integrated into the existing training pipeline.[53]

Space-Specific Training and Education Programs

UST, or "the schoolhouse," as it is colloquially known, lasts six months or 111 training days and is delivered by the 533rd Training Squadron, located at Vandenberg Space Force Base (SFB).[54] UST was redesigned for greater rigor, and the revamped program, titled Undergraduate Space Training NEXT, graduated its first officer class in March 2020.[55] The redesign includes orbital mechanics, radio frequency (RF) fundamentals, and lasers, and it features a capstone event at the end of the course. The 533rd describes training as "moving to the left," that is, occurring earlier in an officer's career. For example, orbital mechanics is now being taught more thoroughly in UST, so that more-advanced material, such as orbital engagements and orbital warfare, can be added into the pipeline rather than orbital mechanics continuing to take up training time after UST. As of this writing, the new curriculum was in the validation phase. The capstone event is simulation-based because new graduates are, understandably, not yet certified to operate actual space systems.[56]

The **advanced warfighter follow-on** course, considered to be an important addition to the space curriculum, graduated its first class in May 2020. Pending validation, this follow-on training to UST will be three weeks long. The curriculum includes three different courses (orbital engagements, space battle management, and advanced electronic warfare), and all are taught within the 319th Combat Training Squadron (CTS) at Peterson SFB. Henceforth, 13S officers will complete UST, report to their initial operational units, and then temporary duty yonder travel to the warfighter course.

IQT or **MQT** follows the advanced warfighter course, and during these courses an officer becomes qualified and certified on their particular weapon systems. Either an IQT course or an MQT course is in place for all 20-plus weapon systems. IQT and MQT courses last from three weeks to six months, with the course for the Space-Based Infrared System being the longest. These programs are located across the space enterprise, including ground-based radars at Beale Air Force Base (AFB) and electronic warfare at Peterson SFB. Once an officer finishes their IQT

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[53] According to conversations with Air Force and Space Force representatives, current 13S training adequately covers defensive space capabilities, while training for offensive space capabilities needs further development because the Space Force is developing offensive space capabilities required for the current threat environment.

[54] Because this course is longer than 20 weeks, it is considered to be a permanent change of station (PCS). Asking officers to take this training later in their careers would be very costly and could drive most of the PCS entitlements.

[55] Tyler Whiting, "Undergraduate Space Training Evolves to Tackle Space Threats," U.S. Space Force, April 15, 2020.

[56] About 65 people in the 533rd Training Squadron, of which 30–35 individuals teach, are involved in UST. The average class size is 12. There are about 38 classes offered per year, with about 15 simultaneous officer and enlisted courses. There are about 16 officer classes and 22 enlisted classes scheduled per year.

or MQT program, they complete a standard evaluation and a certification briefing with the squadron commander or director, and if they do so satisfactorily, they are then certified to fly, for example, a GPS satellite or to manage a payload.

Continuation training (CT) and AT take place after officers have been certified and are on a crew. CT is focused on proficiency and experience level. Experience levels are labeled and tracked as *inexperienced*, *experienced*, and *highly experienced*. Inexperienced, newly certified 13S officers need repetition and practice, and those activities are the focus of CT. AT focuses on combat readiness and fighting that relies on the next generation of satellites or emerging space capabilities, with material based on intelligence information.

By the end of either their first or second operational tour, officers will have upgraded in experience level and may move into an instructor or evaluator role. FGOs coming back to operational units after serving in staff positions will go through a shorter IQT or MQT requalification course.

Exercises are attended by space operators during their dwell cycles. The Space Flag exercise is analogous to a Red Flag exercise (i.e., a "fight tonight" exercise). Advanced, simulator-based training takes place at a Space Flag exercise, and two U.S.-only Space Flag exercises and one coalition-based Space Flag exercise are offered each year. The August 2019 Space Flag exercise was held at the airborne guidance unit level with Australia, Canada, and Great Britain.

The **Schriever Wargames** are future-based events, ten years or so out, for more-experienced space operators, such as senior captains and majors in their second operational tour. These games encompass a broader domain, including the U.S. Department of State and other U.S. government agencies, as well as international partners. The Schriever Wargame is an operational wargame focused on the tactical level, but it also includes strategic policy issues, such as the implications of U.S. assets moving close to another country's satellite, what the United States might communicate, and how the United States might respond if another country were to move close to its satellite. Thus, the curriculum not only is military-focused but also includes policy-level and diplomatic content related to what information is shared with the public.

The **USAF Weapons School** at Nellis AFB is another substantive developmental activity and important asset in the training pipeline. It is a logical follow-on to the Schriever Wargames, and it includes AT and tactics, weapon systems, and associated space concepts. At the time of this writing, the 328th Weapons Squadron was scheduled to transfer from the USAF Weapons School to the Space Force, at the end of FY 2020. The focus of the curriculum will then move into closer alignment with Space Force warfighting disciplines.

Space Systems Operations (1C6X1) Enlisted Personnel Training

Individuals accessed into the 1C6X1 career field begin with an 87-day course, and the enlisted IST is closely aligned with the officer IST. Because the Space Force has been organized around four warfighting functions (orbital warfare, space electronic warfare, space access and sustainment, and space battle management), enlisted personnel are assigned to one of these functions at about the 40-day point. Enlisted IST encompasses 18 blocks of instruction and is conducted by AETC at Vandenberg SFB. The course covers material on what the space domain includes, how operations take place in space, and the science and physics behind the weapon systems. The course has undergone and continues to undergo substantial revisions. For example, the training includes classified material about weapon system capabilities, providing enlisted personnel with exposure to such material early in their careers. Additional revisions will include the integration of space and other warfighting domains, space battle management, and orbital engagement.

After IST, enlisted personnel attend the advanced warfighter follow-on course in the specific warfighting function to which they have been assigned. Enlisted personnel attend follow-on training together with the 13S officers, as described above. On completion of this course, enlisted personnel transfer to their assigned units, where they receive from one to six months of training on their specific weapon system.

Space Force Training Infrastructure

On March 31, 2020, the 533rd Training Squadron started its transfer to the Space Force, and at the time of this writing, named Air Force units, such as the 533rd, were to complete their transfers by the end of FY 2020, in line with SecAF instructions. The 319th Training Squadron automatically transferred to the Space Force. The National Security Space Institute (NSSI) is the AETC unit that delivers PCE, Space 200, and Space 300 education (described in the following section), and it will also eventually transfer to the Space Force.

The Space Force will need to continue interservice agreements until such time as it can independently conduct its own early training pipeline. Space Training and Readiness Command (STARCOM), the Space Force's training and education field command, was not yet stood up at the time of this writing, so the Space Force will need to rely on AETC until the end of the FYDP in FY 2024. Final plans include all training and education transferring to the Space Force, except for accessions training (i.e., Reserve Officer Training Corps [ROTC] and Officer Training School) and PME, which will remain with AETC for the foreseeable future. The Space Force will directly access U.S. Air Force Academy graduates, as it did with 83 direct accessions in summer 2020.

STARCOM is responsible for UST, the advanced warfighter follow-on training, IQT and MQT, additional technical training, and the Weapons School. Within the Weapons School, the units now in Air Combat Command will transfer to STARCOM. Additional training and curricula for offensive warfighting capabilities have been widely discussed as a focus for the Space Force and should be able to be integrated into the existing training pipeline.

Near the very end of our analysis, it came to the research team's attention that curriculum developers were not transitioning to the Space Force and may not be available from any source.

This reporting, if accurate, raises a number of red flags regarding the future of the Space Force training pipeline. Curriculum developers were no doubt essential in creating the currently excellent state of the 13S training pipeline. If current instructors are tasked with also creating new curricula (such as important new content related to enhancement in space offensive capabilities) and continuing to update the current curriculum, the state of training will likely deteriorate over the medium term (two to three years after the stand-up of the Space Force). Professionalism in learning, whether in industry or in DoD, requires a number of professionals—not just platform instructors—to maintain currency and excellence. Curriculum developers, instructors, and professionals who understand and work with Learning Management Systems are all required.

Training and education for officers within the Space Force continue with both PME opportunities and PCE, such as Space 200 and Space 300. These continuing education and training opportunities are described below.

Professional Military Education

Air Force officers across all career fields, including 13S officers, typically attend the Air Command and Staff College (ACSC) and Air War College (AWC), either in residence or via distance learning through AU. ACSC is designed for Air Force majors (O4), and AWC is appropriate for the rank of lieutenant colonel (O5) or colonel (O6). Space Force officers will continue in the foreseeable future to attend ACSC and AWC at AU.

Unfortunately, the current curriculum within AU, under which ACSC and AWC fall, might not offer space content robust enough for Space Force officers over the medium to long term. Both programs offer about eight core hours of space studies (in an 11-month program), a few additional auditorium lectures, and three space electives. The three space electives have an average of 7–12 students per elective, and the content includes space power and future concepts. The exception to this overall general assessment is the Schriever Space Scholars program, described in the next section, a subprogram within ACSC that is available to a small number of students; it offers two core space courses.

In addition to the essential need for sufficiently robust space content for Space Force officers, AU will need to provide increased space content for Air Force officers.

Notably, at the time of writing, there were no plans for updated space content in the Squadron Officer School (SOS) curriculum, which serves the O3 population. In our estimation, this absence is a concern. As the Space Force becomes established and the two DAF services begin to collaborate, it will be important that both Air Force and Space Force officers have a solid grounding in space power theory and strategy. CGOs soon become FGOs, and the logical time to introduce essential space content is in this initial PME course at SOS. More-in-depth treatments of space content can be continued in ACSC and AWC, but the delay in introducing basic space content in DAF PME is difficult to understand.

Joint professional military education (JPME) is a form of PME that is focused on the multi-service approach. The 1986 Goldwater-Nichols DoD Reorganization Act mandated two levels of JPME for joint service officers.[57] Students who complete ACSC in residence or by distance learning gain Phase I JPME credit. Students who attend the Joint Forces Staff College, the National War College, the Industrial College of the Armed Forces, or one of the service (Army, Navy, Marine Corps, or Air Force) war colleges also receive Phase II JPME credit. As of this writing, a new version of JPME was on hold. The five service chiefs had approved the new version, and it was ready for publication in January 2020; however, after the 2020 NDAA language creating the Space Force was released, the service chiefs put their approvals on hold, given that they would also want the approval of Gen John W. Raymond, the first CSO for the Space Force and Commander of AFSPC after joining the Joint Chiefs of Staff.

Discussions regarding the creation of Space Force PME and a Space War College had been reported at the time of this writing, but any such undertakings were estimated to be three to five years down the road. As with AWC, a stand-alone Space War College would likely be open to other service members to attend. In the meantime, Space Force officers will attend Air Force ACSC and AWC.

The Schriever Space Scholars Program at ACSC

As mentioned above, there is little space-related content available within the general content of ACSC: only a single "space day" and no systematic integration of a space curriculum into the average student's educational experience within the program. However, ACSC has a space-specific subprogram, the Schriever Space Scholars program, that offers a deep immersion in space studies and space power concepts. Students are selected via a board process and include Air Force officers, officers from other AFSCs and the other services, and students from abroad. For instance, the first class had 13 students, consisting of seven 13S students, a few students from other AFSCs, and Army and Navy students. The second class, underway in FY 2020, also had 13 students, including a French space officer.

In the first semester, students learn about space power theory, and the second semester focuses on space power strategy. Space professionals headed into the Schriever program arrive at ACSC a month early to receive a condensed Air Power 1 and 2 short course prior to the Schriever Space Scholars program. Cyber officers can also attend the Schriever program, given the program's perspective that cyber and space are inextricably linked.

The Schriever Space Scholars program was in its second year as of the 2020 academic year. Plans over the next three years call for an eventual throughput of 45 students per year, at which point the Schriever program could conceivably migrate to a stand-alone program.

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[57] Public Law 99-433, Goldwater-Nichols Department of Defense Reorganization Act of 1986, October 1, 1986.

Professional Continuing Education and Advanced Degrees

The six-month rotation, or RSP, provides the opportunity to participate in the PCE courses Space 200 and Space 300. These programs are delivered from the NSSI, housed at Peterson SFB. The NSSI was established in 2004 to provide continuing education and training for "the US and select allied space professionals."[58] The NSSI moved from AETC to the Space Force provisionally in August 2020, and the transfer was finalized a year later.

Advanced degrees, especially those in technology disciplines, are valued in the space domain. Advanced degrees are available through the Air Force Institute of Technology and through tuition assistance programs.

Primary Challenges Identified Related to PME and PCE

During our interviews and analysis, we identified the following key challenges associated with PME and PCE:

- All vested parties appeared to generally agree that AU does not have sufficient space content for either Air Force students or Space Force students.
- Ambitious updates were reportedly planned for AU programs, but AETC declined to share the proportion of increase in space content that had been prompted by the stand-up of the Space Force.
- Schriever Space Scholars is the one highly Space Force–aligned program at AU, but it serves only a small number of students, with only half of those being Space Force officers.
- Despite insufficient space-specific PME content at AU, a Space Education Center is likely several years down the road.

Conclusions and Recommendations

Regarding the sustainability of the 13S career field, at the time of our analysis in FY 2020, the Space Force needed to adjust its billet structure by adding only four colonel or O6 authorizations to match LAF grade ratios. Sufficient numbers of officers appeared to be available in the personnel inventory.

The 13S officer training pipeline appeared to be excellent, providing updates and a diverse set of learning experiences over the officers' careers. A key recommendation was that the 13S pipeline be emulated for the other organic career fields within the Space Force, in terms of replicating the pipeline's diversity of content and learning experiences, including tactics and strategy, continuing emphasis and evaluation of technical proficiency, simulator-based exercises and wargames, and educational opportunities specific to space.

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[58] Whiting, 2020.

Space PME, however, presents challenges for the Space Force going forward. For training and PME programs, our recommendations were as follows:

A. **As the DAF moves to the two-service model, expand space content across PME for both Air Force and Space Force officers.** Determine the precise proportion of space coverage that will be increased in ACSC and AWC (about eight hours was reported for each program) for all students.
B. **Consider increased space content for SOS, which serves the O3 population.** These younger cohorts will be critical to building a future Space Force culture and to ensuring Air Force officers' understanding of the Space Force, as the DAF continues to migrate to a two-service model.
C. **Give high priority to a rapid increase in the number of Schriever Space Scholars seminars.**
D. **Ensure that the Space Force's best and brightest are directed to the Schriever Space Scholars program.**
E. **Over the medium term, move toward space-specific PME, fully focused on space power and space strategy,** by putting in place a planning task force to create a Space Education Center and timeline for its launch.

We did not uncover any challenges for 1C6X1 enlisted personnel, either in terms of manning or in terms of training.

Chapter 4. Intelligence Career Fields

In a press release dated March 31, 2020, the Space Force stated that 23 Air Force organizations with space-related missions were slated to transfer to the Space Force from July 2020 to October 2020.[59] Space Force transfer data suggest that these 3,370 transferring billets included 115 space Intelligence officer (14N) positions out of 3,078 Air Force 14N officer billets and, according to space Intelligence enlisted personnel (1N) representatives, approximately 500–800 1N billets out of a total of 13,463 Air Force 1N positions.

There are six disciplines for Intelligence officers within the overall 14N generalist AFSC: geospatial intelligence (GEOINT), human intelligence (HUMINT), measurement and signature intelligence (MASINT), open source intelligence (OSINT), signals intelligence (SIGINT), and technical intelligence (TECHINT).[60] Intelligence enlisted personnel are divided among seven AFSCs: All Source Intelligence (1N0), GEOINT (1N1), SIGINT (1N2), Cryptologic Language (1N3), Fusion/Intelligence (1N4), HUMINT (1N7), and Targeting (1N8). With the exception of 1N3 and 1N7 enlisted positions, which had not been identified to be moved to the Space Force as of this writing, the enlisted Intelligence disciplines and accompanying positions were transitioning to the Space Force. Appendix C provides the job descriptions, entry requirements, and AFSC qualifications for the 14N and 1N Intelligence career fields.

This chapter covers updates to the sustainability analysis carried out in FY 2019 for the 14N officer career field and includes discussion of the 14N officer and 1N enlisted personnel training pipelines. It culminates with conclusions and recommendations specific to the Space Force's Intelligence career field.

Intelligence Officer (14N) Career Field Sustainability Analysis

According to the Space Force transfer data from FY 2020, the Space Force had only 115 authorizations for space Intelligence officers (14N), the smallest of all projected Space Force officer career fields. Having met the three criteria for career field sustainability—pyramid health, career path viability, and senior leadership opportunities—as laid out and examined in previous RAND work,[61] the grade structure would need only minor changes to attain organic sustainability with the Space Force.[62] Table 4.1 represents the selectivity to higher grades for

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[59] William Russell, "Space Force Identifies USAF Missions for Transfer to Newest Service," U.S. Space Force, March 31, 2020.

[60] AFOCD, 2020c, p. 61.

[61] Spirtas et al., 2020.

[62] For career path viability, please see Spirtas et al., 2020, pp. 64–65. Similar to the 13S career field, three elements were evaluated to ascertain career field sustainability. The first and third of these, pyramid health and senior

LAF and for Space Force 14N authorizations, measurements that provide insight into billet structure.

Table 4.1. 14N Authorization Structure and Promotion Rates

Grade	Authorizations as of September 2019	Promotions per Year	Selectivity to Next Higher Grade
Overall LAF			
O1, O2, O3	25,199	2,519.9 (to O1, O2, and O3)	1.2 (O3 to O4)
O4	10,132	2,026.4 (O3 to O4)	1.6 (O4 to O5)
O5	7,405	1,234.2 (O4 to O5)	3.1 (O5 to O6)
O6	2,401	400.2 (O5 to O6)	—
Space Force 14N authorizations			
O1, O2, O3	65	6.5 (to O1, O2, and O3)	1.2 (O3 to O4)
O4	28	5.6 (O3 to O4)	2.0 (O4 to O5)
O5	17	2.8 (O4 to O5)	3.4 (O5 to O6)
O6	5	0.8 (O5 to O6)	—

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.

Table 4.1 demonstrates that selectivity from O4 to O5 within the Space Force does not match LAF ratios (2.0 versus 1.6, respectively). Two O4 Space Force officers would be required to produce one O5, while the LAF numbers tell us that only 1.6 O4 officers would be required to produce one Air Force O5. This difference in ratios would result in either a lower promotion opportunity between O4 and O5 ranks or slower promotions to O5 within the Space Force. A similar issue appears with promotions between O5 and O6.

Any necessary adjustments to match the LAF authorization grade ratios outlined in Table 4.1 are shown in the "Difference from Actual" column in Table 4.2. Thus, the Space Force would need to adjust its billet structure by shedding one CGO (O1–O3) position and two major (O4) positions, while adding two lieutenant colonel (O5) positions and one colonel (O6) position. This adjustment will prevent pressure on promotion rates to O5 and O6 relative to the overall LAF rates. Although the overall numbers and requirements must stay constant, the billet structure can be relatively easily adjusted by realigning positions across the various grades to maintain the promotion ratios aligned with the LAF.

leadership opportunities, were reanalyzed in this study with updated data. These updated numbers, however, did not have an impact on the second element, viability of the career path for 14N officers in the Space Force, and therefore, we did not repeat that analysis.

Table 4.2. 14N Notional Authorization Options for the Space Force to Match LAF Ratios

Grade	Authorizations Using LAF Ratios	Selectivity to Next Higher Grade	Difference from Actual
O1, O2, O3	64	1.2	–1
O4	26	1.6	–2
O5	19	3.2	+2
O6	6	—	+1

SOURCE: AFPC manpower data; AFPC personnel data; Space Force transfer data.
NOTE: The values in the "Difference from Actual" column represent the difference between the values in the "Authorizations Using LAF Ratios" column in this table and the values in the "Authorizations from Space Force Transfer Data" column shown in Table 4.3. We do not show the latter in this table to avoid intermixing notional authorization and actual authorization data.

We found it concerning that the small numbers of available 14N officers may be insufficient to staff combatant command–related and intelligence-related assignments in such agencies as the Combined Space Operations Center and NRO, but at the time of our analysis, it appeared to be too early in the transition process to be able to examine this issue with precision.

Inventory Analysis

Regarding the space Intelligence officer (14N) inventory, 222 officers from the 14N core AFSC inventory were assigned to organizations (by Personnel Accounting System [PAS] codes) listed in the Space Force transfer data. The number of personnel assigned to a PAS code does not necessarily equate to the number of personnel transitioning from those organizations to the Space Force. At the time of our analysis, the specific number of authorizations transferring to the Space Force and the specific organizations from which they came were still under discussion and not precisely defined. There were actually 200 14N authorizations in these same organizations, many more than the 115 that the Space Force planned to bring over. Regarding inventory and manning, available data demonstrated that manning for the 14N career field was more than 100 percent with 222 individuals assigned in the respective PAS codes, compared with the 115 authorizations that would be migrating as listed in the Space Force transfer data. The overmanning was due primarily to an excess of CGOs and lieutenant colonels.

According to the August 2020 career field health sustainment charts from the Plans and Integration Office's Human Resource Data, Analytics, and Decision Support Division (AF/A1XD), the overall 14N career field with 3,087 core authorizations required 390 STP and 403 institutional requirement (IR) positions,[63] for a total of 3,880 sustainment positions, to be supported by around 290 annual accessions. Applying those ratios to the 115 Space Force 14N billets would generate a need for 15 STP and 15 IR positions, for a total of 145 officers, supported by 11 annual accessions.

[63] *Institutional requirement* positions contribute to the service at large, such as ROTC detachment positions or instructors at AU.

As stated previously, based on the data made available at the time of the analysis, it was unclear which 115 of the 222 individuals in the 14N PAS codes for transfer would actually be transferring. The good news, however, is that a sufficient number of O5s and O6s with a 14N core AFSC in the Space Force appeared to be available to fill the small number of authorization modifications needed to match LAF grade ratios, as seen in Table 4.3.

Table 4.3. LAF Inventory Analysis for Overall 14N in Space Force Units

Grade	Authorizations from Space Force Transfer Data	Overall Authorizations in September 2019	Permanent Party Inventory (Manning) DAFSC of 14N	Core AFSC of 14N	Core 14N Serving in a DAFSC of 14N	Core 14N Serving Outside 14N
O1, O2, O3	65 (57%)	98 (49%)	128 (131%)	126	124	2
O4	28 (24%)	56 (28%)	41 (73%)	45	41	4
O5	17 (15%)	29 (15%)	33 (114%)	36	33	3
O6	5 (4%)	17 (9%)	11 (65%)	15	12	3
Total	115	200	213 (107%)	222	210	12

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.

