Jacks of All Trades or Masters of Some?

Alternatives for Occupational Specialization in USAF Space Operations

BY

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ABSTRACT

This study examines the question of occupational specialization applied to United States Air Force (USAF) space operations. It begins with a historical look at the service's approach to specialization illustrating how the USAF's singular space operations officer career field directly contrasts with the service's traditional model for operations, which is more highly differentiated. The paper argues that the space operations career field's monolithic structure points to a preference for generalists in this area of operations, rather than more narrowly focused tactical experts. Acknowledging that a bias toward occupational breadth functioned adequately in an era in which space was not an actively contested military domain, the paper examines concerns about operator expertise that arise when considering a future operational space environment likely to rely more on tactical, time-compressed decision-making. The thesis asserts that future operational tasks associated with electronic warfare, orbital combat, and space battle management are areas that may require future specialization in order to achieve needed proficiency levels. It identifies several possible alternatives for career field restructuring, to include a semi-formal specialization model and a formalized specialization approach. Maintaining the status quo would require the least investment but would pose the most operational risk over the long term. The semi-formal model would retain some organizational agility and flexibility in the development and assignment of operators but would be more susceptible to disruption as leaders move on or business rule enforcement breaks down over time. The formal model offers the greatest opportunity for lasting change but would require significant upfront investment and a tolerance for administrative disruption.

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Introduction

The notion of occupational specialization defies easy categorization. It is a concept simultaneously ancient but possessed of modern relevance. Its intellectual underpinnings are complex, providing the basis for sophisticated models in diverse fields like economics and operational research, yet its ideas describe fundamental truisms that cut across the most basic activities of daily life. Its theoretical roots are grounded in such esoteric issues as the nature of expertise, experience, judgment, and efficiency, but its application is often found in commonplace, unexceptional human decision making: when to see a medical specialist, what type of store or vendor to patronize, or the kind of restaurant at which to eat. While the implications raised by the concept of specialization can appear intuitive or obvious, they nonetheless retain a level of nuance, with subtle trade-offs that can go unrecognized. Higher quality items may be readily available from a specialty hardware vendor, for example, albeit at significantly increased costs in comparison to more generalist department stores. Similarly, the choice to see a medical specialist instead of a general practitioner may incur higher financial costs or longer appointment waiting periods. When the situation under consideration transcends the individual actor level and crosses into organizational or system behavior, these intricacies become even more pronounced. What first appears to be a straightforward decision to improve efficiency or effectiveness within the workforce may in fact have deleterious higher-order effects that require consideration.

Consequently, it is unwise to view occupational specialization as a panacea, and organizational actors should therefore undertake it with care and a clear-eyed view of associated collateral effects. Often, the challenge is in understanding the trades between the benefits and costs of specialization, and in putting those trades in context with administrative and fiscal constraints, the operational environment, and the organization's prioritized mission sets. Only then can one perform a net assessment of the overall utility in a move toward or away from specialization. Such an analysis is now in order for space operations within the United States Air Force (USAF).

USAF space operations are in the midst of a sea change, driven by an adjustment in how nation-state actors view the military utility of space. Though militaries and intelligence agencies have traditionally used space systems to support terrestrial conflict on the land, in the air, or at sea, armed conflict in space itself is now becoming recognized as a viable and realistic (if not yet normative) way to contest geopolitical will. As near-peer potential adversaries more actively compete in space, the USAF career field of space operations is evolving from a discipline primarily focused on the provision of space-enabled terrestrially-focused services like satellite communications, reconnaissance, missile warning, and position, navigation and timing, into one that also recognizes the parallel imperative for war-fighting *within* the space domain.

Accompanying the paradigm shift toward orbital combat are significant changes in how the Air Force and, to a lesser extent the other services, are organized, trained, and equipped for operations in space. For example, the US Department of Defense (DoD) and Intelligence Community (IC) have, in the last two years, brought online the National Space Defense Center (NSDC), located at Schriever Air Force Base in Colorado. The mission of the operational-level command and control center is to bridge organizational seams and ensure unity of effort in the defense of critical space assets.[1] Additionally, in 2015 Air Force Space Command (AFSPC) implemented the Space Mission Force (SMF) training and force presentation construct. According to General John Hyten—then AFSPC Commander and later the Combatant Commander of United States Strategic Command (USSTRATCOM)—SMF is intended to "transform our culture" and "prepare our space forces to meet new challenges within the space domain."[2]

These changes show