Intelligence Officer (14N) Training

Intelligence officers in the Space Force serve the critical function of obtaining and analyzing key intelligence data from multiple sources, analysis that will then be provided to space and cyberspace operators so that they can appropriately, accurately, and effectively direct their efforts. The entire scope of work to be performed and the skills needed had not yet been fully documented by the Space Force at the time of this writing. The scope of intelligence gathering in the Space Force, however, will be more limited than the broader scope of work carried out by Air Force 14N officers because the Space Force's interest is limited to space capability and operations. The 14N career field representatives whom we interviewed indicated that those officers who accept the voluntary transfer from the Air Force to the Space Force will adhere to the Air Force 14N Intelligence officer job description and that required 14N training will remain constant until Space Force training curricula are developed. The AFOCD describes the 14N career field as follows:

> Leads and performs intelligence activities across the full range of military operations supporting the Air Force's Service Core Function (SCF) of Global Integrated Intelligence, Surveillance and Reconnaissance (ISR). . . . To execute these functional competencies intelligence officers utilize subject matter expertise in the six intelligence disciplines of geospatial intelligence (GEOINT), human intelligence (HUMINT), measurement and signature intelligence

(MASINT), open source intelligence (OSINT), signals intelligence (SIGINT), and technical intelligence (TECHINT).[64]

Prior to the end of 2018, the Career Field Education and Training Plan (CFETP) for 14NX Intelligence officers provided information on the 14N officer career path, training requirements, and available training.[65] In December 2018, the Air Force published the 14N Talent Management Framework,[66] which provides a career path for 14NX officers. Air Force intelligence functional competencies are divided into four main disciplines: analysis, collection, targeting, and sensing grid activities.[67] For the first four to eight years of their careers, 14N officers are expected to explore the career field and gain an understanding of these functional competencies and operations in all domains (air, space, cyberspace, and human terrain).[68] There are three primary pathways from which 14N officers can choose in order to gain the depth required to complete their careers: operations, strategy, and academic.[69] The most common pathway is operations (Air, Space, Cyber, and Human Terrain), followed by strategy (intelligence community positions and those supporting planning in staff organizations), and only a very small proportion of officers follow the academic pathway (i.e., pursue a Ph.D.).[70]

Status of Training for Space Intelligence Officers: Many Courses but Few Are Space Specific

Although a large number of courses are available for 14N officers, the CFETP lists only one mandatory training course: Intelligence Officer Initial Skills Course or ISR 100. This course is required for award of the 14N officer AFSC, provides an introduction to Air Force Intelligence core competencies, and establishes the necessary knowledge and foundational skill sets for a 14N career.[71]

The 14N Talent Management Framework lists ISR 100 and three additional core training courses—ISR 200, ISR 300, and ISR 400—each of which is described in Table 4.4. Officers are expected to take additional intelligence courses as needed, based on current or future mission or job needs.

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[64] AFOCD, 2020c, p. 61.

[65] DAF, *AFSC 14NX Intelligence Officer: Career Field Education and Training Plan 14NX*, CFETP 14NX Parts 1 and II, Headquarters, U.S. Air Force, February 13, 2013.

[66] DAF, *14N Talent Management Framework*, December 26, 2018, Not available to the general public.

[67] DAF, 2018.

[68] DAF, 2018.

[69] DAF, 2018.

[70] DAF, 2018.

[71] DAF, 2018.

Table 4.4. 14N Training Pipeline

Course Name	Description	Length of Training	Location
Intelligence Officer Initial Skills Course (ISR 100)	• Introductory course covering Air Force intelligence topics, establishing the foundation for prerequisite knowledge and skill sets for 14N officers • Mandatory attendance for all intelligence professionals • Current curriculum includes 8–10 hours of space content	130 days	Goodfellow AFB
Intelligence Intermediate Skills Course (ISR 200)	• Immediately follows SOS • Focus on operational-level warfighting and the integration of ISR operations across air, space, cyberspace, and ground domains • Prepares CGOs (O1–O3) for leadership roles and responsibilities as captains	5 days	AU
Intelligence Master Skills Course (ISR 300)	• Strategy-focused application of intelligence capabilities across domains • Prepares majors (O4) and major selects for leadership roles and responsibilities as FGOs • Not required, but strongly recommended for professional development	15 days	Goodfellow AFB
Intelligence Senior Skills Course (ISR 400) in development	• Capstone course for 14N colonels (O6) • Intended to prepare intelligence officers for leading ISR planning and programming, cooperating and coordinating with the intelligence community, and integrating intelligence and ISR at air component level • Content will be developed from the current Air Force ISR O6 orientation course	5 days	Pentagon

SOURCE: Adapted from unrestricted information in the 14N Talent Management Framework (DAF, 2018).

The Space Warfighter Intelligence Formal Training Unit (SWIFTU) course, which introduces intelligence personnel to the principles of space operations, is an additional course that is required for intelligence officers going into the space domain, and it typically takes place after completion of ISR 100.[72] SWIFTU is one of the few opportunities for space-specific intelligence training.

Several agencies provide numerous intelligence courses that are available as needed for current job requirements or future mission needs. Interviews with Air Force CFMs and Space Force intelligence and training representatives suggest that no formal analysis of which courses should be provided to Space Force intelligence officers had taken place as of July 2020, and no determination had been made as to whether training should be provided through existing courses within the Air Force and other agencies or whether new courses should be developed and provided by the Space Force. Our interviewees, however, did point to specific courses likely to be valuable—though not required—for space Intelligence officers, and the list is quite lengthy (see Appendix D, which also provides course descriptions and locations for the training

[72] 319th Combat Training Squadron, "Course Catalog: Space Warfighter Intelligence Formal Training Unit (SWIFTU)," webpage, undated.

opportunities identified as important for transitioning intelligence officers and enlisted personnel).

Chapter 3 contains a discussion of PME and PCE programs, including Space 100, 200, and 300, that will be expected of Space Force officers. As education rather than training, both PME and PCE are expected to be completed by all Space Force officers regardless of their career field.

Primary Challenges Identified with the Training of 14N Officers Transferring to the Space Force

The potential training challenges that we identified for 14N officers transferring to the Space Force were related to the career field's small size. The Space Force likely will not have enough officers or bandwidth to provide its own intelligence courses in the short term, and it will need to leverage other ways to train personnel, such as on-station or other flexible means of training delivery, as well as continuing to rely on training provided by the Air Force, defense agencies, and other organizations. Whether this arrangement will be adequate, and for how long, is unclear. This limitation has influenced the push for increased space content in ISR 100. Other challenges include the delay experienced in attendance of the SWIFTU course by officers fresh from ISR 100.

We found concerning the workforce model proposed by the Space Force that would have all Space Force officers spend their first four to eight years as space operators, not assigning or training them for other AFSCs until later in their careers. This concern applies to both the Intelligence and Cyberspace Operations career fields because of their extensive initial training pipelines and the technical nature of their disciplines. Therefore, we outline these concerns here, but we chose not to repeat them in full in the next chapter.

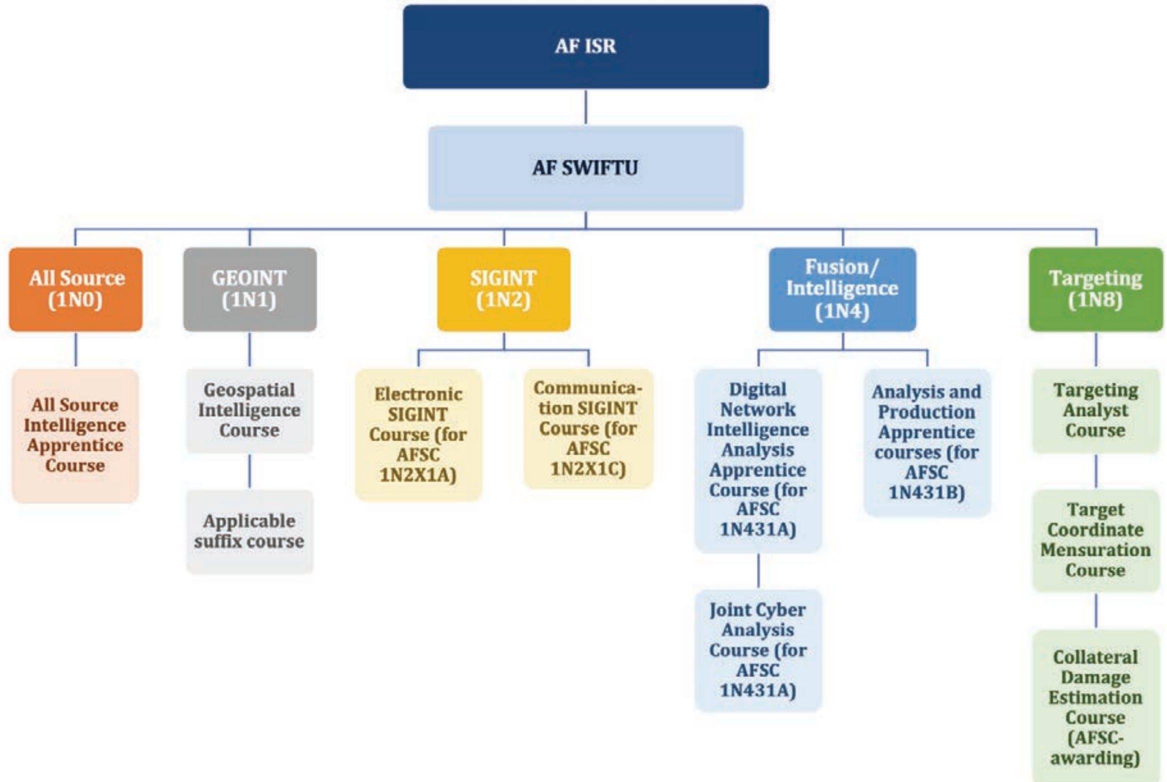
In what some refer to as "the Marine Corps model," officers would be assigned and trained for a second discipline and AFSC at, for example, the eight-year point in their careers. This model has been proposed, in part, by a desire to have all space professionals be proficient in space operations, with a solid grounding in space warfighting tactics and strategy. We believe that the negative outcomes of such a model are likely to outweigh its advantage, and that the objective of a thorough grounding in space operations can be achieved by other means (as suggested in the "Conclusions and Recommendations" section of this chapter).

Notwithstanding the significant added STP and PCS costs (e.g., student man-years, second PCS for two separate ISTs), possibly without the extra end strength needed, the potential negative outcome of most concern would be the drastic abbreviation of the developmental pipelines to build experts and senior leaders in intelligence (and the other non–space operator disciplines that may follow this proposed model, such as cyberspace operations). The Space Force would no longer be able to produce 20-year experts in intelligence over a 20-year career, or full-career seasoned, experienced leaders in intelligence; rather, the maximum depth and breadth for the typical Space Force intelligence officer at 20 years of service would be 12 to 16 years of intelligence assignments, 12 to 16 years of acquiring depth of discipline, and 12 to 16 years of growth into broader and more-demanding intelligence leadership roles. We view this limitation as a potential vulnerability in an environment in which technological advances and technological pressure from adversaries continue to challenge U.S. superiority in space, a domain in which intelligence capabilities are increasingly crucial. The Space Force will also partner with the broader intelligence and space communities, in which civilian intelligence experts typically have careers even longer than 20 years. A more limited space intelligence career of roughly 12 years could put Space Force professionals at a potential disadvantage with professionals in other intelligence organizations, a situation that could prove detrimental to the credibility and influence of the Space Force when international conflicts arise.

Intelligence Enlisted Personnel (1N) Training

As previously discussed in this chapter, five of the seven enlisted intelligence specialty areas transferred to the Space Force. Enlisted members across all intelligence specialty areas are required to complete SWIFTU. Additionally, each of these specialty areas has specific training requirements for award of the AFSCs, and these requirements include several post-ISR and post-SWIFTU courses, as shown in Figure 4.1 and further described in Appendix C. These requirements are unlikely to change for those in the 1N career field who are transitioning to the Space Force; however, a remote or virtual version of SWIFTU was in the planning stages as of September 9, 2020, with plans for it to enter the development stage by October 1, 2020. The sequence of enlisted intelligence training will then be the Air Force ISR courses followed by SWIFTU at Peterson SFB. Figure 4.1 presents the training pipeline for enlisted intelligence personnel in the five transferring specialty areas.

Figure 4.1. 1N Training Pipeline



SOURCE: Adapted from AFPC, "Air Force Enlisted Classification Directory (AFECD): The Official Guide to the Air Force Enlisted Classification Codes," April 30, 2020b, Not available to the general public.
NOTE: AF = Air Force.

The longer-term vision for Space Force enlisted training is that the Space Force will establish its own "schoolhouse" structure. Until such time, the Space Force has three IST instructors for 1N0, 1N2A, and 1N2C that may help conduct the SWIFTU from Goodfellow AFB. Otherwise, the Space Force will be reliant on existing 1NX courses provided by AETC.[73]

Overall, then, similarly to Space Force intelligence officers, enlisted personnel will likely continue to rely on Air Force–provided intelligence training, supplemented by space-specific training as needed and as can be developed.[74] The Space Force may also continue to utilize training from the broader intelligence community, academia, private industry, and other services aside from the Air Force.[75]

[73] Mitch Overton, "US Space Force Enlisted ISR Training Strategy," draft briefing, Headquarters, U.S. Space Force, May 21, 2020.

[74] Overton, 2020.

[75] Overton, 2020.

Appendix D provides course descriptions and locations for the training opportunities for enlisted personnel. Although this list is not exhaustive, it does include those courses deemed most important by the experts interviewed.

Primary Challenges Identified with the Training of 1N Enlisted Personnel Transferring to the Space Force

Not surprisingly, the challenges in training the Space Force's 1N enlisted workforce are similar to challenges identified for the 14N officer workforce. The intelligence community within the Space Force is small in number, and it will likely be challenging to man instructor slots for space intelligence–related courses.

But our primary concern, echoing that discussed for the 14N officer training, is the model calling for classification of enlisted personnel as space operators for their first four to eight years prior to intelligence training and assignment to intelligence technical positions. This model would hinder the Space Force's ability to have enlisted personnel with the appropriate level of intelligence training and expertise. Enlisted personnel not starting intelligence training and technical intelligence assignments until—in the worst case—their eighth year would be unlikely to have the same 20-year intelligence depth of expertise and experience as has been the norm for Air Force intelligence senior master sergeants and chief master sergeants. Moreover, military intelligence professionals are players in the larger intelligence community. Space Force intelligence specialists with more-limited expertise and experience in their disciplines could be disadvantaged vis-à-vis their counterparts in other intelligence and space organizations, which could manifest in lesser influence and perceived effectiveness, to the detriment of the Space Force intelligence function overall and the Space Force itself. Finally, as mentioned with the officer training, this model adds significant STP costs without any guarantees that the Space Force end strength will be large enough to cover the personnel STP account without significant detriment to unit permanent party inventory (i.e., manning).

Conclusions and Recommendations

The Space Force will need to perform only minor changes to its intelligence officer billet structure to bring it in line with the LAF grade ratio. However, the small size of the 14N officer career field may result in additional challenges down the road, such as manning or staffing of joint assignments.

A more critical concern, however, was the continued conversation of a space operator "generalist" model for a Space Force professional's first one or two assignments. We agree that the Space Force's interest in building deeper understanding and exposure to space operations and warfighting across all Space Force disciplines is desirable. However, many paths can achieve this end and build space intelligence expertise and experience in service of the United States without disrupting the training pipelines in place.

As discussed in Chapter 3, many of the most-compelling developmental experiences in building space operators also included participants from other space disciplines. The advanced warfighter follow-on course, Space Flag exercises, and the Schriever Space Scholars program are professional development examples in which space operators, intelligence, and cyber professionals engage together. An approach that could serve the Space Force well, in lieu of truncating the long developmental paths leading to deep expertise in space career fields, could be a focus on integrating all space disciplines into the rich set of experiences already in place that provide exposure to warfighting tactics and strategy. The Space Force could also expand on those experiences with a Space Weapons School that could focus on integrated space scenarios with full cross-disciplinary teams participating; other exercises and wargaming designed for space operators, intelligence, and cyber teams to work collaboratively; and an enlarged Schriever Space Scholars program capacity for a broader representation of the Space Force community.

To address some of the challenges identified in the officer and enlisted personnel sections of this chapter, we made the following recommendations for both 14N officers and 1N enlisted intelligence specialists:

A. **Keep the space Intelligence function fully intact, with continued efforts to build space intelligence experts and seasoned intelligence leaders with even deeper knowledge and experience.** In the face of increasingly sophisticated threats in space from near peers and adversaries, the creation of deep expertise within the space Intelligence career field will be crucial to the development of new space capabilities and the United States' ability to counter threats. Space intelligence is highly specialized. We estimate that any disruption of the continuing focus on developing intelligence officers and enlisted experts with 20 or more years of expertise would be detriment to gaining the experience needed to provide the most advanced analysis and a strategic miscalculation. And, as is well known, missteps in building long pipelines of talent within the military take years to overcome. Space Force officers and enlisted personnel have many excellent options already in place for exposure to operations and to warfighting tactics and strategy, as discussed above. Leveraging and building on existing cross-disciplinary, operations-focused courses, exercises, and the Schriever Space Scholars program would be a viable alternative to the considered model, as well as the creation of a dedicated Space Force Weapons School, for all space professionals to achieve a solid grounding in space warfighting tactics and strategy.

B. **Conduct a needs assessment for space intelligence–related training and develop a plan (with the necessary STP end strength) for the creation of additional space intelligence courses and content,** which could then be developed independently or in collaboration with Air Force or other pertinent agencies.

    i. Evaluate the potential need within the AETC's ISR 100 curriculum for additional substantive space content for intelligence officers of both services. Given the greater need for coordination within the DAF between the Air Force and the Space Force, all intelligence officers may need a better baseline of space knowledge and understanding of how to leverage the Space Force.

    ii. Determine whether timing delays in attendance at SWIFTU can be addressed.

Chapter 5. Cyberspace Operations Career Fields

Cyberpower differs from other elements of military power and serves an essential strategic purpose—to establish "the ability in peace and war to manipulate perceptions of the strategic environment to one's advantage while at the same time degrading the ability of an adversary to comprehend that same environment."[76]

Similar to the Intelligence career field, only a portion of the officer and enlisted billets for Cyberspace Operations will transfer from the Air Force to the Space Force.[77] For officers, both AFSCs that fall under the Air Force's 17X Cyberspace Operations career field—Warfighter Communications Operations (17D) and Cyber Effects Operations (17S)—were expected to migrate to the Space Force at the time of this writing, as well as the 11 enlisted AFSCs that fall under the Cyberspace Support (3D) career field.[78]

According to the data made available to us in early 2020, billets for 133 17X cyberspace operations officers,[79] including AFSPC billets and NRO and other staff assignments, were expected to transfer to the Space Force. Of these 133 17X billets, 116 were 17D positions, 16 were 17S positions, and one was a Cyberspace Operations Commander (17C) position. From the 11 3D AFSCs, 1,116 enlisted billets were expected to transfer to the Space Force.

This chapter includes a partial sustainability analysis focused on the pyramid health and career path viability for the 17X Cyberspace Operations officer career field, an analysis of training for both 17X officers and 3D enlisted personnel, and conclusions and recommendations specific to the Cyberspace Operations career fields transferring to the Space Force. Because the concerns associated with the generalist space operator model are similar to those discussed in

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[76] John B. Sheldon, "Deciphering Cyberpower: Strategic Purpose in Peace and War," *Strategic Studies Quarterly*, Vol. 5, No. 2, Summer 2011, p. 95.

[77] To avoid any confusion between cyber training for space professionals and cyberspace training, we have adopted the National Institute of Standards and Technology's definition of *cyberspace* as "[a] global domain within the information environment consisting of the interdependent network of information systems infrastructures including the Internet, telecommunications networks, computer systems, and embedded processors and controllers" (Computer Security Resource Center, "Cyberspace," National Institute of Standards and Technology website, undated).

[78] The 11 AFSCs that fall under the 3D career field, which are migrating to the Space Force, are as follows: 3D0X1, 3D0X2, 3D0X3, 3D0X4, 3D1X1, 3D1X2, 3D1X3, 3D1X4, 3D1X7, 3D190—all senior master sergeants—and 3D100—all chief master sergeants.

[79] This number comes from Space Force transfer data provided to us in February 2020, although it diverges from the number provided by the office of the 17X CFM (111 billets) and the number that came up in our interview with Space Force cyber commanders (124 billets).

Chapter 4—specifically the lengthy training pipelines and the need for in-depth functional specialization throughout a full career—we do not repeat them in this chapter.[80]

Career Field Overview and Sustainability Analysis

For Cyberspace Operations (17X), the authorization structure from the Space Force transfer data has 133 positions, shown in the bottom half of Table 5.1.[81] To achieve a healthy pyramid structure within the Space Force, the 17X career field would require only minor adjustments to the billet structure. The criterion of career path viability is likely to be met in the future, as discussed in this section. However, the limited information available at the time of writing regarding the exact command billets for 17X colonels at other agencies outside the Space Force makes it difficult to assess in full the third criterion: senior leadership opportunities. Table 5.1 presents the authorization structure and selectivity ratios for the LAF and the Space Force.

Table 5.1. 17X Authorization Structure and Promotion Rates

Grade	Authorizations as of September 2019	Promotions per Year	Selectivity to Next Higher Grade
Overall LAF			
O1, O2, O3	25,199	2,519.9 (to O1, O2, and O3)	1.2 (O3 to O4)
O4	10,132	2,026.4 (O3 to O4)	1.6 (O4 to O5)
O5	7,405	1,234.2 (O4 to O5)	3.1 (O5 to O6)
O6	2,401	400.2 (O5 to O6)	—
Space Force 17X authorizations			
O1, O2, O3	78	7.8 (to O1, O2, and O3)	1.1 (O3 to O4)
O4	34	6.8 (O3 to O4)	2.4 (O4 to O5)
O5	17	2.8 (O4 to O5)	4.3 (O5 to O6)
O6	4	0.7 (O5 to O6)	—
Total	133		

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.

[80] For more details regarding some of the key concerns associated with the generalist space operator model, please see the discussions of such challenges in Chapters 4 and 8, as well as the limitations associated with the model discussed in the "Limitations" section of Chapter 1.

[81] For this career field, we did not encounter any disconnect between the authorizations in the Space Force transfer data and the AFPC manpower data for the PAS codes as happened with the intelligence officer (14N) career field.

The data in Table 5.1 demonstrate that the 2.4 selectivity to the next higher grade for O4s in the 17X career field is much higher than the LAF value of 1.6. The main implication of this difference is that promotion rates in the Space Force would be slower than in the Air Force; in the Space Force, there would be 2.4 17X majors for every lieutenant colonel, compared with only 1.6 in the LAF. The same is true for the selectivity from O5 to O6, with the Space Force ratio for 17X at 4.3 compared with the LAF ratio of 3.1 (i.e., 3.1 O5s for every O6).

To ensure a healthy and sustainable pyramid and better align its selectivity ratios to the LAF, the Space Force would need to make minor adjustments to its billet structure. To match the LAF grade ratios (and selectivity from one grade to the next), the Space Force would need to decrease the number of CGOs (O1–O3) by four and equally reduce the number of major (O4) billets, while adding five lieutenant colonel (O5) and three colonel (O6) positions, thus overall redistributing eight positions across grades, as detailed in Table 5.2. Because the number of positions is so small, minor changes would have a relatively large impact on the grade ratios and selectivity.

Analysis of career path viability for the 13S and 14N career fields was presented in prior RAND work.[82] For 17X officers, interviews with career field leadership indicated good variability in assignments available across the Space Force, both at the unit level and the Delta level,[83] as well as future assignments to the Joint Staff, USSPACECOM, and other combatant commands, as would be expected. This variability in assignments would take place despite the fact that Space Force 17X officers are likely to spend more time at the unit level than their counterparts in the Air Force. However, as previously mentioned in this section, the precise distribution of 17X colonel rank billets for joint positions and in other agencies was still to be determined at the time of writing, with the authors being unable to fully assess the senior leader opportunities criterion.

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[82] See Spirtas et al., 2020.

[83] Space *Deltas* are the equivalent of Army brigades with an O6 (colonel) in command. They were stood up in July 2020 to replace former Air Force space wings, which were deactivated in the context of setting in place a flatter structure for the Space Force vis-à-vis the Air Force. The new Space Force structure eliminated "one general officer echelon and one colonel-level echelon of command" (Sandra Erwin, "Space Force Reorganizes Former Air Force Space Wings into 'Deltas' and 'Garrisons,'" *SpaceNews*, July 24, 2020b).

Table 5.2. 17X Notional Authorization Options for the Space Force to Match LAF Ratios

Grade	Authorizations Using LAF Ratios	Selectivity to Next Higher Grade	Difference from Actual
O1, O2, O3	74	1.2	–4
O4	30	1.6	–4
O5	22	3.1	+5
O6	7	—	+3

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.
NOTE: The values in the "Difference from Actual" column represent the difference between the values in the "Authorizations Using LAF Ratios" column in this table and the values in the "Authorizations from Space Force Transfer Data" column shown in Table 5.3. We do not show the latter in this table to avoid intermixing notional authorization and actual authorization data.

Inventory Analysis

In PAS codes listed in the Space Force transfer data, 145 officers from the Warfighter Communications Operations (17D) core AFSC inventory were assigned to the Space Force at the time of our analysis. This number was slightly higher than the 134 authorizations listed in the Space Force transfer data, which include one commander (17C) position. These cyberspace operations authorizations were more than 100-percent manned due primarily to an excess of CGOs.

The August 2020 career field health sustainment charts from AF/A1XD showed 2,628 core 17X authorizations in the Air Force 17X career field, with an additional 364 STP and 268 IR positions, for a total sustainment requirement of 3,260 authorizations. Applying these STP and IR ratios to the 134 Space Force 17X positions would equate to an additional 32 officers needed for STP and IR, taking the Space Force cyber officer total from 134 to 166.[84]

As Table 5.3 shows, if authorizations for lower ranks were converted to lieutenant colonel (O5) and colonel (O6) authorizations to match the LAF grade ratios, there would not be enough core 17X officers in the inventory assigned to the Space Force PAS codes to fill the revised grade distribution of authorizations. At the time of our analysis, only three core 17X colonels were assigned to 17X colonel positions, and one colonel was serving outside the core; even if that individual were brought back to fill one of those billets, the Space Force would still be short three colonels and would be short on lieutenant colonels in the inventory, which means that the Space Force would have to build up and promote more individuals in these two grades.

[84] However, this is not necessarily a bad thing as, in general, it is preferable to have more officers than authorizations because some officers are in transient mode, moving from one duty location to the next, while others are in student status. In this light, having more officers than authorizations allows the Space Force, on one hand, to have enough officers to fill out the respective authorizations, while, on the other hand, it provides other officers with the ability to attend PME programs.

Table 5.3. LAF Inventory Analysis for Overall 17X in Space Force Units

Grade	Authorizations from Space Force Transfer Data	Overall Authorizations as of September 2019	Permanent Party Inventory (Manning) DAFSC of 17X	STP Inventory DAFSC of 17X	Core AFSC of 17X	Core 17X Serving in a DAFSC of 17X	Core 17X Serving Outside 17X
O1, O2, O3	78 (59%)	79 (59%)	99 (125%)	0	98	96	2
O4	34 (26%)	33 (25%)	20 (61%)	1	23	21	2
O5	17 (13%)	18 (13%)	19 (106%)	0	20	19	1
O6	4 (3%)	4 (3%)	3 (75%)	0	4	3	1
Total	133	134	141 (105%)	1	145	139	6

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.

Cyberspace Operations Officers (17X) Training

The 17X career field was created in 2010, when the Communications and Information (33S) career field was eliminated and the officers in that community transitioned to the new 17D cyber operations designator.[85] According to the AFOCD, the 17X career field "encompasses all functions performed by cyberspace operations officers to conduct or directly support cyberspace operations and cyberspace training."[86] Although no specific major is required, cyberspace warfare personnel generally have degrees in computer science, computer engineering, or information technology (IT).

In its initial years, the field produced generalists rather than specialists, favoring breadth over depth of experience. According to feedback received from the units where cyber operations officers were assigned and with increasing recognition of the importance of developing specialists with deep expertise in specific functional areas,[87] over summer and fall 2019, the 17X career field was formally reorganized into two AFSCs:[88] Warfighter Communications Operations (17D) and Cyber Effects Operations (17S).[89] Based on the AFOCD description, the 17D AFSC

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[85] Chaitra M. Hardison, Leslie Adrienne Payne, John A. Hamm, Angela Clague, Jacqueline Torres, David Schulker, and John S. Crown, *Attracting, Recruiting, and Retaining Successful Cyberspace Operations Officers: Cyber Workforce Interview Findings*, RAND Corporation, RR-2618-AF, 2019.

[86] AFOCD, 2020c, p. 77.

[87] Kevin Kennedy, "17D Career Field Management Brief," internal document shared with the RAND team, U.S. Air Force, July 30, 2019a, p. 3.

[88] The 17S designator for offensive and defensive cyber operations was established around 2015. However, the breakdown of the 17X career field into two specialties was formalized only in 2019. For more details on the establishment of the 17S designator and the early history of the 17X field, please see Hardison et al., 2019, pp. 2–3.

[89] For minimum education requirements and qualifications for cyberspace operations officers, please see details provided at U.S. Air Force, "Cyberspace Operations Officer," webpage, undated-d. For a summary description of each specialty (17D and 17S), the corresponding details regarding the duties and responsibilities, and specialty qualifications, please see AFOCD, 2020c, pp. 79–80; for a summary description of each of the shreds (17DXA,

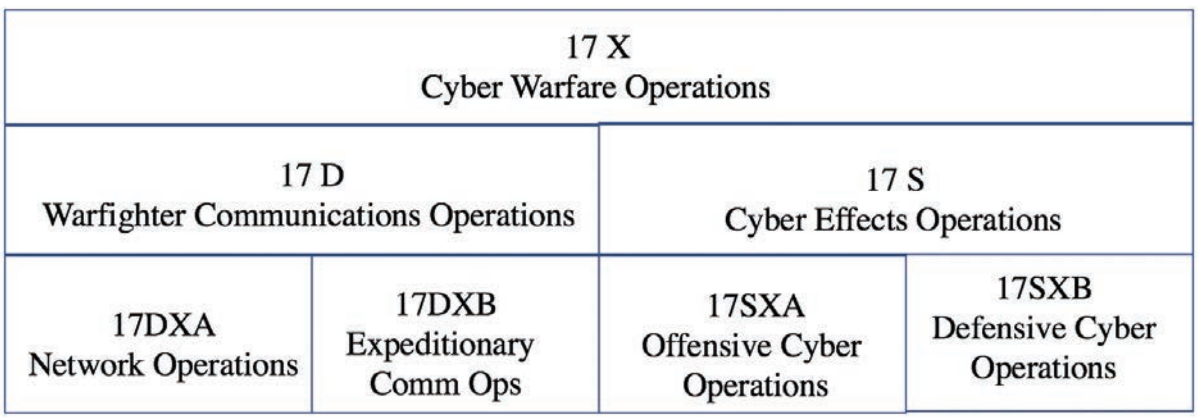
> [o]perates, secures, configures, designs, maintains, sustains, and extends cyberspace infrastructure; provides and employs cyberspace capabilities; and leads Department of Defense information network (DODIN) operations missions to achieve Commander's objectives in or through cyberspace.[90]

The AFOCD describes the 17S AFSC as follows:

> Operates cyberspace weapons systems and commands crews to accomplish cyberspace, training, and other missions.[91]

Each of the two 17X AFSCs is further divided into two separate shreds (XA and XB): The 17D code includes Network Operations (17DXA) and Expeditionary Communication Operations (17DXB), and 17S encompasses Offensive Cyber Operations (17SXA) and Defensive Cyber Operations (17SXB). These two AFSCs and accompanying shreds are presented in Figure 5.1. While the 17D AFSC is also divided into two shreds, the divide is not along offensive and defensive operations but rather along garrison (17DXA) and expeditionary (17DXB) tracks.

Figure 5.1. 17X Career Field Structure



SOURCE: Features information from Kennedy, 2019a, p. 4; Kevin Kennedy, "17X Career Field Management Brief," internal document shared with the RAND team, U.S. Air Force, October 4, 2019b.
NOTE: Comm Ops = Communications Operations.

A third designator under the 17X career field was also established: Cyber Capability Developer (Z17X).[92] At the time of this writing, there were no billets with this designator, and no one completing IST directly became a Z17X. According to our conversations with Air Force and

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17DXB, 17SXA, and 17SXB) and the corresponding responsibilities and competencies, please see Veralinn Jamieson, "Cyberspace Warfare Career Field Development Plan," U.S. Air Force, July 2019, pp. 10–13.

[90] AFOCD, 2020c, p. 79.

[91] AFOCD, 2020c, p. 80.

[92] For details on Z17X, please see Jamieson, 2019.

Space Force leadership, as both services expand their development capabilities in the following years, Z-prefix billets will be established accordingly.[93]

As of FY 2020, 70 percent of the 17X career field fell under the 17D AFSC and 30 percent fell under the 17S AFSC. However, according to our interviews with Air Force career field leadership, they expect that within eight to ten years the distribution will flip to 30 percent of the 17X officers falling under the 17D AFSC and 70 percent under the 17S AFSC.[94]

Space Cyber Warfare Operators Have Long and Complex Training Pipelines with Differing Requirements

Officers who enter the 17X career field as new accessions go through three levels of training, depending on their AFSC and shred:[95]

- IST, also known as Undergraduate Cyber Training (UCT), is a standard 23-week program that takes place at Keesler AFB.
- IQT takes place after the officers are assigned to their units and varies in length and nature depending on the AFSC, shred, and specific function area (e.g., Computer Simulation Technology [CST] Tool Development or Crash Header Operations) to which each officer belongs. This training provides the officers with the specific functional skills they need prior to the weapon system–specific training they receive during MQT.
- MQT is unit specific and varies in length depending on the weapon system to which the individual is assigned.[96]

Because IST and IQT are the two levels of cyber training that are most highly standardized across the Air Force and are dependent to a lesser degree on officers' unit assignments, we focus our discussion on them. Table 5.4 summarizes the 17X training pipeline across the two main AFSCs (17D and 17S) and their corresponding shreds, which we discuss in more detail in the subsequent sections.

[93] AFPC, "17X Spread the Word," internal document shared with the RAND team, U.S. Air Force, March 2020a.

[94] The projected distribution for the Space Force and whether it will follow the Air Force trend was unknown at the time of this writing.

[95] Content of the training also depends on the AFSC and shred.

[96] USAF, "17S Training Pipelines," internal chart, undated-a. During MQT, officers learn how to defend and secure a specific platform or weapon system.

Table 5.4. 17X Training Pipeline

	17D Warfighter Communication Operations		17S Cyber Effects Operations				
			17SXA Offensive Cyber Operations		17SXB Defensive Cyber Operations		
Training Level	**17DXA Network Operations**	**17DXB Expeditionary Communications Operations**	**CST Tool Developer**	**Crash Header Operations**	**Cyber CMT Operations**	**NAS Operations**	**CPT Operations**
IST	• Standard 23-week program that takes place at Keesler AFB • All 17X AFSCs and all their corresponding shreds attend the IST, also known as UCT.						
IQT	• No formal IQT for 17D AFSC • OJT once 17D officers arrive at their units • If officers join Mission Defense Teams (MDTs), they receive the corresponding MDT training at their gaining unit.		13 weeks	13 weeks	94 weeks	13 weeks	12 weeks
			• Primarily take place at JBSA-Lackland with specific TDYs to other locations as required.				• Primarily takes place at the 39th IOS at Hurlburt Field.
MQT	• MQT is unit specific and varies in length depending on the weapon system to which the individual is assigned.						
Additional training offered	• These courses are available to all 17X but are assignment driven. • In-residence 5-week Cyber Vulnerability Assessment course at Little Rock AFB. • Three-day cyber-related Functional Mission Analysis course at Maxwell AFB. • As officers' careers progress, they become eligible to take Cyber 200, Cyber 300, and Cyber 400.						

SOURCES: Features information from USAF, undated-a; Jamieson, 2019; AFPC, 2020a; RAND research team interviews with Air Force and Space Force personnel conducted for this project.
NOTE: CMT = Combat Mission Team; CPT = Cyber Protection Team; IOS = Information Operations Squadron; JBSA = Joint Base San Antonio; NAS = National Airspace Systems; OJT = on-the-job training; TDY = temporary duty yonder.

Initial Skills Training

All 17X second lieutenants, regardless of AFSC or shred, start their IST at the "schoolhouse" at Keesler AFB, where all take the same set of initial cyber courses. IST is divided into two main phases:

1. **Cyber Fundamentals** is the unclassified portion of training and lasts 41 days. During this phase, the officers learn how to use computers and how cyber works in the Air Force, and they acquire the basic terminology specific to their field.[97] The five courses taught during this phase and their durations are described in Table E.1 in Appendix E.
2. **Military Application** is the classified portion of the training, which lasts 63 days, including a capstone block. During this phase, officers learn what the Air Force does in the cyber domain and how it is being done, working toward an operator's mindset on

[97] USAF, undated-a; AETC, "Undergraduate Cyberspace Training (phase 1)," internal document shared with the RAND team, U.S. Air Force, August 2016b.

both the offensive and defensive sides.[98] The capstone and the seven courses taught during this phase and their durations are shown in Table E.1 in Appendix E.

At the end of IST, officers are assigned to a unit and are given a shred within their respective AFSC that will determine the IQT that they will receive.

Space Training Available During IST or UCT

As of FY 2020, five days are dedicated to space training during IST or UCT in which students are provided with a basic understanding of the cyber and space domains. Students also learn the main concepts laid out in Joint Publication 3-14, *Space Operations*, and acquire basic knowledge regarding space orbits, military and commercial satellite communications, frequencies used, and the differing capabilities that space units have. Despite some elements of space operations being included in the UCT curriculum, it appeared from our investigations that space was not a high priority and did not garner much attention among those responsible for curriculum design. However, a redesign and revamp of the space curriculum at UCT was underway at the time of this writing. This effort was enabled and supported by the 17X career field leadership. The list of space-related topics that will be taught to 17D (not 17S) students is included in Table E.3 in Appendix E. The new curriculum consists of a total of 112 hours, or 14 days, dedicated to space operations, and it was expected to be in place at the end of FY 2020 or at the beginning of calendar year 2021. The reason for focusing exclusively on the 17D students is because, after UCT, many of them join MDTs,[99] and they need to get additional formal training prior to their unit arrival.

During our interviews, Air Force and Space Force leaders who are involved in space operations advocated for baseline space-specific training for the cyber operators coming into the Space Force, and AU faculty also acknowledged this need while emphasizing the broader need for more rigorous space training. Many of the Space Force's weapon systems to which the cyber operators are assigned are very different from those on which they are trained and from those on which an Air Force 17D or 17S would work. Cyber operators destined for the Space Force need a deeper technical understanding of their respective space weapon systems than they have and, therefore, more rigorous space training for cyberspace officers prior to arriving at their space units would logically follow.

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[98] USAF, undated-a; AETC, "Undergraduate Cyberspace Training (phase 2)," internal document shared with the RAND team, U.S. Air Force, July 2016a.

[99] MDTs were stood up as a result of the Cyber Squadron Initiative, "which is a plan to move communications squadrons away from Information Technology (IT) service and toward a mission set that involves the cyberspace side of their wing's operational mission" (Haley Stevens, "Mission Defense Team: Defending the RPA Network," Air Combat Command, October 10, 2019). Most MDTs are unit based, and they are responsible for unit-level "defensive cyber operations of Air Force [or Space Force] weapons systems" (Sergio A. Gamboa, "Tyndall Mission Defense Team Conducts First Exercise," Air Combat Command, June 19, 2018).

According to AF/A1XD career field health data, the Air Force's 17X accession target in FY 2019 was 261 new accessions to meet the career field sustainment number of 3,260. Applying that ratio to the 166 Space Force sustainment estimate would yield 13 new 17X accessions per year.

Because of the small number of 17X officers assigned to the Space Force (given the small accession requirement and small career field pyramid), coupled with the Space Force being a very lean service focused on a specific mission set, Air Force and Space Force leadership whom we interviewed agreed that, in the short to medium term, it makes sense for the Space Force to leverage the training that the Air Force currently provides rather than replicating UCT at Keesler AFB. However, Air Force career field leadership acknowledged the value of creating an add-on course (one to three weeks long, to be determined) focused on space cyber operations at Keesler AFB.[100]

During our interviews, AU faculty argued in favor of Space Force officers receiving as little as possible of Air Force–related training and indoctrination on their accession into the Space Force and, instead, maximizing their exposure to and acculturation with the Space Force. Although this proposition has value, the approach is unlikely to be feasible in the short term. However, as the Space Force becomes established and matures as a service, it might become less inclined to extensively train and develop its officers in Air Force institutions and expose them, predominantly, to Air Force culture and doctrine early on, with that exposure taking precedence over acculturation with the Space Force.

Initial Qualification Training

As mentioned earlier in the report, the IQT that cyber officers receive depends on which AFSC they belong to. At the time of writing, there was no formal IQT for 17D officers,[101] who are sent directly to their units after they finish IST. At their units, they receive OJT. Our interviews with career field leadership revealed that the Air Force and Space Force are aware of the need to formalize the IQT and MQT portions of training for 17D officers, and as of FY 2020, they were in the process of creating a standardized post-IST training path for this AFSC.

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[100] An alternative might be to make Space 100 a requirement for all 17X cyber operators. In the words of one of our interviewees, "this would be an overkill" because most cyber operators will not become part of the Space Force or have Space Force assignments during their careers and would be unlikely to put to good use most of the Space 100 training.

[101] As of FY 2020, the 17X AFPC team that handled both 17D and 17S assignments assigned officers to the units they would join when they graduated from UCT based on the needs of the Air Force but also based on preference and performance during UCT. Not all of those who express preference for 17S assignments, especially for the offensive operations shred, are selected, unless they have the necessary proficiency and their instructors recommend them for such assignments. Moving forward, the assignments would be based on the needs of both the Air Force and the Space Force.

For 17S officers, IQT is formalized and follows a standardized path depending on the shred to which the officers belong. The length of training varies depending on the specific function each officer performs within their respective shred. For instance, for 17SXA (offensive cyber operations) officers, IQT usually lasts 13 weeks and is directly related to the function they perform as either CST Tool Developer or Crash Header Operations.[102] For 17SXB (defensive cyber operations) officers, IQT could last 12, 13, or even up to 94 weeks, depending on the functional area of their shred (e.g., CPT Operations, NAS Operations, CMT Operations).[103] This training takes place at the 39th IOS at Hurlburt Field. A summary of the training that 17S officers receive is presented in Table E.2 in Appendix E.

Alongside the courses offered as part of IQT, two additional advanced skills trainings are offered to 17S officers: an in-residence five-week Cyber Vulnerability Assessment course at Little Rock AFB and a three-day cyber-related Functional Mission Analysis course at Maxwell AFB. Both the Little Rock and Maxwell AFB courses are offered approximately 10 to 12 times each year, with classes of about 20 students. Officers are expected to take the Little Rock–based training after arriving at their units and after completing any prerequisites, although the Functional Mission Analysis course can be taken at any time their schedules permit after arrival at their units. According to Air Force and Space Force career field leadership and cyberspace commanders interviewed in FY 2020, it was expected that, in the future, 17X UCT graduates (both 17D and 17S) will complete IQT *before* joining their units instead of waiting until after they arrive at their units to be scheduled for IQT. As mentioned previously in this section, the 17Ds go directly to their units and do not receive any formal IQT, a process that will change once a formalized IQT for 17D has been completed. There could be end strength implications if IQT attendance were to take place before officers arrive at their units; for this reason, it is important to ensure that these student man-years do not come at the expense of permanent party manning.

All second lieutenants take Cyber 100 as part of their UCT training, but as their careers progress, they are eligible to receive additional cyber-related developmental education at Wright-Patterson AFB as follows:

- Captains (O3s) are eligible for Cyber 200.
- Majors (O4s) are eligible for Cyber 300.
- Colonels (O6s) are eligible for Cyber 400.[104]

After IQT, officers return to their units and undertake MQT, which varies in length depending on the platform they need to secure and defend. MQT is usually offered based on demand within the respective unit, varying from once a month to once a quarter.

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102 USAF, undated-a.

103 USAF, undated-a.

104 Jamieson, 2019.

Post-IST or -UCT Training for 17X Officers

One to two students per IST or UCT class at Keesler AFB will be Space Force officers, and their next training assignment will be to the Space 100 course at the 319th Training Squadron. This two-week training is provided at Peterson SFB every six months. Similar to Air Force officers previously assigned to AFSPC, Space Force cyber officers will continue to be required to take Space 200 and Space 300 courses, as well as Cyber 200, Cyber 300, and Cyber 400 courses, as their careers progress.

Schriever and Vandenberg SFBs are the two most likely destinations for 17X cyberspace officers who are assigned to the Space Force.[105] Most 17X officers fall under the 17D AFSC, and as mentioned above, they do not have formal IQT but instead receive OJT. Many will receive additional MDT training on how to use cyber operations to defend different space- and ground-based systems and their supporting infrastructure. This MDT training builds on the IST that they previously received related to offensive and defensive operations, and they learn how to apply that training to the Space Force.

Although in its first years of operation as of the time of this writing, the Space Force will be mainly manned by 17D officers doing network operations (or 17DXA officers). With the implementation over the next few years of the Cyber Squadron Initiative across both the Air Force and the Space Force,[106] expectations were that training requirements will shift. The defense of missile warning systems and communications satellites and of other space systems requires extensive system-specific and cyber training. Hence, by contracting out network IT at the bases and shifting the training requirements from those associated with 17D to the 17S AFSC, the Space Force would be more likely to build the cyber warriors of the future, ensuring that the United States has in place a viable and competent cyber and space defense system. Consequently, the training requirements for 17X officers within the Space Force are likely to change in the next few years once the Cyber Squadron Initiative is fully implemented and as the Space Force becomes better established.[107]

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[105] Peterson SFB and Buckley AFB are two other locations where 17X officers who are assigned to the Space Force are likely to go after they finish UCT.

[106] In 2017, the Air Force created the Cyber Squadron Initiative, under which most base network services are outsourced to an external contractor, while the Air Force uses its existing workforce to defend its air and space systems. For more details, please see Jannelle McRae, "Cyber Squadron Initiative: Arming Airmen for 21st Century Battle," Air Force Space Command, archived, May 5, 2017; and Lauren C. Williams, "Air Force Plans to Convert IT Staff into Cyber Force," Nextgov/FCW, March 7, 2018.

[107] At the time of this writing, the Program Action Directive still had to be signed by the SecAF, and the Cyber Squadron Initiative still had to receive funding.

Primary Challenges Identified with the Training of 17X Officers Transferring to the Space Force

It appears that some of the challenges related to training on the space side are not unique to the Space Force and that the Air Force also seems to be experiencing similar challenges associated with training in the cyberspace career field. We identified the following primary challenges:

- *Limited number of 17S operators available in the Air Force overall and among those officers transferring to the Space Force*. If, similar to the Air Force, the Space Force plans to flip the distribution of 17D and 17S officers, the Space Force would be likely to come up short if the transition were faster than what the Air Force training pipeline is able to support. Plans to reverse 17D and 17S proportions in both services will take time and require focused implementation.
- *Inadequate baseline space training*. Cyberspace operators are responsible for defending extremely expensive and sophisticated weapon systems, but the training they receive prior to their first space assignments is inadequate, leaving them in charge of weapon systems for which they have not mastered the technology. This concern was voiced many times during interviews with subject-matter experts. Our understanding is that a space-related course for 17Ds was under development to address this challenge at the time of this writing.
- *Increased training demands but limited resources*. With two AFSCs and four shreds in the 17X career field, there are many training requirements. The creation of the Space Force added pressure for space operations–related training to be offered to 17X officers. However, the resources available have remained limited, and the additional training requirements for space operations must fit within the existing course length, making it difficult to satisfy the new training needs during IST or UCT.
- *Inadequate coverage of space-related cyberspace operations during follow-on training*. In the absence of cyber warfare training tailored specifically for space, there are training gaps that the Space Force will have to cover and fund internally. These gaps represent unfunded requirements because they are not associated with any training program of record, and such training must compete for funding with other Space Force needs.

Cyberspace Support Enlisted Personnel (3D) Training

For the enlisted personnel Cyberspace Support career field, nine AFSCs together with two additional AFSCs for senior and chief master sergeants were in discussion to transfer to the Space Force at the time of this study. AFSCs that may transfer are listed in Table 5.5. Our interviews indicated that the three primary AFSCs of interest for transfer to the Space Force are 3D0X2 (Cyber Operations), 3D1X2 (Cyber Transport), and 3D1X3 (RF Transmission Systems). Four additional 3D AFSCs were in the gray area regarding transfer due to either their base support functions or extremely low numbers, which would severely limit sustainability once in the Space Force: 3D0X1 (Knowledge Management), 3D0X4 (Programmers), 3D1X4 (Spectrum Operations), and 3D1X7 (Cable and Antenna Systems).

Table 5.5. Enlisted 3D Cyberspace Support AFSCs Proposed for Transfer

Row	AFSC	Function	Number of Personnel
1.	3D0X1	Knowledge Operations	28
2.	3D0X2	Cyber Operations	213
3.	3D0X3	Cyber Surety	104
4.	3D0X4	Computer Programming	4
5.	3D1X1	Client Systems	137
6.	3D1X2	Cyber Transport	359
7.	3D1X3	RF Transmission Systems	210
8.	3D1X4	Spectrum Operations	4
9.	3D1X7	Cable and Antenna Systems	14
10	3D190	Senior Master Sergeants	36
11.	3D100	Chief Master Sergeants	7
Total			1,116

SOURCE: Features information from Space Force transfer data for enlisted personnel as of September 2019.
NOTE: These 11 AFSCs, part of the enlisted 3D Cyberspace Support career field, were under discussion to transfer to the Space Force at the time of writing.

An overarching tenet for the Space Force, since its inception, has been that the service's cyberspace operators should not provide base operating support, also referred to as Base Operating Support–Information Technology (BOS-IT), in line with the provisions of the NDAA. However, these duties are the function of some of these AFSCs. In the context of discussions that all 3D AFSCs were to transition to the Space Force, the potential transfer of the AFSCs involved in BOS-IT remained part of a gray area as of this writing. For example, 3D1X7 (Cable and Antenna Maintenance) is not a cyber operations AFSC, but it is related to the maintenance of physical cable infrastructure in the ground. Ongoing discussions between the Air Force and the Space Force will determine whether the 3D1X7 airmen should transfer to the Space Force or whether the Air Force will continue to do this work.

Three primary AFSCs (3D0X2, 3D1X2, and 3D1X3) were also important as the Air Force considered folding all 3D AFSCs into the 1D7 (Cyberspace Defense Operations) AFSC, which has several defense shreds underneath it. This change would take place in the context of the "Agile Airmen" model that the Air Force was implementing at the time of this writing. Airmen within the 1D7 shreds would carry out operations as part of MDTs. This change would also have implications for training; if all 3D AFSCs were to be incorporated into one 1D7 AFSC with multiple shreds, baseline training would be provided to individual airmen, and subsequently, when airmen switched from one shred to another, they would receive only quick, shred-specific training that would render the operation of the entire system much more agile.

Furthermore, during our interviews with Space Force career field leadership, we understood that for the first two years of the Space Force's stand-up, training and promotion activities would follow the Air Force model. However, after that initial two-year period, training and promotion systems for space professionals may diverge, as the Space Force ultimately moves to craft its own training and promotion models and systems. In the words of one interviewee, "Everything is on the table."

Training Pipeline for 3D Enlisted Personnel

The training pipeline for 3D enlisted personnel is organized along similar lines to the 17X officer training pipeline, with three levels of training taking place: IST, IQT and MQT. Table 5.6 summarizes the main details associated with training for 3Ds across these three levels.

Table 5.6. Training Pipeline for 3DXXX Cyberspace Support Enlisted Career Field AFSCs

AFSC and Function	IST Duration	IST Location	IQT	MQT Unit Specific
3D0X1 Knowledge Operations	6.5 weeks	Keesler AFB		
3D0X2 Cyber Operations	13 weeks	Keesler AFB		
3D0X3 Cyber Surety	8 weeks	Keesler AFB		
3D0X4 Computer Programming	14 weeks	Keesler AFB		
3D1X1 Client Systems	11 weeks	Keesler AFB	Mission dependent	
3D1X2 Cyber Transport	20 weeks	Keesler AFB		
3D1X3 RF Transmission Systems	24 weeks	Keesler AFB		
3D1X4 Spectrum Operations	11.5 weeks	Keesler AFB		
3D1X7 Cable and Antenna Systems	15.5 weeks	Sheppard AFB		

SOURCE: Features information from USAF, "3DXXX Training Pipelines," internal document shared with the RAND team, undated-b, Not available to the general public.

3D190 senior master sergeants have no in-residence requirements but complete a nine-level course via distance learning, and 3D100 chief master sergeants have no further training requirements. 3D1X4 is a retrain-only AFSC for airmen who have been in the Air Force for a few years, are doing a related job (usually involving RF, radio, or signals analysis), and then move to Spectrum Operations. Once 3D airmen complete IST at Keesler AFB, most report to their first duty stations.

The majority of missions to which 3D airmen are assigned do not have IQT or MQT requirements; instead, airmen start traditional upgrade training once they arrive at their units. IQT or MQT are mission dependent; in other words, the mission area determines the method of instruction, duration, frequency, and curriculum. However, the training requirements differ based on the mission. For example, a 3D airman going to a base communications squadron to run the network has no IQT requirements; IST would likely be adequate for this mission. However, a 3D airman joining a remotely piloted aircraft unit to maintain a ground control station and a distributed ISR network will have an IQT requirement.

For 3D space professionals, the mission of the former AFSPC is very similar to the mission of the Space Force, and therefore, the IST cyberspace training that space professionals receive would be sufficient to meet the immediate technical requirements of the Space Force and will likely remain so for the first year or two after stand-up.[108] As of FY 2020, the Air Force will continue to provide IST cyberspace training at Keesler AFB to 3D personnel assigned to the Space Force. However, in the medium term, the Space Force planned to infuse space elements, such as knowledge of the space domain and its key attributes, into enlisted technical training of all core and common AFSCs to create a common service culture for all space personnel.

According to the projections made at the time of this writing, in the medium term, the Air Force and the Space Force are likely to enter an Interservice Training Review Organization (ITRO) agreement, which is a formal agreement between the Air Force, as a training provider, and other services—in this case, the Space Force—that receive training from the Air Force. As the training provider, the Air Force designs curricula for specific courses; the receiving service can choose to accept most of the training provided, but it also has the flexibility to replace one or several blocks of training with service-specific training.

For instance, in the context of an ITRO agreement between the Air Force and the Space Force for 3D space professionals, the Space Force would be likely to send its cyberspace enlisted personnel to the RF Transmissions Systems course but not to courses related to BOS-IT, which are less relevant to the Space Force. Instead, during the instruction blocks focused on IT service delivery, Space Force 3D professionals would be likely to attend specific space-related courses, return to finish the Air Force–related courses (e.g., satellite communications blocks) relevant to their work within the Space Force, and graduate.

Because the Air Force curriculum as of FY 2020 was still heavily focused on IT service delivery and of little relevance to the Space Force, it made sense for the Space Force to have the flexibility of picking and choosing which instruction blocks its 3D space professionals were to attend. Because all relevant Air Force courses are designed in a modularized format revolving around specific topics, airmen and space professionals do not have to take them serially or take all of them. For example, space professionals could take modules A and B, skip module C, pick things back up at module D, and graduate while the other services continue through modules E and F.

Space Training Available to 3D Enlisted Cyber Personnel

As Table 5.6 reflects, IST differs by cyber AFSC, and as of FY 2020, the space-related training in IST for most 3D airmen is generic. But content can vary based on the particular AFSC to which the airman belongs. For example, airmen belonging to the 3D1X3 (RF Transmission Systems) AFSC maintain satellite terminal equipment and have some basic space knowledge, such as satellite orbits and key characteristics of a space domain, built into their courses.

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[108] Cyberspace training differs from space-related training; hence, in this context, our assessment is that cyberspace training is sufficient, while deficiencies remain when it comes to space-related training for space professionals.

Beyond IST, space-related training is dependent on the unit and mission to which Space Force 3D professionals are assigned after graduation, as well as their own requests for training. When moving on to a new unit or a new weapon system, a space professional is typically sent to Vandenberg SFB for retraining on the weapon system before reporting to the new space unit.

Regarding education, at the time of this study, formal PCE for Space Force 3D professionals was not mandated. Space 100 slots were available for 3D space professionals interested in taking the course, but 3D airmen and space professionals did not have the opportunity to take the Space 200 and Space 300 courses because no slots were allotted to enlisted personnel. Of course, Space Force professionals are expected to attend PME.

As of FY 2020, the Space Force was assessing its options to fill the existing gap in space training and education for cyberspace enlisted personnel. Options under discussion included mandatory Space 100 for cyberspace enlisted personnel and a cyber version of SWIFTU. As a reminder, SWIFTU is the training program for intelligence personnel joining the Space Force. It takes place after IST and offers a grounding in space and the integration of space and intelligence.

Primary Challenges Identified with the Training of 3D Enlisted Personnel Transferring to the Space Force

The most important challenges we identified related to the training of 3D Space Force enlisted personnel were as follows:

- lack of appropriate space-related training for 3D enlisted personnel
  - IST has a dearth of space-specific content.
  - Because Space 100 is not mandatory, 3D enlisted personnel are reporting to their first space units with inadequate space-related knowledge.
- the non-standardized approach to PCE for 3D space professionals. As of FY 2020, Space 100 was not mandatory for the 3D enlisted personnel joining the Space Force, and no Space 200 and Space 300 slots were allotted to 3D senior noncommissioned officers (SNCOs) to allow them to continue their education and development throughout their careers.

Similar to the 17X career field for cyberspace officers, funding challenges exist with the additional space-related training needed for Space Force cyber enlisted personnel. The cyber workforce transferring from the Air Force is generally skilled with base network IT responsibilities. However, new, additional training, which entails potential manpower or staffing costs, such as extra end strength to cover increased STP costs for the space domain and space warfighting, will need funding, and that had not yet been secured.

Conclusions and Recommendations

The cyber function and structure of the Cyberspace Operations career fields are unusually complex. Given this complexity, coupled with the small numbers of cyber professionals in the Space Force with responsibility to carry out the cyber function, it will be important to anticipate cyber training and education requirements for the Space Force. Informed by the challenges that we identified, and with full cognizance that Space Force leadership was making important changes on a daily basis at the time of this writing, we offered the following recommendations for 17X officer and 3D enlisted personnel training:

A. **Develop space-specific cyber training curricula to be delivered after IST and before 17X officers and enlisted 3D personnel report to their first space assignments.**[109]
B. **Authorize mandatory attendance for Space 100 for all 17X officers and 3D enlisted personnel assigned to the Space Force.**
C. **Formalize the specific career junctures where 17X officers and 3D SNCOs take Space 200 and Space 300 courses.**
D. **Identify specific training requirements for 17X officers and 3D enlisted personnel and attach them to programs of record within the Space Force,** as a means of providing a steady source of funding to address Space Force–specific training needs.[110] These requirements could have end strength implications depending on how the STP account is used for additional training man-years.

Additionally, for 17X officers, we recommended the following:

E. **Identify precise requirements for 17S billets in the Space Force and develop an implementation plan to migrate required numbers of 17D cyber operators to 17S over the next few years** to ensure that adequately trained and skilled individuals are available to fill the respective positions.
F. **Consider setting in place a formal training for all 17Ds who are transferring to the Space Force for initial and advanced space training at the 319th CTS prior to arrival at their new space units.**
G. **Improve the flow through the training pipeline:** When 17X officers are identified for transfer into the Space Force, this decision should also be communicated in real time to the 319th CTS with the request that these officers be placed into the first-available follow-on Space 100 class on finishing UCT at Keesler AFB.
H. **Formalize the continuance of Space Force cyberspace officers in attending the Air Force–provided advanced skills cyber training at Little Rock and Maxwell AFBs.**
I. **Detail one Space Force 17X officer to the office of Air Force 17X CFM to provide support and advocate on behalf of the Space Force 17X officers.** Given the small size

[109] It is also worth mentioning that as the Space Force was finalizing its training infrastructure, significant cost and end strength considerations needed to be addressed. The timing of training could have significant implications for unit manning.

[110] A program of record is an "Acquisition Program which is a directed, funded effort that provides a new, improved, or continuing materiel, weapon, or information system or service capability in response to an approved need" (A. J. Yarmie, "Finding the Right Transition Path: Common Pitfalls in Commercialization," presentation prepared for the U.S. Department of Defense, ByteCubed, August 15, 2017).

of the Cyberspace Operations career field within the Space Force, it may not be financially feasible to have an independent cyber CFM office. However, in the medium to long term, as this career field grows within the Space Force, such an endeavor may become justified. Another alternative would be to combine under one civilian CFM the military and civilian sides of the cyber career fields within the Space Force. A benefit of this alternative would be increased stability and continuity under civilian leadership, which traditionally has not been subject to fast-paced military rotation.

And for 3D enlisted personnel, we recommended the following:

J. **Perform a needs assessment of cyber and space training available to 3D enlisted personnel transferring to the Space Force.**
K. **Formalize PCE requirements for enlisted personnel and allot slots for 3D SNCOs in the Space Force to attend Space 200 and Space 300 courses as their careers progress.**

Chapter 6. Engineering and Acquisition Career Fields

A 2019 U.S. Government Accountability Office report noted that "[w]hile there is increased attention on funding for space and building the Space Force, new programs can still face resource challenges." These resource challenges include having both a "sufficient workforce" and "attracting and retaining candidates with the requisite technical expertise."[111] In this chapter, we review the sustainability of the expected initial Space Force acquisition workforce and the education and training that its members enter with and are given. It should be noted that our perspective was necessarily focused on the status of personnel and training as of FY 2020, but there is every reason to believe that the size and composition of the workforce (e.g., military, civilian, and contractor), as well as the training provided to the workforce, will evolve as the Space Force grows into its role as a distinct military service. In addition, this chapter discusses only the sustainment and training of the military acquisition workforce in the Space Force.

The engineering and acquisition career fields play a pivotal role in the Space Force's effectiveness because they oversee the design, development, and production of the systems that deliver capability to the space and joint warfighter. At the time of this writing, the Space Force planned to have officers in two career fields managing and overseeing acquisitions: Developmental Engineering and Acquisition Management (62X/63X).[112] The billet structure for the Space Force included no enlisted personnel in either finance or contracting and relied on the DAF for contracting and finance support.

Traditionally, the 62E (Developmental Engineer) and 63A (Acquisition Manager) career fields are managed together because the 62E career field has a bulk of CGO positions and very few FGO billets. Conversely, the 63A career field does not have many CGO positions but has primarily FGO billets. In the Air Force, there is crossflow between these two career fields; many 62Es convert into 63As once they reach the O4 level. Because of this, our analysis of career field sustainability treats 62E/63A as a single career field in the tables in this chapter. These are the only career fields in the Air Force that are managed in this way.

This chapter continues with a sustainment analysis of the 62E/63A career fields, a discussion of training for 62E/63A officers, and conclusions and recommendations specific to these two career fields. As mentioned in the "Limitations" section in Chapter 1, for the 62E/63A career fields, we did not have the same concerns associated with the generalist space operator model

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[111] U.S. Government Accountability Office, *Space Acquisitions: DOD Faces Significant Challenges as It Seeks to Accelerate Space Programs and Address Threats*, Highlights of GAO-19-458T, March 27, 2019, paragraph 3.

[112] An individual who holds a command-level position in the engineering and acquisition workforce is referred to as a Materiel Leader (with an AFSC of 62S for engineering or 63S for acquisition), Senior Materiel Leader- Lower Echelon (AFSC of 63G), or Senior Materiel Leader-Upper Echelon (AFSC of 60C). We included them in the sustainability analyses as part of the 62X/63X pipeline.

because these career fields do not have extensive IST pipelines and they are not requiring the same in-depth level of functional specialization throughout a full career as the Intelligence and Cyberspace Operations career fields do. For these reasons, we do not include a discussion of the generalist operator model in this chapter.

Developmental Engineer (62E) and Acquisition Manager (63A) Officer Career Field Sustainability Analysis

Table 6.1 displays the authorization structure for officers in the LAF. As in the previous chapters, we evaluated the pyramid health criterion of the career field sustainability model by comparing the grade structure for 62X/63X in the Space Force (Table 6.2) with the grade structure of the LAF in terms of selectivity to the next higher grade.[113] For example, looking at the O4 row in the table, the rightmost column shows that the selectivity to the next higher grade is 1.6 for an O4.

Table 6.1. LAF Authorization Structure for Officers

Grade	LAF Authorizations as of September 2019	Promotions per Year	Selectivity to Next Higher Grade
O1, O2, O3	25,199 (56%)	2,519.9 (to O1, O2, and O3)	1.2 (O3 to O4)
O4	10,132 (22%)	2,026.4 (O3 to O4)	1.6 (O4 to O5)
O5	7,405 (16%)	1,234.2 (O4 to O5)	3.1 (O5 to O6)
O6	2,401 (5%)	400.2 (O5 to O6)	—
Total	45,137		

SOURCE: Authors' analysis of AFPC manpower data and AFPC personnel data as of September 2019.

Table 6.2 shows the total expected Space Engineering and Acquisition (60C, 62E, 63A) authorizations by pay grade for the Space Force at 1,676 as of September 2019.[114] Within the PAS codes listed in the Space Force transfer data, there were 1,724 positions for 62X/63X officers identified in the AFPC manpower data. Similar to the 14N career field, there are more

113 As mentioned in Chapter 1, given the many unknowns still associated with the transfer of the 62E/63A career fields into the Space Force at the time of writing, we limited our evaluation of career field sustainability to the first criterion, pyramid health, for which we had complete data available. The career path viability and senior leadership opportunities criteria require assessment at a later time when more information becomes available.

114 There were three enlisted billets associated with the 9S100 acquisition career field expected to transfer to the Space Force at the time this analysis was carried out, but we were unsure whether this small number was a purposeful inclusion based on a functional need.

positions in the AFPC manpower data for these PAS codes than in the Space Force transfer data; hence, it is unclear which positions within these organizations were intended to transfer.

Table 6.2. 62X/63X Space Force Authorization Structure

Grade	Authorizations from Space Force Transfer Data	Promotions per Year	Selectivity to Next Higher Grade
O1, O2, O3	927 (55%)	92.7 (to O1, O2, and O3)	1.0 (O3 to O4)
O4	446 (27%)	89.2 (O3 to O4)	2.2 (O4 to O5)
O5	242 (14%)	40.3 (O4 to O5)	4.0 (O5 to O6)
O6	61 (4%)	10.2 (O5 to O6)	—
Total	1,676		

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.
NOTE: This table presents overall data for 60X, 62X, and 63X in Space Force units. These counts also include 60C authorizations, which are commander or equivalent jobs at the O6 level, usually filled by 63A personnel.

In addition, the Space Force has a selectivity ratio to the next higher grade of 1.0 from CGO (O1, O2, and O3) to FGO (O4). This selectivity ratio means that the service would need to promote almost all O3s to O4 because it has so many positions (446) at the O4 level. At the time of the analysis, the Space Force expected to promote 90 individuals out of 93 to the O4 level—which effectively means no selectivity in choosing whom to promote. The situation reverses in promotion to O5: A smaller proportion of O4 officers would be promoted to O5 relative to the Air Force, where the LAF selectivity to the next higher grade is 1.6 versus 2.2 in the Space Force. A similar dynamic takes place for promotions from O5 to O6. At the time of the analysis, it was estimated that the Space Force would have 242 O5 billets for 61 O6 positions, which translated into a very high selectivity rate. At 100-percent manning, the Space Force would have four O5s for every O6 position; in the Air Force, the same ratio is only 3.1. Under these circumstances, fewer O5s would be promoted in the Space Force compared with the Air Force as a whole. If the Space Force were to promote the same proportion of O5s as the Air Force does, it would end up overmanned at the O6 grade.

The Space Force authorization structure has an excess of O4 authorizations (27 percent of structure) relative to the LAF O4 authorizations (22 percent of structure). This excess in O4 authorizations in the Space Force creates an upward pressure on promotion rates from CGO ranks to O4 and significant downward pressure on promotion rates to O5 and O6 relative to the LAF.

For the combined 62E/63A career fields to match the LAF grade ratios, the Space Force would need to eliminate 70 O4 positions and add 9 CGO (O1, O2, and O3), 33 O5, and 28 O6 billets (Table 6.3). These are significant adjustments to the billet structure because of the challenge of increasing the number of O5 and O6 positions. The Defense Officer Personnel Management Act established a cap on the numbers of these ranks for the services,[115] but how this cap will be applied to the Space Force was uncertain at the time of this writing. Billets would likely need to be redistributed across the Space Force to accommodate these changes. Other career fields transferring to the Space Force have billet structure adjustments to make as well (as discussed in previous chapters), although not as significant; an analysis to optimize the redistribution will likely be required.

However, as described in the next section, even if the billet structure could be adjusted as noted, the inventory of personnel at the time of analysis does not exist to support the needed adjustments.

Table 6.3. 62E/63A Notional Authorization Options for the Space Force to Match LAF Ratios

Grade	Authorizations Using LAF Ratios	Selectivity to Next Higher Grade	Difference from Actual
O1, O2, O3	936	1.2	+9
O4	376	1.6	–70
O5	275	3.1	+33
O6	89	—	+28

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.
NOTE: These notional counts also include 60C authorizations, which are commander or equivalent jobs at the O6 level, usually filled by 63A personnel. The values in the "Difference from Actual" column represent the difference between the values in the "Authorizations Using LAF Ratios" column in this table and the values in the "Authorizations from Space Force Transfer Data" column shown in Table 6.2. We do not show the latter in this table to avoid intermixing notional authorization and actual authorization data.

Inventory Analysis

The total number of expected 62X/63X authorizations for the Space Force was 1,676, and the manning for 62X/63X officers transferring to the Space Force was 1,529, by pay grade, as of September 2019 (Table 6.4). In the PAS codes listed in the Space Force transfer data, 1,592 officers from the 62X/63X core AFSC were assigned, of which 1,514 were assigned to a DAFSC of 62X/63X, showing that many officers were available as manpower. However, the counts of core personnel in these AFSCs were substantially short of the 1,724 authorizations to be filled in these PAS codes, which are identifiers of units that were undermanned. If lower-ranked authorizations (O4 positions, in essence) were to be converted to O5 and O6 authorizations to match the LAF grade ratios, these shortages would worsen because there were not enough officers with 62X/63X core AFSCs to draw from.

[115] Public Law 96-513, Defense Officer Personnel Management Act of 1980, December 12, 1980.

As of August 2020, there was a total inventory of approximately 5,200 officers in these career fields in the Air Force, and approximately one-third was expected to transfer into the Space Force. This relatively smaller number could have consequences that limit career opportunities available to these officers if Space Force officers in these career fields were limited to opportunities strictly related to space engineering and acquisition.

At least part of the reason for the shortages of 62X/63X core personnel is that overall Air Force accession targets for these officers were missed for each of the past three years (FYs 2017, 2018, and 2019) by an average shortage of 78 accessions per year. The average accession goal for these core personnel had been 460 per year for these same FYs. But only approximately 83 percent of the goal had been met, on average, across those years. As of FY 2020, the question of whether these shortages would continue—and, if they did, how they would be distributed between the Air Force and the Space Force—remained. One option for mitigating the shortages could be to change the proportions of the military-to-civilian mix in the acquisition workforce.

Table 6.4. LAF Inventory Analysis for Overall 62X/63X in Space Force Units

Grade	Authorizations from Space Force Transfer Data	Overall Authorizations as of September 2019	Permanent Party Inventory (Manning) DAFSC of 62X/63X	Core AFSCs of 62X/63X	Core 62X/63X Serving in a DAFSC of 62X/63X	Core 62X/63X Serving Outside 62X/63X
O1, O2, O3	927 (55%)	968 (59%)	870 (90%)	921	869	52
O4	446 (27%)	449 (25%)	372 (83%)	378	368	10
O5	242 (14%)	245 (13%)	230 (94%)	236	226	10
O6	61 (4%)	62 (3%)	57 (92%)	57	51	6
Total	1,676	1,724	1,529 (89%)	1,592	1,514	78

SOURCE: Authors' analysis of AFPC manpower data, AFPC personnel data, and Space Force transfer data as of September 2019.

Developmental Engineer (62E) and Acquisition Manager (63A) Officer Training

The AFOCD summarizes the 62E career field as follows:

> Plans, organizes, manages, and implements systems engineering processes to assure required capability delivery over the life cycle of Air Force systems. Included are accomplishing specialized engineering processes and sub-processes; formulating engineering policy and procedures; and coordinating and directing engineering and technical management activities and operations necessary for system conception, development, production, verification, deployment, sustainment, operations, support, training, and disposal. This includes technical management associated with the requirements definition, design, manufacturing and quality, test, support engineering and technologies,

> modifications, spares acquisition, technical orders, mission critical computer resources, support equipment, and specialized engineering.[116]

The Acquisition Manager specialty (or 63A) is described as follows:

> Manages defense acquisition programs covering every aspect of the acquisition process, including integrating engineering, program control, test and deployment, configuration management, production and manufacturing, quality assurance, and logistics support. Performs functions essential to acquisition programs involving major defense acquisition programs and other than major systems or subsystems. Performs acquisition support roles.[117]

Although distinct career fields, the two are closely related, and they work closely together. The Developmental Engineering (62X) career field encompasses the design, development, installation, modification, testing, and analyses of materials, techniques, or processes. It is mandatory for 62X officers to have an engineering degree. The Acquisition Management (63X) career field includes acquisition managers, materiel leaders, and senior materiel leaders. Officers in 63X may have degrees in engineering, mathematics, physical sciences, economics, business, or management.

Status of Training for Engineering and Acquisition Officers: Relies Heavily on DAU

The Air Force has relied heavily on DAU for training for 62X and 63X officers according to our examination of available and required courses and discussions with space acquisition leaders. Prior to first assignment, IST is not required in these two career fields. Officers entering the 62X career field must possess an undergraduate degree in engineering.

Officers assigned to either a 62X or 63X billet are in most cases required to meet certification standards stemming from the Defense Acquisition Workforce Improvement Act (DAWIA), which sets the core standards for required training, education, and experience for the acquisition career fields.[118] There are three levels of DAWIA certification or three core certification standards. The required training, education, and experience for DAWIA certification in engineering are presented in detail in Figure 6.1 for Developmental Engineers (62E)[119] and in Figure 6.2 for Acquisition Managers (63A). All training is conducted by DAU, and Figures 6.1 and 6.2 indicate only the minimum training, education, and experience requirements for a given type and level of certification. These requirements are not binding on entry to a position. Officers are given two years in a position to attain the required certification. Officers in these career fields tend to have taken more than the minimum required courses at DAU.

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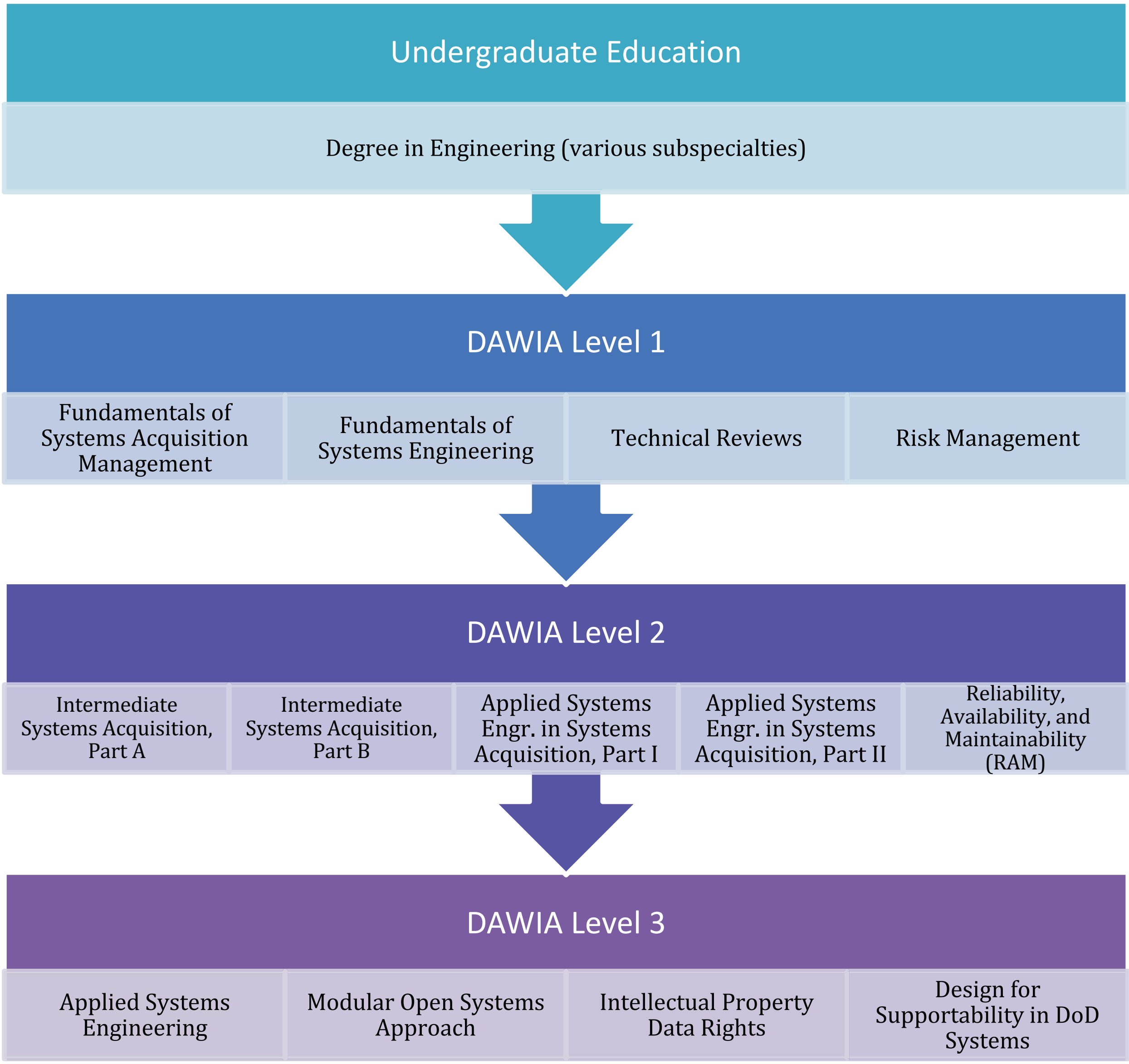
[116] AFOCD, 2020c, p. 215.

[117] AFOCD, 2020c, p. 219.

[118] Public Law 101-510, National Defense Authorization Act for Fiscal Year 1991; Section 1202, Defense Acquisition Workforce, November 5, 1990.

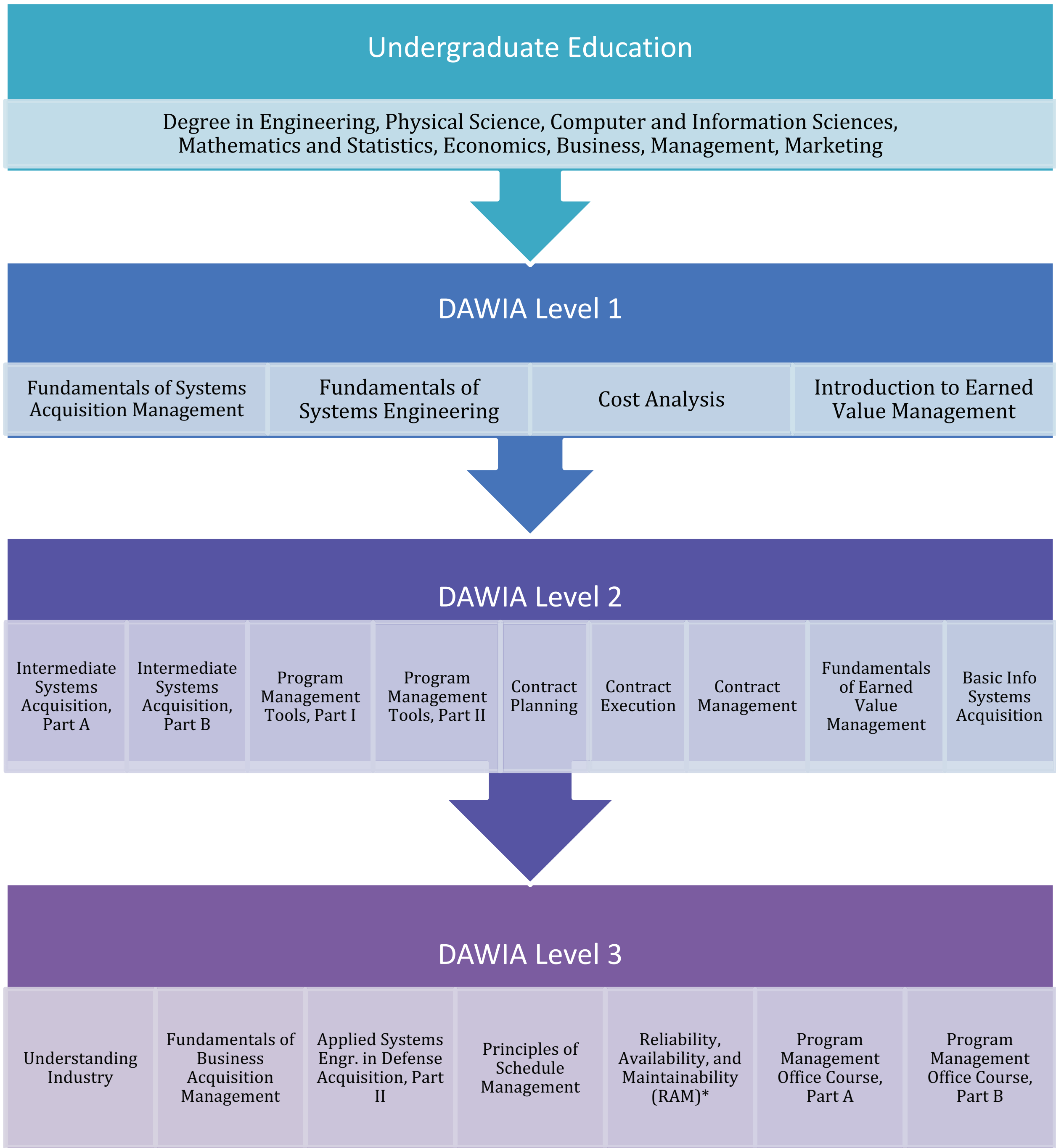
[119] Additional details regarding the existing training and education for Developmental Engineers (62EXX) are presented in Appendix F.

Figure 6.1. 62E Training Pipeline



SOURCES: Features information from DAU, “Certification Standards & Core Plus Development Guide: Engineering Level I,” webpage, undated-a; DAU, “Certification Standards & Core Plus Development Guide: Engineering Level II,” webpage, undated-b; DAU, “Certification Standards & Core Plus Development Guide: Engineering Level III,” webpage, undated-c.
NOTE: The information in this table was current as of November 1, 2020. Engr. = Engineer.

Figure 6.2. 63A Training Pipeline



SOURCES: Features information from DAU, “Certification Standards & Core Plus Development Guide: Program Management Level I,” webpage, undated-d; DAU, “Certification Standards & Core Plus Development Guide: Program Management Level II,” webpage, undated-e; DAU, “Certification Standards & Core Plus Development Guide: Program Management Level III,” webpage, undated-f.
NOTE: The information in this table was current as of November 1, 2020. *Indicates courses are also required of 63A officers. Engr. = Engineer.

Three forces are likely to influence future changes to the training of the acquisition workforce. First, our interviews indicated that space acquisition officers would prefer additional space-specific acquisition content and examples. Second, the Space Force has stated its desire to build a workforce that is focused across the board on warfighting. Finally, the 2020 DAF report titled *Alternative Acquisition System for the United States Space Force* proposes "nine near-term, critical statutory and policy features."[120] Taken together, it seems likely that these forces will require as yet unspecified changes in training.

Developmental Engineer (62EXX) Officer Training

Prior to entry into the Air Force in a 62EXX career field, officers are required to meet specific education requirements that are related to their specific shred within the AFSC. Table 6.5 lists the complete list of shreds for 62EXX.

Table 6.5. Specialty Shreds for 62EXX

Suffix	Portion of Air Force Specialty to Which Shred Is Related
A	Aeronautical
B	Astronautical
C	Computer Systems
E	Electrical/Electronic
F	Flight Test
G	Project
H	Mechanical
I	Systems/Industrial/Human Factors

SOURCE: Reproduced from AFOCD, 2020c, p. 216.

Acquisition Manager (63X) Officer Training

This career field includes acquisition managers, materiel leaders, and senior materiel leaders. Officers generally do not enter the 63X career field directly on commissioning into the Air Force. With regard to the 63X career field, the AFOCD notes,

> [i]t is desirable that entry into the career field be preceded by assignment in another utilization field whenever possible. Officers who enter the career field on their initial tour should seek a subsequent assignment in another utilization field followed by a return to the acquisition program management career field. This desired career broadening is to provide a better perspective and understanding of the interfaces between functions of acquisition management and related functions in the developing, operating, training, and support commands. Lateral inputs will

[120] DAF, *Alternative Acquisition System for the United States Space Force*, report to congressional committees, May 2020, p. 2.

> include only those officers who have clearly demonstrated a potential for effective administration and program management beyond their basic specialty.[121]

Similar to Developmental Engineers (62E), Acquisition Managers (63A) complete DAWIA training in levels 1 through 3. DAWIA training required for 63A officers is indicated in Figure 6.2. There is no fixed timeline to complete training, only the requirement that the DAWIA level of training required for assignment to a billet must be completed within two years of assignment to that billet. Additional details on the training and education available to 63A officers are presented in Appendix G. Similar to 62Es, 63As will continue to attend in-residence PME programs provided by AETC, as described in Chapter 3.

The main challenges that we identified during our interviews and analysis of the available data for 62E/63A career fields are twofold:

- Existing training provided by DAU could benefit from additional space scenarios. Interviewees stated that more space-specific material would be welcome but did not report that it was crucially needed.
- The Space Force is likely to be too small to have a substantive impact on the well-established DAWIA curriculum, particularly because the 62X/63X professionals appeared not to be lacking necessary training and were not, at least thus far, signaling a demand.

Conclusions and Recommendations

The sustainability of the two acquisition-related career fields will likely have challenges within the Space Force, although to what extent was still unclear at the time of this writing. The Air Force faces difficulties in meeting its own accession goals for the 62X and 63X acquisitions career fields, an issue which could carry over to the Space Force. Furthermore, career opportunities in the Space Force for engineers and program managers could be too limited to provide necessary developmental opportunities without assignments back into the Air Force. In light of these factors, our key recommendations for these two acquisition-related career fields were as follows:

A. **Consider whether a program of bonus or incentive payments for engineers and program managers would increase accessions** into these two specialties to reduce the shortages in accessions seen over FYs 2017, 2018, and 2019.
B. **Address shortages in the acquisition workforce** by adjusting the military-to-civilian mix.
C. **Work with DAU on the possibility of adding space scenarios to existing training.**
D. **Perform a training needs analysis at the one- to two-year juncture after Space Force Acquisitions is in place** to ensure that training still meets the needs of these personnel.

[121] AFOCD, 2020c, p. 218.

Chapter 7. Civilians Transitioning to the Space Force

The legislation that established the Space Force specified that the new military service would be under the leadership and authority of the SecAF, and its civilian employees would remain DAF employees.[122] The bulk of the workforce to support the Space Force consists of the military and civilian personnel who were assigned to AFSPC, along with personnel from the other military services performing complementary space work and any civilians needed for leadership positions created in the new Space Force.[123] The information in this chapter focuses on the civilian positions that were within AFSPC and now support the Space Force and the importance of civilians in leadership and mission operations positions within the Space Force.

While some civilian positions had begun migrating to the Space Force as of this writing, there were insufficient data to draw conclusions on what the full civilian complement in the Space Force would be after the transition was completed. Therefore, the numbers and analyses presented in this chapter, unless otherwise specified, are based on data from the May 31, 2020, iteration of the monthly demographic "Ready References" on the DAF civilian workforce from AFPC/DSYA, specifically focusing on AFSPC-related data. This data source will henceforth be referred to as the "AFPC/DSYA Civilian Workforce Ready Reference."

Considerations for Civilian Personnel Transitioning to the Space Force

A wide variety of civilian employees who were assigned to AFSPC transitioned to the Space Force to help lead the new service and to fulfill critical roles in mission accomplishment. The primary efforts as of FY 2020 in standing up the Space Force had been focused on the military command and control structure and how the military officer and enlisted structures would function. Also important, however, are critical decisions regarding the Air Force civilian workforce that will transition to the Space Force, and how these civilian employees will be deployed throughout the organization in roles of importance to mission accomplishment.

AFSPC had a total of 5,852 appropriated-fund civilian employees, consisting of 5,623 U.S. permanent full-time employees, 150 temporary or term employees, 58 on leave without pay, and 21 in other statuses.[124] Civilian employees were predominantly located in the continental United States (5,567), with a small number (56) located outside the continental United States.[125] Although we used the number of positions in AFSPC to conduct our analysis, the Space Force

[122] U.S. House of Representatives, 2019.

[123] U.S. House of Representatives, 2019.

[124] AFPC/DSYA, "AFPC/DSYA Civilian Workforce Ready Reference," May 31, 2020.

[125] AFPC/DSYA Civilian Workforce Ready Reference, May 2020.

transfer data indicated only 4,862 positions that will move. We were unable to confirm the final number as 4,862 or to confirm the organizational destinations of these positions. Therefore, because we were not able to examine the projected civilian workforce of the Space Force, we used official data from the Defense Civilian Personnel Data System for those civilians working for AFSPC (the organization from which the vast majority of Space Force civilians will transfer), provided to us by AFPC/DSYA, for the following analyses.

AFSPC employees spanned a wide range of grade levels, from executives to blue-collar-wage–grade employees. AFSPC had 14 employees at an executive level that equated to uniformed GO levels (Table 7.1). These executives fulfilled key leadership and senior technical positions within AFSPC and could provide significant executive-level support to the Space Force.

Table 7.1. Senior Executives in AFSPC

Category of Senior Executive	Number of Employees
Expert	2
SES	7
Senior Intelligence Executive Service	1
Senior Intelligence Professional	2
SL positions	2

SOURCE: Features information from AFPC/DSYA Civilian Workforce Ready Reference, May 2020.

The distribution of AFSPC's civilian employee population by grade level, as seen in Table 7.2, conveys the potential impact of the number of senior- and journeyman-level civilians available to provide benefits of the DAF's civilian leadership, continuity, and technical expertise to the Space Force. Having 190 GS-15 employees, equivalent to military O6 positions, provides senior leadership to lead projects, programs, and support functions. The most populous grades were GS-12 and GS-13 journeyman levels, with 2,381 employees at these levels. GS-11 employees are typically technicians, administrative support, or employees in developmental positions. Table 7.2 shows the civilian grade stratification within AFSPC.

Table 7.2. Number of Employees in AFSPC, by Grade Level

Grade Level	Number	Percentage of Workforce
Executive	14	0.25
GS-15	190	3.38
GS-14	312	5.55
GS-13	1,098	19.53
GS-12	1,283	22.82
GS-11	711	12.64
GS-10	49	0.87
GS-09	486	8.64
GS-08	122	2.17
GS-07	390	6.94
GS-06	298	5.30
GS-01 – GS-05	206	3.66
Wage	464	8.25

SOURCE: Features information from AFPC/DSYA Civilian Workforce Ready Reference, May 2020.

Civilians destined for the Space Force spanned 19 different AFSPC career fields, listed in Table 7.3. The five most populous were civil engineering, force support, logistics, communication and information, and scientists and engineers. Each of these career fields was managed and administered by a Career Field Team that was responsible for managing permanent civilian careers through training and developmental programs.[126] Table 7.3 also provides the number of employees in each career field.

Table 7.3. AFSPC Civilian Employees Moving to the Space Force, by Career Field

Career Field	Number of Employees	Rank Order of Top Five Fields	Percentage of Workforce
International Affairs	5		0.09
Medical	218		3.88
History and Museum	17		0.30
Security	363		6.46
Special Investigations	28		0.50
Public Affairs	74		1.32
Financial Management	353		6.28
Civil Engineer	828	1	14.73
Communication and Information	612	4	10.88
Intelligence	17		0.30
Chaplain	1		0.02
Legal	49		0.87

126 Air Force Manual 36-606, *Civilian Career Field Management and Force Development*, Department of the Air Force, November 14, 2019, p. 7.

Career Field	Number of Employees	Rank Order of Top Five Fields	Percentage of Workforce
Scientists and Engineers	476	5	8.47
Safety	98		1.74
Logistics	657	3	11.68
Contracting	424		7.54
Program Management	294		5.23
Operations	313		5.57
Force Support	776	2	13.80
Weather	20		0.36

SOURCE: Features information from AFPC/DSYA Civilian Workforce Ready Reference, May 2020.

The Aging Civilian Space Workforce

AFSPC had an aging workforce with 3,193 employees (or 58.6 percent) over 50 years old, and the largest age-based group of employees in its civilian workforce, age 50–59, numbered 2,121. More than 1,000 of these employees could retire as of FY 2020, and another 1,197 employees would be eligible in the next five years. These numbers indicate that almost 40 percent of the civilian workforce in space-related work was at or very near retirement eligibility age, a higher percentage than the 32 percent of the overall civilian workforce at or near retirement in the DAF.[127] Of the 14 senior executives moving to the Space Force at the time of this writing, five were under the age of 50, five were in the 50–60-year-old age group, and four were over age 61. The Space Force will need solid workforce planning to replace these older civilian employees.

Tables 7.4 provides a snapshot of civilian employee age groups, and Table 7.5 provides the employees' years to voluntary retirement eligibility as of FY 2020.

Table 7.4. AFSPC Civilian Employees, by Age Group

Age Group	Number of Employees	Percentage of Workforce
29 or younger	219	3.31
30–39	917	15.23
40–49	1,294	22.90
50–59	2,121	40.00
60–69	993	17.23
70–79	73	1.26
80 or older	6	0.07
Total	5,623	100

SOURCE: Features information from AFPC/DSYA Civilian Workforce Ready Reference, May 2020.

[127] AFPC/DSYA Civilian Workforce Ready Reference, May 2020.

Table 7.5. AFSPC Civilian Employees, by Years to Voluntary Retirement Eligibility

Years to Voluntary Retirement Eligibility	Number of Employees	Percentage of Workforce
20+	858	15.26
11–20	1,513	26.91
6–10	1,036	18.42
1–5	1,197	21.29
Less than 5 years ago	759	13.50
More than 5 years ago	244	4.34
Data not available	16	0.28

SOURCE: Authors' analysis of data from AFPC/DSYA Civilian Workforce Ready Reference, May 2020.
NOTE: Years to voluntary retirement eligibility are based on our calculations from FY 2020 data.

Primary Challenges Identified with the Civilian Workforce Transferring to the Space Force

In addition to the challenges of developing and operating a new military service within the confines of resources allocated for such an ambitious undertaking, the Space Force will face the following challenges in managing its civilian workforce:

- The lean composition of the Space Force will create challenges in establishing the needed organizational structure to perform the Space Force's mission. The number of civilians will be limited by DAF full-time equivalent counts, which might depress the numbers available for mission accomplishment.
- The small numbers of civilians in any given career field may require the Space Force to consider merging the development and management of civilian career fields, which could limit growth opportunities and make civilians less competitive for SL jobs.
- The aging civilian space workforce, many of whom are approaching retirement eligibility, will need to be replaced.

Conclusions and Recommendations

The projected organizational structure of the Space Force appears to be military-centric, perhaps to an extent more than necessary, with civilians filling in the remaining gaps. A step back, and a second look, may prove beneficial; a careful analysis of the strengths of both types of leaders could prove advantageous. As of FY 2020, several outstanding questions and challenges remained with regard to the Space Force's leadership structure, as the Space Force senior leadership continued to refine organizations and operations.

With the civilian workforce on track to constitute a major portion of Space Force positions, we posit the following two questions related to the integration of civilians into the Space Force for the Space Force senior leadership's consideration:

- Has the organizational structure for the Space Force factored in the key role that civilian employees can play in leadership and organizational continuity?

- Has benchmarking of other organizations with space or research missions been accomplished to inform the Space Force's organizational plan?

We offered the following recommendations to assist Space Force leadership in managing its organizational challenges and its ability to fully utilize its civilian workforce to support Space Force mission and goals:

A. **Benchmark other organizations with space or research missions and leverage the findings to inform the Space Force organizational and leadership structure.** As discussed fully in Chapter 2, civilians and civilian leaders have served successfully in many technical and space-focused organizations. Much can be learned from these organizations about their civilian workforces and civilian leadership that would benefit a new service. We therefore recommend that the Space Force benchmark other organizations with space or research missions (such as NASA, AFRL, and other services) and leverage the findings to inform the Space Force organizational and leadership structure.
B. **We further encourage the Space Force to ensure that civilian positions are strategically placed to enhance and sustain continuity,** as a counterbalance to military positions in which rotation frequently occurs.
C. **We encourage the Space Force to establish a consortium of senior civilian human resource professionals** involved in supporting civilians in space missions and research and to leverage this consortium to address challenges and best practices for the recruitment and retention of key civilian leaders and employees. The personnel challenges that the unique space mission faces can appear daunting, but several comparable organizations might offer the benefit of long experience with civilian leadership cadres and civilian workforces.

Chapter 8. Conclusions and Recommendations

The analyses undertaken in this project have resulted in a series of findings concerning the ability of the Space Force to organically generate a sufficient number of GOs to sustain their projected distribution, the sustainability of the five core career fields transferring to the Space Force, the extent to which existing training pipelines for officers and enlisted personnel can support new space-specific training needs, and the implications associated with the civilian workforce that will be an integral part of the Space Force. Our findings in each of these four primary study areas have led to recommendations for addressing challenges faced by the Space Force in its early stages. In this chapter, we synthesize and summarize the specific recommendations put forward in Chapters 2 through 7 to present a set of recommendations numbered from 1 to 20.

GO Numbers and Selectivity

As presented in Chapter 2, we replicated FY 2019 findings with an updated officer corps estimate of 3,032 authorizations, determining that the Space Force will be able to internally generate only about half of its requested number of GOs. The updated officer corps estimate of 3,032 would result in about 16 GO positions of the 30 requested.[128]

We also found that the GO structure under consideration by the Space Force (six O7s, eight O8s, five O9s, and two O10s) at the time of this writing was untenable because of both sustainment issues and the inherently problematic selection rates among GO ranks that such a structure would produce. The resulting GO promotion trajectory of guaranteed promotion from O7 to O8, with a high probability of selection to O9, would diverge significantly from Air Force GO promotion ratios and introduce a higher level of risk surrounding GO promotions than typically seen in the Air Force. These risks would result from the need, under the Space Force–proposed structure, for the very long-term prediction of success at subsequently increasing levels of responsibility; the decision to promote an O6 to O7 would be, in effect, the very same decision to promote that individual to O8—with a high probability for promotion to O9. Prediction of success three organizational levels up is inherently risky. The Space Force–proposed GO structure also eliminates a very large portion of competition among one-, two- and three-star generals. Risks will also result if or when GOs from sister services are brought into the Space Force.

To address these challenges caused by shortfalls, an unsustainable GO pyramid, and GO selectivity issues, we provide detailed recommendations and supporting arguments in Chapter 2,

[128] The 30 GO positions include 9 joint positions.

including the importance of leveraging and integrating senior civilian leadership to a greater extent into the Space Force leadership structure, as well as best practices from industry for the prediction of long-term executive success. We synthesized those recommendations addressing the GO corps and issues of selectivity as follows.

Recommendation 1: *Explore best-in-class executive selection practices from industry*, given that GO promotions in the Space Force will likely hold higher risk than GO promotion decisions have in the Air Force. Risks stem both from the necessity to promote O7s up the chain to higher GO grades at much higher selection rates and from risks associated with bringing GOs in from sister services to address the 50-percent shortfall of GOs that can be generated within the Space Force.

Recommendation 2: *Explore greater use of civilian leaders within the Space Force.* Leverage civilian DISES and SES positions for Space Force leadership positions to help mitigate the nearly 50-percent GO shortfall (see our recommended Space Force senior leadership structure presented in Chapter 2). The Space Force, a highly technical warfighting organization, could also leverage SL and ST positions, which provide leadership and technical talent and expertise at compensation rates more competitive with industry.

Recommendation 3: *Ensure a fully sustainable GO pyramid when creating the Space Force's leadership structure.* A clearly sustainable number of GOs combined with a GO distribution that enables healthy selection rates will best position the Space Force as it establishes its place among the sister services.

Career Field Sustainability

Our sustainability analysis of the five core officer career fields transitioning to the Space Force demonstrated that the Space Operations and Intelligence career fields were sustainable with only minor adjustments to their authorization structures. Similarly, for Cyberspace Operations, the billet structure would require very minor adjustments to satisfy the pyramid health criterion. The officer billet structures for the two acquisition-related career fields (62E/63A), however, require significant adjustments for both to meet the pyramid health criterion and become sustainable within the Space Force, as discussed in detail in Chapter 6.

Recommendation 4: *Perform minor adjustments to the officer billet structure for Space Operations, Intelligence, and Cyberspace Operations and major adjustments for Developmental Engineering and Acquisition Management career fields transitioning to the Space Force.* Align Space Force promotion ratios with LAF promotion ratios and ensure sustainability of these career fields within the Space Force.

Training Pipeline for Officers and Enlisted Personnel

The key challenges that emerged from our analysis of the training pipelines of officers and enlisted personnel, in the core career fields transferring to the Space Force, centered around three themes:

1. a generalist space operator model (an alternative discussed in FY 2020) that would channel all Space Force officers and enlisted personnel into generalist operator roles for the first four to eight years of their careers
2. the dearth of space-specific training for officers and enlisted personnel and, in particular, in the Intelligence and Cyberspace Operations career fields
3. the need for Space Force–specific PME platforms and expanded participation in PCE across ranks.

Generalist Space Operator Model

A principal mandate of the Space Force is to develop deep technical proficiencies that will lead to increased warfighting capabilities in the contested space environment. The widely discussed alternative of channeling Space Force officers and enlisted personnel belonging to the Intelligence and Cyberspace Operations career fields into generalist operator roles for the first four to eight years of their careers would have significant drawbacks and could result in multiple negative outcomes.

First, this model would risk undermining the development of deep technical capabilities and experienced technical leadership. The extensive training pipelines required in Intelligence and Cyberspace Operations, in particular, are necessary for the development of not only deep technical proficiency but also mid- and senior-level technical leadership. As of FY 2020, concerns had surfaced that mid- and senior-level technical leaders were in insufficient numbers for the Space Force. Under this model, the Space Force would no longer be able to produce 20-year experts in intelligence or cyber over a 20-year career or full-career, seasoned, and experienced leaders in these disciplines; rather, the maximum depth, breadth, and leadership opportunities in the discipline for typical intelligence or cyber senior officers at 20 years of service would be three four-year assignments. It would be extremely challenging to develop a leader to a mid or senior level within these technical disciplines in three tours.

Additionally, as all military services do, the Space Force partners with other national security organizations. For example, the Space Force intelligence officer would partner and collaborate within the larger intelligence community, in which civilian intelligence experts typically have careers of even longer than 20 years. We are not convinced that a space officer with three intelligence assignments in a 20-year Space Force career (e.g., lieutenant colonel) would be seen as being at parity with intelligence professionals in other national security intelligence organizations. If that were the case, the credibility, influence, and perceived effectiveness of the Space Force would suffer when international conflicts arise.

Notably, several interviewees in both Air Force and Space Force leadership roles (both officers and enlisted personnel) voiced serious apprehension over this proposed generalist space operator model.

However, as our analyses confirmed, the Space Force has an exemplary set of developmental experiences after IST that it can bring to bear, including Space Flag exercises, USAF Weapons School, and cross-disciplinary courses, such as the advanced warfighter follow-on course. The warfighting ethos and cross-disciplinary orientation seen as essential to the Space Force could be well developed under the existing personnel training and development model. Thus, we made the following recommendations.

Recommendation 5: *For both officers and enlisted personnel, maintain Intelligence and Cyberspace Operations as independent career fields* to ensure the growth of technical depth and breadth that will be required of mid and senior leaders in these disciplines.

Recommendation 6: *Create the integrated warfighting ethos and skill sets that are desired through cross-disciplinary, combined training opportunities; expanded simulation-based exercises and wargames; and educational emphases on space power and space strategy, involving all core Space Force disciplines* instead of having intelligence and cyber officers spend their first four to eight years in a generalist role.

Dearth of Space-Specific Training

We found that, overall, the training pipelines in the five core career fields are fundamentally sound, but additional space content is needed in several venues. For the short term, the Space Force must rely on AETC to fulfill many of its foundational training and educational needs.

Recommendation 7: As consistent with Recommendation 5, *maintain IST for officers and enlisted personnel in Intelligence and Cyberspace Operations through AETC,* but develop and insert space-specific modules as appropriate.

Recommendation 8: *Approach the training pipeline for the remaining three organic Space Force career fields with an eye toward replicating the diversity of content and learning experiences within the 13S training pipeline*, including tactics and strategy, continuing emphasis on and evaluation of technical proficiency, simulator-based exercises and wargames, and educational opportunities specific to space.

Recommendation 9: *Mandate Space 100 for all Space Force officers and enlisted personnel*. Mandatory attendance at Space 100 after graduation from IST and prior to reporting to the first Space Force assignment would assist with existing gaps in space- specific training and address concerns that personnel in their first assignments are not properly prepared for the space enterprise.

Recommendation 10: *Ensure that curriculum designers continue to be fully involved in designing space training across all five Space Force career fields* to maintain the training pipelines' current excellence.

Recommendation 11: *Attach space-specific training requirements for officers and enlisted personnel to programs of record within the Space Force* to ensure a steady source of funding to address Space Force–specific training needs.

Recommendation 12: *Perform a full training needs assessment across all five career fields as soon as it is feasible* to better and fully align the training pipelines for Space Force personnel with the service's mission and goals.

Space Force PME and PCE Programs

Existing Air Force PME programs provided by AETC and AU will not serve the doctrinal, educational, and developmental purposes of the Space Force over the long term. These Air Force–centric PME programs that Space Force professionals attend emphasize air power and air strategy to the near-total exclusion of content focused on space power and space strategy. Moreover, Air Force officers also need exposure to expanded space content to operate effectively within the DAF's two-service model.

Recommendation 13: *Considerably expand space-related content across the full scope of PME for both Space Force and Air Force officers* as the DAF establishes its two-service model. Develop PME programs that educate all students in an understanding of the Space Force and the elements of partnership with it, which will serve the needs of the DAF.

Recommendation 14: *Develop Space Force senior PME programs with a deep focus on and expertise in space power and space strategy* that will be essential for the development of the Space Force leadership cadre. One component, the Schriever Space Scholars program, will be pivotal to Space Force future leadership and to other services' understanding of the Space Force, and it should be rapidly expanded. Ensure that the Space Force's best and brightest are directed to the Schriever Space Scholars program.

Recommendation 15: *Consider increased space content and Space Force flights for SOS, which serves the O3 population.* These younger cohorts will be critical to building a future Space Force culture and to ensuring Air Force officers' understanding of the Space Force as the DAF establishes its two-service model.

Recommendation 16: *Standardize the delivery of PCE for enlisted personnel*, ensuring access for SNCOs in Intelligence, Cyberspace Operations, and Space Operations, such as allotments for SNCO attendance at Space 200 and Space 300 courses as these officers' careers progress.

Recommendation 17: As soon as practical, *charter a Space Education task force to begin preliminary planning for a Space Education/PME Center and timeline for its launch.*

Civilian Workforce Transferring to the Space Force

Key challenges associated with the civilian workforce transferring to the Space Force are related to the small size of the Space Force relative to other military services and the aging of the civilian space workforce, especially at the senior executive level. The small numbers of civilians in individual career fields may require the merging of these career fields or the combined management of them. Concerns were voiced during our interviews that most leadership positions in the Space Force will be filled "by default" with GOs instead of considering civilian leaders, such as SES, ST, and SL professionals who have a track record of successfully leading highly technical and space-focused organizations. To address these challenges, we made the following recommendations.

Recommendation 18: *Leverage lessons learned from the successful use of civilian leaders in other organizations that have similar technical orientations or space missions, such as AFRL and NASA;* civilian leaders can enhance organizational continuity and provide long-term technical leadership.

Recommendation 19: *Leverage DISES positions and existing Air Force SES, ST, and SL positions and consider requesting additional SL civilian positions* to mitigate some of the challenges related to the limited capability of the Space Force to organically generate the full number of GOs it will require.

Recommendation 20: *Establish a consortium of senior civilian human resource professionals* to advise and support the Space Force as it stands up its civilian workforce.

Final Remarks

At the time of this writing, the DAF was at an inflection point as it undertook the rare opportunity of standing up a new service. Congress made clear its intent that the Space Force would not be the former AFSPC under a different name. The enhanced space warfighting capabilities that the United States seeks must be enabled by an organization that understands and manifests deep technical expertise and excellent technical leadership.

Key challenges associated with standing up the Space Force as a warfighting military service, given its size and budget constraints, could require wider-ranging solutions instead of the more typical or traditional solutions. For instance, the Space Force could make more comprehensive use of senior civilian leaders and adopt best practices from industry. These solutions will also include a resolute emphasis on technical depth and superb technical leadership, a leadership model that is to be viewed not as being at odds with the more traditional, generalist approach to leadership, but as being additive and complementary.

The Space Force recognizes that its missions are broader than military operations and that within its responsibilities lies the protection of fundamental U.S. communications and economic assets. The options considered in this report to enhance the Space Force's structure and configuration affirm that the Space Force will be not an extension of the Air Force but rather an entirely new type of warfighting and national security organization.

Appendix A. GO Criteria and Requirements

Historically, Congress has set the rules that govern “appointments, assignments, grade structure, promotions, and separations” of general and flag officers (GFOs),[129] including “the number of GFOs authorized, the proportion of GFOs to the total force, compensation levels of GFOs, and duties and grades of certain GFOs.”[130] In addition, Congress sets the functions or duties for key positions, such as the “Joint Chiefs of Staff, the Combatant Commanders, the top two officers of each service, the Commander of U.S. Special Operations Command, and the Chief of the National Guard Bureau.”[131] For the majority of the remaining GFO positions, DoD has developed specific “criteria for determining whether a position is to be filled by a general or flag officer.”[132] These criteria are as follows:

- nature, characteristics, and function of the position
- grade and position of the GFO’s superior, principal subordinates, and lateral points of coordination
- degree of independence of operation
- official relations with other U.S. and foreign governmental positions
- magnitude of responsibilities
- mission and special requirements
- number, type, and value of resources managed and employed
- forces, personnel, value of equipment, and total obligation authority
- geographic area of responsibility
- authority to make decisions and commit resources
- development of policy
- national commitment to international agreements
- impact on national security and other national interests
- effect on the prestige of the nation or the armed force.[133]

In a 2018 report, RAND researchers presented an analytic methodology to evaluate GFO requirements that included four approaches: (1) an examination of the functions performed by GFOs within and across organizations, (2) a position-by-position review against a defined set of criteria, (3) the development and administration of a forced-choice exercise to identify priorities

[129] In the Army, Air Force, Space Force, and Marine Corps, the most-senior military officers with grades from O7 to O10 are referred to as “general officers,” while in the Navy, officers in these grades are referred to as “flag officers.”

[130] Lawrence Kapp, *General and Flag Officers in the U.S. Armed Forces: Background and Considerations for Congress*, Congressional Research Service, updated February 1, 2019.

[131] Kapp, 2019, p. 3.

[132] Kapp, 2019, p. 3.

[133] Kapp, 2019, pp. 3–4.

for how GFOs should be used, and (4) an evaluation of how positions affect the development of GFOs within functional areas.[134] The guidelines used in these reviews are summarized in Table A.1.

Table A.1. RAND Assessment Guidelines for GFO Requirements

Organization-Level Guidelines	Position-Level Guidelines
• Manage the flow of GFOs through senior ranks. • Decrease the use of GFO deputies and, particularly, assistants to deputies, deputies to assistants, assistants to assistants, etc. • Reduce circumstances in which one GFO reports to another GFO of the same grade. • Avoid “breaks” in GFO hierarchy (e.g., an O7 reporting to an O9). • Avoid duplicative responsibilities in the same immediate organization. • Increase the span of control of GFOs. • Assign direct reports to GFOs. • Maintain parity across equivalent types of internal organizations. • Use GFOs to support the direct mission of the organization.	• Military essentiality of the position (i.e., could this position be filled by a senior civilian?) • Consistency of span of control or responsibilities with peers (e.g., much smaller span than equivalent positions without mitigating additional duties) • Rank and number of immediate subordinates • Rank of immediate superiors • Parity with other like organizations, such as across services or combatant commands • Precedents in filling the position with more-junior or civilian persons

SOURCE: Adapted from Harrington et al., 2018.

[134] Lisa M. Harrington, Bart E. Bennett, Katharina Ley Best, David R. Frelinger, Paul W. Mayberry, Geoffrey McGovern, Igor Mikolic-Torreira, Sebastian Joon Bae, Barbara Bicksler, Lisa Davis, Steven Deane-Shinbrot, Joslyn Fleming, Ben Goirigolzarri, Russell Hanson, Connor P. Jackson, Kimberly Jackson, Sean Mann, Jenny Oberholtzer, Christina Panis, Alexander D. Rothenberg, Ricardo Sanchez, Matthew Sargent, Peter Schirmer, Hilary A. Smith, and Mitch Tuller, *Realigning the Stars: A Methodology for Reviewing Active Component General and Flag Officer Requirements*, RAND Corporation, RR-2384-OSD, 2018.

Appendix B. Comparison of Private Sector and Space Force Headquarters

In the context of our analysis of the number of GOs that the Space Force could develop internally and of the prevailing mindset among DAF leadership and Congress that a small Space Force headquarters staff would be "lean and agile," we carried out a brief, nonexhaustive review of the existing management literature to gain insights from both industry and the public sector regarding the relationship between the size of headquarters staff and performance.

As a general rule, the size and structure of headquarters depend on a few key elements, such as the absolute size of the organization,[135] its strategy, and its formal structure. The formal structure of the organization usually focuses on three elements:

- the number of discrete units reporting to headquarters
- divisional complexity[136]
- geographical scope, which usually increases with geographical diversification.

In our literature review, we found evidence that private sector companies with larger headquarters typically outperform those with smaller headquarters,[137] and we found no empirical evidence that a "lean and mean" headquarters is associated with superior financial performance. On the contrary, in many companies, a large corporate headquarters staff improved performance by creating value that more than paid for its costs, and companies reporting above-average profitability had, on average, 20-percent larger headquarters than the headquarters of less-profitable companies of similar size (in terms of number of employees).

Another key insight from the private sector is that structure should follow strategy; headquarters size and design need to be aligned with the organization's corporate strategy.[138] Although no ideal model regarding the standard size for a successful headquarters exists, cuts in headquarters staff do not automatically translate into high or improved performance; this lesson is often referred to as the "false promise of quick wins." On the other hand, private sector organizations that successfully improve performance do so by aligning headquarters size and

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[135] Shawki J. Bazzaz and Peter H. Grinyer, "Corporate Planning in the U.K.: The State of the Art in the 70s," *Strategic Management Journal*, Vol. 2, No. 2, April–June 1981, pp. 155–168; David Collis, David Young, and Michael Goold, "The Size, Structure, and Performance of Corporate Headquarters," *Strategic Management Journal*, Vol. 28, No. 4, April 2007, pp. 383–405.

[136] Organizations with greater divisional complexity tend to have significantly smaller headquarters because many of the activities are decentralized and take place at the unit level.

[137] Michael Goold and S. David Young, "When Lean Isn't Mean," *Harvard Business Review*, April 2005.

[138] Christopher A. Bartlett and Sumantra Ghoshal, *Managing Across Borders: The Transnational Solution*, Harvard Business School Press, 1989.

roles with their overall corporate strategies.[139] For public organizations, despite the negative connotation of overhead-related headquarters as government waste,[140] studies show that public organizations require sufficient overhead capacity to perform,[141] as well as to protect them from external shocks or crises.[142]

Also, headquarters size and overhead play an important role in a military service, where the option of lateral entry or of bringing in an external hire for a top uniformed leadership position does not exist. Leaders must be developed internally over decades, and it is imperative that the size of the officer and GO corps be large enough to provide a healthy pyramid that can sustain the GO corps. It is equally important for multiple candidates to be available to choose from when selecting individuals to promote into critical senior leadership roles.

Small private sector companies—which are often seen as the epitome of the lean-and-mean paradigm—do not face the pyramid problem that a military service does because they can hire from outside the organization at any time, thereby increasing competition for promotions and infusing new talent into the leadership pipeline. However, as military services cannot laterally hire a GO from outside their organizations, they are forced to promote from among the eligible officers at the next lower grade.

In this light, considering the constraints associated with growing from within and the high performance requirements and expectations of GOs in a military service, coupled with the very small size of the projected Space Force as of FY 2020, plus the selection rate challenges that were discussed in previous chapters of this report, Congress might want to exercise caution in severely limiting the size of the Space Force headquarters. Too small of a headquarters structure could ultimately hinder the overall performance of the service, instead of bringing in the touted benefits of a lean-and-mean organization.

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139 Goold and Young, 2005.

140 Rolf Bühner, "Governance Costs, Determinants, and Size of Corporate Headquarters," *Schmalenbach Business Review*, Vol. 52, April 2000, pp. 160–181.

141 Kenneth J. Meier and Laurence J. O'Toole, Jr., "Beware of Managers Not Bearing Gifts: How Management Capacity Augments the Impact of Managerial Networking," *Public Administration*, Vol. 88, No. 4, 2010, pp. 1025–1044; Rhys Andrews and George A. Boyne, "Corporate Capacity and Public Service Performance," *Public Administration*, Vol. 89, No. 3, 2011, pp. 894–908; Amanda Rutherford, "Reexamining Causes and Consequences: Does Administrative Intensity Matter for Organizational Performance?" *International Public Management Journal*, Vol. 19, No. 3, 2016, pp. 342–369.

142 Kenneth J. Meier and Laurence J. O'Toole, Jr., "The Dog That Didn't Bark: How Public Managers Handle Environmental Shocks," *Public Administration*, Vol. 87, No. 3, September 2009, pp. 485–502; Laurence J. O'Toole, Jr., and Kenneth J. Meier, "In Defense of Bureaucracy: Public Managerial Capacity, Slack and the Dampening of Environmental Shocks," *Public Management Review*, Vol. 12, No. 3, 2010, pp. 341–361.

Appendix C. Intelligence AFSC Details

Intelligence Officers (14N)

The Air Force intelligence officer's job description provides information on the type of work performed and typical duties. Intelligence officers "coordinate intelligence activities such as SIGINT, HUMINT, Numbered Air Force, Combatant Command and other operational units."[143]

The minimum education requirement for assignment into the intelligence officer career field is a bachelor's degree in one of the following disciplines: science, humanities, social sciences, structured analysis, engineering, or mathematics.[144] The Air Force also indicates that foreign language study is highly desirable. Air Force intelligence officers must complete the required training courses along with "12 months in commissioned service after completing the intelligence officer Initial Skills course performing intelligence functions."[145]

Intelligence officers (14N) "often work in conjunction" with the intelligence community, including "the [Central Intelligence Agency], [Defense Intelligence Agency] and with intelligence agencies in other branches of the military." They are responsible for conducting "information operations to include analysis of information vulnerability." They engage in "intelligence operations and applications activities"; planning, "collecting, exploiting, producing, and disseminating foreign military threat information; mapping, charting, and geodetic (MC&G) data application; developing intelligence policies and plans; and human, signals, imagery, and measurement and signature types of intelligence." They plan and coordinate the "use of intelligence resources, programming, and budgeting." Their actions support "force employment planning, execution, and combat assessment." They advise "commanders, government officials, and other users of intelligence information essential to military planning and aerospace operations."[146]

The qualifications to perform these functions are what drive the training courses and experience that intelligence officers must obtain. They must have the following:[147]

- knowledge of the means, methods, sources, and techniques used in intelligence operations, applications functions, and doctrine, including collection, exploitation, production, and dissemination of foreign military threat information derived from HUMINT, SIGINT, MASINT, and imagery intelligence

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[143] Rod Powers, "AFSC 14NX–Intelligence Officer: U.S. Air Force Commissioned Officer Job Descriptions," LiveAbout, September 17, 2019.

[144] USAF, "Careers: Intelligence Officer," webpage, undated-c.

[145] USAF, undated-c.

[146] All quoted text in this paragraph comes from Powers, 2019.

[147] List is adapted from Powers, 2019.

- an understanding of the theories, principles, and applications of the electromagnetic spectrum; U.S. and foreign space systems and operating parameters; and applications of intelligence information to support military operations, target materials, analysis, weaponeering, mission planning, force application, and combat assessment
- ongoing education and learning in the following areas:
  - information warfare operations, associated countermeasures, threats, and vulnerabilities
  - survival, evasion, resistance, escape, combat search and rescue, and Code of Conduct techniques and procedures
  - knowledge of the means, methods, sources, and techniques used in U.S. and allied military capabilities, organization, operations, and doctrine, as well as intelligence systems and acquisition management
  - intelligence force management and national intelligence community structure and relationships
  - intelligence oversight
  - foreign military capabilities, limitations, and employment techniques
  - fusion, analysis, processing, and proper handling of intelligence information
  - analytical methods, forecasting, and estimating techniques, as well as intelligence information–handling systems
  - national and DoD regulatory guidance for conducting intelligence activities and management-sustaining functions, such as intelligence communications and information systems, security, manpower, personnel, and training.

Intelligence (1N) Enlisted Personnel

The Intelligence career field "encompasses functions involved in collecting, producing, and distributing data that have strategic, tactical, or technical value from an intelligence viewpoint."[148] The following five enlisted intelligence positions were transitioning to the Space Force as of this writing. The AFECD from April 2020 defines these intelligence positions as follows:

- All Source Intelligence Analyst (1N0): "Performs/manages intelligence activities/functions including discovering, developing, evaluating, and providing intelligence information."[149]
- GEOINT Analyst (1N1): "Manages, supervises, and performs intelligence activities and functions including planning, collection, analysis, exploitation, development, and dissemination of multi-sensor geospatial and target intelligence products to support warfighting operations and other activities."[150]

148 AFECD, 2020b, p. 58.

149 AFECD, 2020b, p. 60.

150 AFECD, 2020b, p. 62.

- SIGINT Analyst (1N2): "Acquires, processes, identifies, analyzes, and reports on electromagnetic emissions. Operates electronic equipment and computer systems to exploit signals intelligence production efforts."[151]
- Fusion/Intelligence Analyst (1N4): "Performs and manages intelligence analysis activities/functions in all domains. Analyzes and exploits intelligence information, develops targets, and provides situational awareness for operations personnel and key leadership. Conducts research and develops assessments of adversarial actions and intentions. Drafts and disseminates long-term and time-sensitive intelligence reports to consumers worldwide."[152]
- Targeting Analyst (1N8): "Manages, supervises, and performs targeting intelligence activities and functions including analyzing targets. In addition, develops targeting solutions and evaluates effects in support of planning and execution of an effects-based approach to operations that achieves the commander's objectives."[153]

Entry Requirements for Enlisted Personnel

One of the evaluations that an enlistee must complete for entry into the Air Force (and all other military branches) is the Armed Services Vocational Aptitude Battery (ASVAB) exam, the scores from which are used to identify the most-suitable career assignments for enlistees.[154] The ASVAB contains ten subtests, which are sorted into four qualification areas—Mechanical (M), Administrative (A), General (G), and Electrical (E)—to determine the enlistee's AFSC.[155] Table C.1 shows the minimum scores required across each of these qualification areas for enlisted intelligence AFSCs. Only scores for Administrative and General are considered for intelligence AFSCs. It is important to note that the Air Force requires higher ASVAB scores than any of its sister services.[156] It is also important to note that the Administrative and General score requirements for intelligence are among the highest of any of the AFSCs.[157]

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[151] AFECD, 2020b, p. 65.

[152] AFECD, 2020b, p. 70.

[153] AFECD, 2020b, p. 74.

[154] Military.com, "ASVAB Scores and Air Force Jobs," webpage, undated.

[155] Military.com, undated; Stewart Smith, "How the ASVAB Score Is Computed: The Real Score of the ASVAB," LiveAbout, April 8, 2020.

[156] Military.com, undated.

[157] AFECD, 2020b, Attachment 4: Additional Mandatory Requirements for AFSC Entry–Enlisted.

Table C.1. Mandatory Intelligence AFSC Entry Requirements

	Minimum ASVAB Score			
Intelligence AFSC	Mechanical	Administrative	General	Electrical
1N0X1 (All Source)		64		
1N1X1A (GEOINT)			66	
1N2X1A (SIGINT)		72		
1N2X1C (SIGINT)		72/67*		
1N3X1/X (Cryptology)			72	
1N4X1A (Fusion)			62/57**	
1N4X1B (Fusion)			62	
1N7X1 (HUMINT)			72	
1N8X1 (Targeting)			66	

SOURCE: Adapted from AFECD, 2020b, Attachment 4.
NOTE: * Minimum score for 1N2X1C is 72 in A or 67 in A with a 60 on the cyber test; ** minimum score for 1N4X1A is 62 in G or 57 in G with a 60 on the cyber test.

Intelligence AFSC Qualifications

The training and qualifications for each intelligence AFSC differ depending on the work the enlisted member is expected to perform. Requirements vary in terms of prior education, training, ASVAB scores, and necessary knowledge for the job.

For All Source Intelligence Analyst (1N0), enlistees must have completed high school or received a General Educational Development equivalent, as well as completed the All Source Intelligence Apprentice course. Enlistees must also have a minimum score of 64 on the Administrative portion of the ASVAB. The AFECD lists a large variety of knowledge requirements, which include "intelligence organizations and systems; collection and reporting systems, procedures, and methods; intelligence information sources; [and] techniques of identifying, collating, evaluating, and analyzing information . . . ."[158]

GEOINT Analysts (1N1) must have completed high school and a GEOINT Apprentice course, along with having a minimum score of 66 on the General portion of the ASVAB. Among a longer list of mandatory knowledge areas are "basic and advanced imagery interpretation principles, techniques, and procedures for imagery exploitation, reports, and presentations; Air Force, DoD, and national imagery intelligence collection systems and procedures; [and] techniques of collating, analyzing, and evaluating imagery intelligence . . . ."[159]

Enlistees entering the SIGINT (1N2) field are required to have completed high school and the Electronic SIGINT course (for 1N2X1A) or the Communication SIGINT course (for 1N2X1XC). In addition, they must earn a minimum score of 72 on the Administration section of

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[158] AFECD, 2020b, p. 60.

[159] AFECD, 2020b, p. 62.

the ASVAB. Mandatory knowledge areas include “intelligence and cryptologic support operations provided to commanders, service cryptologic elements, and national agencies; joint service relationships and operational concepts; tasking strategies; [and] communications networks [and] radio wave propagation . . . .”[160]

Fusion/Intelligence Analysts (1N4) must have completed high school and the Digital Network Intelligence Analysis Apprentice course and Joint Cyber Analysis course (for 1N431A) or the Analysis and Production Apprentice course (for 1N431B). In addition to having a minimum score of 62 on the General portion of the ASVAB, enlistees in this field must be knowledgeable in “global communications procedures; analytical techniques; organization of the national intelligence structure; intelligence organizations and systems; Information Operations; [and] organization of designated military forces,” among other knowledge areas.[161]

Finally, enlistees entering the Targeting (1N8) career field must have completed high school and the Targeting Analyst multi-course pipeline, which consists of three courses: the Targeting Analyst course, the Target Coordination Mensuration course, and the Collateral Damage Estimation course. Enlistees must also earn a minimum score of 66 on the General portion of the ASVAB. Those looking to enter as Targeting Analysts must have knowledge in “basic imagery interpretation principles, techniques, and procedures for imagery exploitation; Air Force, DoD, and collection and reporting systems; [and] techniques of identifying, collating, evaluating, and analyzing information . . . ,” among many other knowledge areas.[162]

Intelligence Skill Levels

AFSCs also include reference to an individual’s skill level, which is based on education, on-the-job performance, and testing.[163] An enlistee’s skill level can be determined by the fourth character in their AFSC as follows:[164]

- 1, *helper*, typically for those entering technical school for an AFSC
- 3, *apprentice*, typically with graduation from technical school (E2–E3)
- 5, *journeyman*, typically after a period of on-the-job training and courses (E4–E5)
- 7, *craftsman*, typically on promotion to technical sergeant (E6–E7)
- 9, *superintendent*, typically on promotion to senior master sergeant (E8)
- 0, *Chief Enlisted Manager*, typically on promotion to chief master sergeant (E9).

We looked into the cross-training that would be needed for enlisted members joining the Space Force from a military service other than the Air Force. Regardless of the enlisted

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160 AFECD, 2020b, p. 65.

161 AFECD, 2020b, p. 70.

162 AFECD, 2020b, p. 74.

163 Air Force Instruction (AFI) 36-2101, *Classifying Military Personnel (Officer and Enlisted)*, Department of the Air Force, March 9, 2017.

164 AFI 36-2101, 2017; Rod Powers, “Air Force Specialty Codes,” LiveAbout, December 18, 2018.

member's skill level and rank on entry, they would be expected to start at the 3-level in the AFSC.[165] After graduation from the relevant technical school as a 3-level, the enlisted member could then work their way back up to the skill level that they previously held, likely at a faster pace than those without prior experience in the technical field.[166] We anticipate that there would be no reduction in rank, but this supposition has not been verified.

[165] AFECD, 2020b, p. 386; AFI 36-2101, 2017.

[166] AFECD, 2020b, p. 386; AFI 36-2101, 2017.

Appendix D. Training and Education for Space Force Intelligence Officers and Enlisted Personnel

Officers and enlisted personnel in the Intelligence career field, as well as CFMs who have already been working in the Space Force, shared suggestions for courses that would be particularly important for the officers and enlisted personnel transitioning into the space Intelligence career field. Table D.1 provides a list of these courses, along with their intended audiences (14N officers or 1N enlisted personnel), descriptions, durations, and locations. In an effort to distinguish course audiences at a glance, we employed color coding to designate courses for officers (purple), courses for enlisted personnel (blue), and courses offered to both officers and enlisted personnel (green).

As discussed in Chapter 4, these courses are currently offered by the Air Force and other agencies, and the Space Force will likely need to continue using other agencies' courses for the foreseeable future. Unless otherwise noted, the course descriptions in Table D.1 were provided by the career field representatives with whom we spoke about intelligence training, often taken directly from the AETC's course announcements webpage,[167] and lightly edited.

Table D.1. Training and Education for Space Force Intelligence Officers and Enlisted Personnel

Course Name	Audience	Description	Duration	Location
Intelligence Officer Initial Skills Course (ISR 100)	Officers (14N)	ISR 100 provides new personnel with an introduction to the breadth of AF Intelligence core expertise and establishes the foundation they will need to develop the specific knowledge and prerequisite skill sets for their development throughout their careers. All intelligence professionals will attend this 14N AFSC-awarding course (or receive an AFCFM waiver) prior to attending any other intelligence training courses. Note: ARC members must attend the 14N AFSC-awarding course (or receive an AFCFM waiver) within two years of assignment to a 14N billet.[a]	130 days	Goodfellow AFB

[167] AETC, "Education and Training Course Announcements," webpage, undated.

Course Name	Audience	Description	Duration	Location
Intelligence Intermediate Skills Course (ISR 200)	Officers (14N)	An in-residence course conducted immediately following SOS, ISR 200 is an intermediate skills course that focuses on the operational level of warfighting, integrating ISR operations in air, space, cyberspace, and ground operations. Officers will have an opportunity to complete ISR 200 following their attendance at SOS. The intent is to provide post-IST to CGOs to better prepare them for the leadership roles and responsibilities they will assume as captains. The course consists of modules for each of the core functional competencies (Analysis, Sensing Grid	5 days	AU
		Activities, Targeting, Collection), as well as one module dedicated to officer professional development (senior leader mentoring, career management, etc.).[a]		
Intelligence Master Skills Course (ISR 300)	Officers (14N) Enlisted (1N)	ISR 300 is an ISR advanced course that focuses on the strategic application of intelligence capabilities across all domains. The intent is to provide mid-career training to majors and major selects to prepare them for the leadership roles and responsibilities they will assume as FGOs. The course will again cover the core functional competencies but from a more strategic level, which includes the integration of ISR effects, strategy, policy, doctrine, law and acquisition across the joint military and intelligence communities. Officer professional development will be tailored to what a new major needs to know (budgeting, manpower, mentorship, etc.). ISR 300 is not mandatory at this time, but completion is highly encouraged for professional development. The 14N Force Development Council will determine future expectations and non-resident options for ISR 300 by FY 2020.[a]	15 days	Goodfellow AFB
Intelligence Senior Skills Course (ISR 400)	Officers (14N)	ISR 400 is a capstone course for colonels. The course should prepare career intelligence officers to lead ISR planning and programming, operate within the intelligence community, and integrate intelligence and ISR at the air component level in such positions as the CISR within an AOC. The majority of the ISR 400 course content will be taken from the AF ISR O6 Orientation course currently hosted by the HAF/A2. The ISR 400 course requirements are being finalized and will be available in the next update to the 14N Talent Management Framework.[a]	5 days	Pentagon

Course Name	Audience	Description	Duration	Location
SWIFTU	Officers (14N) Enlisted (1N)	The course provides students a broad-based understanding of the fundamental principles of space operations, including an overview of space as an operational domain, orbital mechanics, Annex 3-14 *Counterspace Operations*, AFTTP 3-1, AFTTP 3-3 IPE (ATT 2), and the capabilities and limitations of current U.S. space systems and adversary systems. SWIFTU also provides students with opportunities to apply tools and processes used to assess space intelligence, providing a foundation for individual units' MQT.[b]	15 days	Peterson SFB
Company Grade Officer SIGINT Orientation Seminar (CSOS)	Officers (14N)	CSOS provides a SIGINT overview for CGOs currently assigned to or who have been identified for assignment to an AF service Cryptologic Element unit. The course provides an academic overview of NSA/CSS and 70 ISRW organizations and resources, cryptologic authorities and relationships, the components of SIGINT as a discipline, and details of cryptologic mission areas and operations.	5 days	Fort Meade
Executive SIGINT Orientation Seminar (ESOS)	Officers (14N)	ESOS provides a SIGINT overview for FGOs currently assigned to or who have been identified for assignment as commander or Director of Operations and chief or senior master sergeants currently assigned to or who have been identified for assignment to the wing or group level within AF Service Cryptologic Element units. Additionally, the course is open on a space-available basis to other officers in command or to civilians who require knowledge of the SIGINT enterprise in the performance of their duties. ESOS provides an academic overview of the NSA/CSS mission, 70 ISRW organizations and resources, cryptologic authorities and relationships, the components of SIGINT as a discipline, details of cryptologic mission areas, and operational and tactical applications to military operations. The course also includes a Commanders Panel for discussions and mentorship between local commanders and attendees. Course instruction is conducted on a volunteer basis from joint military and civilian personnel stationed at Fort Meade, and facilitation is provided by the CSOS program manager.	4 days	Fort Meade
Applications in Critical Thinking (ACT) I	Officers (14N)	ACT I introduces advanced analytical techniques to equip analysts with the skills needed to triage information in the expanding realm of ISR. It employs a student-centric approach to training in which learners participate in discussions and discovery exercises to fully examine and appreciate the content. This approach puts the students in charge, leaving instructors to facilitate the event, answer questions, coach participants through difficult concepts, and keep the training on track.	5 days	Location not available

Course Name	Audience	Description	Duration	Location
ACT II	Officers (14N)	ACT II looks toward the middle of an analytic problem. The courses were intentionally decoupled so ACT II can be taken before or after ACT I. ACT II also discusses the basic [tenets] of critical thinking but goes more in depth with some common structured analytic techniques, such as chronologies and timelines and change analysis. This course is also relevant to those involved in operations, planning, or intelligence support to operations.	5 days	Location not available
ACT III	Officers (14N)	Description not available.	5 days	Location not available
Air Force Intelligence Support to Force Protection (FP) Intelligence Formal Training Unit (IFTU) Qualification Course	Officers (14N)	This course is designed as IQT for Air Force Intelligence and Security Forces personnel en route to their first role in providing intelligence support to FP. Graduates will have a thorough understanding of the intelligence duties, responsibilities, and associated tasks critical to successful integrated defense operations through informal lectures, guided discussions, and practical exercises.[c]	10 days	Air Force Expeditionary Center, Fort Dix
Air Force National Tactical Integration (NTI) Intelligence Initial Qualification Course (IIQC)	Officers (14N)	The AF NTI IIQC has been created to replace the AF NTI Initial Certification Training. It is designed to centralize newly assigned analysts to better aid in collaboration efforts and introduce them to AF NTI–enabling capabilities. The objective for this course is to establish a training baseline, standardize AF NTI training, and produce the highest quality of AF NTI analysts.	5 days	Location not available
*Cyberspace 200	Officers (14N) Enlisted (1N)	Students will expand their knowledge of full-spectrum cyberspace operations to develop their capability to apply tactical-level tasks to operational-level planning and integration in support of the joint warfighter. Cyberspace 200 is an intermediate PCE course designed for the development of cyberspace professionals. Course curriculum is structured to leverage students' career experience and training to demonstrate, explain, and plan defensive, offensive, and DODIN operations in support of the AF core missions and joint operations. Students learn how to articulate, apply, and integrate AF cyberspace capabilities and weapon systems at the operational level of the multi-domain battlespace. Cyberspace 200 is not an introductory course; Cyberspace 200 is a fast-paced, hands-on course for those individuals with advance understanding of the tactical level of cyber operations.[d]	40 hours distance learning; 15 days in residence	Wright-Patterson AFB

Course Name	Audience	Description	Duration	Location
*Cyberspace 300	Officers (14N) Enlisted (1N)	Cyberspace 300 is an advanced PCE course designed for the development of cyberspace professionals. Students' career experience and training are leveraged with the course curriculum to educate and develop cyberspace professionals on the strategic application and integration of cyberspace capabilities and resources in joint operations. Cyberspace 300 is not an introductory course. Note: Cyberspace 300 is not to be taken earlier than 2 years after Cyberspace 200. Cyberspace 200 may not be taken after Cyberspace 300.[e]	Duration not available	Location not available
Space 200	Officers (14N) Enlisted (1N)	Space 200 is the NSSI's mid-career course for space professional education. It develops space professionals who think critically about the application of space power. The course investigates two major areas: space systems development and space power. In each area, students actively participate in exercises challenging them to determine what to do given the dynamics and uncertainty of the national security environment. Space 200 was certified FVEY in September 2018, opening attendance to students from New Zealand. Additionally, the NSSI is initiating the development of a "FVEY+3" course to open a comparable, Space 200–like course to students from Japan, France, and Germany. This new course will be available in FY 2020.[f]	18 days	Peterson SFB
Space 300	Officers (14N) Enlisted (1N)	Space 300 is the NSSI's capstone course for space professional education. It develops space professionals who understand national policy considerations and strategic thought within an international geopolitical environment. Students will be able to critically address space acquisition, capabilities, and power at the operational and strategic levels across the range of military operations, as well as space power's strategic contributions to national security. A Space 300 Course open to FVEY partners is offered two times per year per memorandum signed by both the SecAF and the AF Chief of Staff.[g]	15 days	Peterson SFB
Intelligence Support to Defensive Cyber Operations (DCO)	Officers (14N) Enlisted (1N)	The Intelligence Support to DCO course provides students with requisite knowledge and hands-on experience in providing intelligence support to DCO missions and the Cyberspace Vulnerability Assessment/Hunter (CVA/H) weapon system. The course focuses on student education and training in intelligence analysis and tradecraft, product and brief building, mission support initiatives, and mission debriefing and reporting. Students learn to build intelligence products and briefings that are provided to cyberspace operators throughout the DCO mission life cycle. On completion of this course, students should be able to effectively provide intelligence support and products that drive and enhance DCO.	10 days	Lackland AFB

Course Name	Audience	Description	Duration	Location
Cyber Intelligence Formal Training Unit (CIFTU)	Officers (14N) Enlisted (1N)	CIFTU provides IQT in accordance with AFI 14-202, ver. 1, *Intelligence Training*, for intelligence personnel either en route or assigned to cyber units. Specifically, this course provides training in the unique aspects of cyber operations, as well as intelligence support to the AF cyber mission. Successful completion of the CIFTU curriculum fulfills all IQT requirements, and graduates are assigned Basic Qualification status. This is not an AFSC-awarding course. Graduates will be proficient in cyber intelligence mission tasks as indicated by the Master Task List / Course Training Standards (MTL/CTS) of this syllabus. The unit will award an AF Form 1256, Certificate of Training following satisfactory completion of all course requirements.	25 days or 200 hours	Joint Base San Antonio
AF HUMINT Integration Course (HIC)	Officers (14N)	The HIC provides ISR professionals (analysts, planners, targets officers) a foundation of knowledge for HUMINT. Students will enhance their ability to integrate HUMINT into unit-level intelligence planning, analysis, and targeting operations.	3.5 days	Lackland AFB
ISR Operators Course	Officers (14N)	This is an advanced course designed to prepare officer, enlisted, and civilian personnel for ISR Operations positions above wing level. The scope of training includes ISR asset capabilities; collection requirements, management procedures, and processes; ISR employment, planning, and execution considerations; operations management procedures, processes, and tools; and national, theater, coalition, and AF Processing Exploitation Dissemination systems. The course includes a field trip to an operational ISR collections unit and an integrated exercise.	25 days	Goodfellow AFB
*Joint Cyber Analysis Course (JCAC)	Enlisted (1N)	JCAC provides training to cyberspace ISR analysts in concepts ranging from fundamental networking, programming, and computer network architecture to robust computer network exploitation, offensive cyber operations (OCO), and DCO.[h]	120 days	Corry Station (Navy installation)
*Weapons Instructor Courses (WICs)	Enlisted (1N)	The USAF Weapons School teaches graduate-level WICs that provide the world's most advanced training in weapons and tactics employment to Combat, Mobility, and Special Operations AF officers and noncommissioned officers. The USAF Weapons School consists of 19 individual Weapons Squadrons (WPs) teaching 27 individual WICs. It is headquartered at Nellis AFB NV, with geographically separated WPs located at Barksdale AFB LA, Dyess AFB TX, Fairchild AFB WA, Hurlburt Field FL, Little Rock AFB AR (including Det 1, Rosecrans MO), McChord AFB WA, and Whiteman AFB MO.	108 days	Nellis AFB

Course Name	Audience	Description	Duration	Location
*Intermediate Communications Signals Analysis Course (451)	Enlisted (1N)	Training mid-level SIGINT ISR analysts in intermediate stages of signals search, analysis, target identification, and reporting to enhance their performed duties on various collection and analysis systems.[h]	92 days	Corry Station (Navy installation)
*Advanced Communications Signals Analysis Course (452)	Enlisted (1N)	Training experienced SIGINT analysts as subject-matter experts in signals search, analysis, and development by providing the knowledge and skills necessary to perform detailed analysis and reporting of known, unknown, and unusual signal variations of any configuration.[h]	83 days	Corry Station (Navy installation)
*Advanced Intelligence Instructor Course (AIIC)	Enlisted (1N)	The purpose of AIIC is to develop enlisted intelligence instructors skilled in conducting threat analysis and facilitating ISR integration into multi-Mission Design Series (MDS) mission planning, execution, and debriefing in a contested, degraded and operationally limited environment. AIIC provides a unique context in which students must demonstrate advanced skills in mission planning, adversary knowledge, ISR, and multi-MDS employment. The AF charges graduates of AIIC with leading, educating, and training their unit's personnel in core intelligence mission planning skills acquired during the course.	Duration not available	Location not available
Air Force Critical Thinking Structured Analysis Course (CTSAC)	Enlisted (1N)	CTSAC is a basic to intermediate analysis course for officer, enlisted, and civilian intelligence analysts of all specialties. This course will take analysts through academics on the subjects of bias, perception, intelligence community standards, and analytical methodologies that are used across all national-level agencies. Students become proficient in the application of 16 structured analytical techniques (SATs) against real-world and fictional scenarios in order to hone critical thinking skill sets. Students will use their newly acquired analysis skills to work through an extensive two-week exercise that will focus on the application of all SATs learned against real-world adversaries. Analysts completing the course will earn 4 credit hours in CCAF/AMU degree plans. Finally, graduates will be able to immediately apply critical thinking skills to any mission.[i]	15 days	Goodfellow AFB

Course Name	Audience	Description	Duration	Location
#Targeting Fundamentals Course	Enlisted (1N)	This course provides fundamental-level targeting intelligence training for DoD personnel who support targeting functions across all organizational spectrums and domains. The scope of training includes an introduction to targeting fundamentals, as well as a walkthrough of the Joint Targeting Cycle and Air Tasking Cycle with an emphasis on areas in which intelligence support to targeting is crucial. Emphasis areas include strategy-to-task methodology and the joint operational planning process; target system analysis processes and products; basic, intermediate, and advanced target development processes; effects-based approach to operations, highlighting kinetic and non-kinetic capabilities across all domains; boards, bureaus, centers, cells, and working groups ranging from Joint Targeting Coordination Boards to Joint Collections Management Boards; wing-level targeting responsibilities; and all functions of combat assessment. These emphasis areas are designed to provide non-targeting analysts with the foundational information to perform roles in support of target intelligence professionals and targeting analysts.[j]	19 days	Goodfellow AFB
*Intermediate Technical Electronic Intelligence Analysis Course (SIGE-3810)	Enlisted (1N)	Description not available.		
*Advanced Technical Electronic Intelligence Analysis Course (SIGE-4810)	Enlisted (1N)	Description not available.		

NOTE: We have color-coded the table as follows: purple = courses for officers only; green = courses for officers and enlisted personnel; and blue = courses for enlisted personnel only. * Mandatory courses for those members that are vectored onto those specific tracks; they will be open to multiple Intelligence AFSCs in the Space Force. # Mandatory course for those members vectored onto Targeting positions or tracks. AF = Air Force; AFCFM = Air Force Career Field Manager; AFTTP = Air Force Tactics, Techniques, and Procedures; AOC = Air Operations Center; ARC = Air Reserve Component; ATT = Air Transportability Training; CCAF/AMU = Community College of the Air Force/Air Military University; CISR = Chief of Intelligence, Surveillance, and Reconnaissance Division; FVEY = Five Eyes; HAF/A2 = Headquarters Air Force/Intelligence; IPE = Individual Protective Equipment; ISRW = Intelligence, Surveillance and Reconnaissance Wing; NSA/CSS = National Security Agency/Central Security Service.

[a] DAF, 2018.

[b] 319th Combat Training Squadron, undated.

[c] U.S. Air Force Expeditionary Operations School, “U.S. Air Force Expeditionary Operations School Course Catalog,” November 2019.

[d] Air Force Institute of Technology, “Cyber 200 Course Info,” webpage, undated-a.

[e] Air Force Institute of Technology, “Cyber 300 Course Info,” webpage, undated-b.

[f] NSSI Public Center, “Courses: Space 200 (SP200),” webpage, undated-a.

[g] NSSI Public Center, “Courses: Space 300 (SP300),” webpage, undated-b.

[h] Air Force detachment located at Corry Station in Pensacola, Florida, course description provided to the authors via email, September 9, 2020.

[i] 313th Training Squadron, *Book of Hawks 2019: Course Catalog*, Goodfellow Air Force Base, January 2019, p. 2.

[j] 313th Training Squadron, 2019, p. 1.

Appendix E. Cyberspace Training

Tables E.1–E.4 provide additional details regarding the cyberspace training available to incoming Space Force cyberspace officers.

Table E.1. UCT Courses

Phase	Course/Block	Duration	Location
Phase 1 (unclassified training)	• Intro to Cyber Ops • Operating Systems (Win/Linux) • Scripting • Network Fundamentals • Network Config	• 8 days • 8 days • 8 days • 6 days • 11 days	Keesler AFB
Phase 2 (classified training)	• Attack & Exploitation (OCO) • Defensive & DoDIN Ops • Industrial Control Systems • Telephony Networks • Strategic Network Warfare • Law & Ethics • Capstone • DoD 8570.1M (Security+)	• 14 days • 13 days • 4 days • 4 days • 8 days • 2 days • 8 days • 10 days	Keesler AFB

SOURCE: Adapted from USAF, "Undergraduate Cyber Training (UCT)," internal chart, undated-e.

Table E.2. 17S Training Pipelines

Function	IST (Keesler AFB)	IQT (39th IOS Hurlburt Field)	Total	MQT Unit Specific
17XSA–CST Tool Developer	23 weeks	13 weeks	36 weeks	Length varies
17XSA–Crash Header Operations	23 weeks	13 weeks	36 weeks	Length varies
17XSB–CMT Operations	23 weeks	94 weeks	117 weeks	Length varies
17XSB–NAS Operations	23 weeks	13 weeks	36 weeks	Length varies
17XSB–CPT Operations	23 weeks	12 weeks	35 weeks	Length varies

SOURCE: Adapted from USAF, undated-a.

Table E.3. Space-Related Topics to Be Included in UCT Curriculum Update

Topic Number	Description
6	RF Transmission
6.1	RF Theory
6.2	Antenna Principles
6.2.1	Basic Properties/Shapes
6.2.2	Propagation
6.2.3	Purpose
6.3	Modulation Techniques
6.4	Jamming
6.4.1	Basics
6.4.2	Causes
6.4.3	Countermeasures
6.4.4	Natural vs. Man-Made
6.4.5	Radiation Hazards
7	RF Systems
7.1	UHF/VHF Radios
7.2	LMR
7.3	ELMR
7.4	Point-to-Point (RF Kit [RFK], microwave, laser)
7.5	Radio over Internet Protocol (RoIP)
7.6	Retransmission/Relay (airborne and terrestrial)
8	Satellite Communications (SATCOM)
8.1	Satellite Orbits
8.2	SATCOM Bands Use and Limits
8.3	GPS/Navigation Warfare (NAVWAR)
8.4	MILSTAR/Global ASNT
8.5	WGS
8.6	MUOS
8.7	GBS
8.8	DoD Entry Points
8.9	Teleports/STEP/RGAP/SSEP
8.10	Broadband Global Area Network (BGAN)
8.11	Radar
8.11.1	Design
8.11.2	Architecture
8.11.3	Components
8.11.4	Configurations
8.12	Operational Uses of RF Transmission Systems
9	Spectrum Management
9.1	Spectrum Management/Frequency Allocation
9.2	Frequency Request
9.3	Satellite Access Request/Gateway Access Request (SAR/GAR)

SOURCE: Features information from AETC representative, email communication with the authors, April 2020.
NOTE: ASNT = aircrew strategic network terminal; ELMR = Enterprise Land Mobile Radio; GBS = Global Broadcast Service; LMR = Land Mobile Radio; MILSTAR = Military Strategic & Tactical Relay; MUOS = Mobile User Objective System; SSEP = STEM Student Employment Program; STEP = Stripes for Exceptional Performers; UHF/VHF = Ultra High Frequency/Very High Frequency; WGS = Wideband Global SATCOM Satellite.

Table E.4. Space Training Available to 17X Officers

Training Level	Description
IST or UCT	• Five days of space-related training is provided during UCT (Space and Satellite Networks course, which includes both unclassified and classified material). • As of FY 2020, in development for 17Ds (who will likely join MDTs): 112 hours of space training offered during UCT (most likely starting in early 2021 due to COVID-19–related delays).
IQT	• No formal space training is offered. • OJT is provided, if assigned to a Space Force unit. • If assigned to a Space Force MDT, specific MDT is provided at gaining unit.
MQT	• If assigned to the Space Force, MQT is specific to the space weapon system that officers will man (hence the need for mandatory Space 100 training right after IST or UCT).
Additional training offered (these courses are available to all 17X, but are assignment driven)	• Space 100 for the 17Xs who go into the Space Force, but as of FY 2020, this course is not mandatory for all those who join the Space Force. Space 100 is a two-week course provided at Peterson SFB. • As officers' careers progress, they become eligible to take Space 200 and Space 300.

SOURCE: Features information from AETC representative, interview with the authors, 2020.

Appendix F. Available Training and Education for Developmental Engineers

Table F.1 lists the courses that Developmental Engineers (62XX) are required to take to achieve DAWIA certifications.

Table F.1. Available Training and Education for Developmental Engineers

Program or Course	Content or Purpose	Duration	Location
Engineering Level 1 DAWIA Certification			
ACQ 1010* (replaces ACQ 101)	Fundamentals of systems acquisition management	To be determined	DAU Online
ENG 101*	Fundamentals of systems engineering	12 hours	DAU Online
CLE 003	Technical reviews	3 hours	DAU Online
PMT 0170	Risk management	To be determined	DAU Online
Engineering Level 2 DAWIA Certification			
ACQ 202*	Intermediate systems acquisition, Part A	19 hours	DAU Online
ACQ 203*	Intermediate systems acquisition, Part B	5 classroom days	Several optional locations
ENG 201*	Applied systems engineering in systems acquisition, Part I	9 hours	DAU Online
ENG 202	Applied systems engineering in systems acquisition, Part II	4 classroom days	Several optional locations
LOG 104*	Reliability, Availability, and Maintainability (RAM)	6 hours	DAU Online
Engineering Level 3 DAWIA Certification			
ENG 302	Advanced systems engineering	8.5 classroom days	Several optional locations
CLE 019	Modular open systems approach	3 hours	DAU Online
CLE 068	Intellectual property and data rights	4 hours	DAU Online
CLL 008	Designing for supportability in DoD systems	3 hours	DAU Online

SOURCES: Features information from DAU, undated-a; DAU, undated-b; DAU, undated-c.
NOTE: The information in this table was current as of November 1, 2020. * Courses are also required for program management certification (see Table G.1 in Appendix G).

Appendix G. Available Training and Education for Acquisition Managers

Table G.1 lists the courses that Acquisition Managers (63XX) are required to take to achieve DAWIA certifications in program management.

Table G.1. Available Training and Education for Acquisition Managers

Program or Course	Content or Purpose	Duration	Location
Program Management Level 1 DAWIA Certification			
ACQ 1010* (replaces ACQ 101)	Fundamentals of systems acquisition management	To be determined	DAU Online
ENG 101*	Fundamentals of systems engineering	12 hours	DAU Online
CLB 007	Cost analysis	4 hours	DAU Online
CLV 016	Introduction to earned value management	1 hour	DAU Online
Program Management Level 2 DAWIA Certification			
ACQ 202*	Intermediate systems acquisition, Part A	19 hours	DAU Online
ACQ 203*	Intermediate systems acquisition, Part B	5 classroom days	Several optional locations
PMT 2520	Program management tools course, Part I	To be determined	DAU Online
PMT 257	Program management tools course, Part II	5 classroom days	Several optional locations
CON 121	Contract planning	11 hours	DAU Online
CON 124	Contract execution	9 hours	DAU Online
CON 127	Contract management	8 hours	DAU Online
EVM 101	Fundamentals of earned value management	10 hours	DAU Online
ISA1010	Basic information systems acquisition	9 hours	DAU Online
Program Management Level 3 DAWIA Certification			
ACQ 315	Understanding industry	4.5 classroom days	Several optional locations
BCF 110	Fundamentals of business financial management	22 hours	DAU Online
ENG 201*	Applied systems engineering in defense acquisition, Part I	9 hours	DAU Online
EVM 263	Principles of schedule management	3 classroom days	Several optional locations
LOG 104*	Reliability, availability, and maintainability (RAM)	6 hours	DAU Online
PMT 355	Program management office course, Part A	9 hours	DAU Online
PMT 360	Program management office course, Part B	18.5 days	Several optional locations

SOURCES: Features information from DAU, undated-d; DAU, undated-e; DAU, undated-f.
NOTE: * Courses are also required for Developmental Engineer certification (see Table F.1 in Appendix F).

Abbreviations

ACSC	Air Command and Staff College
AETC	Air Education and Training Command
AFB	Air Force Base
AFECD	Air Force Enlisted Classification Directory
AFOCD	Air Force Officer Classification Directory
AFPC	Air Force Personnel Center
AFPC/DSYA	Air Force Personnel Center, Strategic Research and Assessment
AFRL	Air Force Research Laboratory
AFSC	Air Force Specialty Code
AFSPC	Air Force Space Command
ASVAB	Armed Services Vocational Aptitude Battery
AT	advanced training
AU	Air University
AWC	Air War College
BOS-IT	Base Operating Support–Information Technology
CFETP	Career Field Education and Training Plan
CFM	Career Field Manager
CGO	company grade officer
CMT	Combat Mission Team
CPT	Cyber Protection Team
CSO	Chief of Space Operations
CST	Computer Simulation Technology
CT	continuation training
CTS	Combat Training Squadron
DAF	Department of the Air Force
DAFSC	duty Air Force Specialty Code
DAU	Defense Acquisition University
DAWIA	Defense Acquisition Workforce Improvement Act
DISES	Defense Intelligence Senior Executive Service
DoD	U.S. Department of Defense
DODIN	Department of Defense information network
FGO	field grade officer
FY	fiscal year
FYDP	Future Years Defense Program
GEOINT	geospatial intelligence

GFO	general and flag officer
GO	general officer
GPS	Global Positioning System
GS	General Schedule
HUMINT	human intelligence
IQT	Initial Qualification Training
IR	institutional requirement
ISR	intelligence, surveillance, and reconnaissance
IST	Initial Skills Training
IT	information technology
JPME	joint professional military education
LAF	Line of the Air Force
MASINT	measurement and signature intelligence
MDT	Mission Defense Team
MQT	Mission Qualification Training
NAS	National Airspace Systems
NASA	National Aeronautics and Space Administration
NDAA	National Defense Authorization Act
NRO	National Reconnaissance Office
NSSI	National Security Space Institute
OCO	offensive cyber operations
OJT	on-the-job training
OPM	U.S. Office of Personnel Management
PAF	RAND Project AIR FORCE
PAS	Personnel Accounting System
PCE	professional continuing education
PCS	permanent change of station
PME	professional military education
RF	radio frequency
ROTC	Reserve Officer Training Corps
RSP	Ready Spacecrew Program
SecAF	Secretary of the Air Force
SES	Senior Executive Service
SIGINT	signals intelligence
SL	senior-level (position)
SOS	Squadron Officer School
SNCO	senior noncommissioned officer
ST	scientific and technical (position)
STARCOM	Space Training and Readiness Command

STP	student, transient, and personnel
SWIFTU	Space Warfighter Intelligence Formal Training Unit
UCT	Undergraduate Cyber Training
USAF	U.S. Air Force
USSPACECOM	U.S. Space Command
UST	Undergraduate Space Training

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AETC—*See* Air Education and Training Command.

AFECD—*See* Air Force Personnel Center, "Air Force Enlisted Classification Directory."

AFI—*See* Air Force Instruction.

AFOCD—*See* Air Force Personnel Center, "Air Force Officer Classification Directory."

AFPC—*See* Air Force Personnel Center.

AFPC/DSYA Civilian Workforce Ready Reference—*See* Air Force Personnel Center, Strategic Research and Assessment.

AFRL—*See* Air Force Research Laboratory.

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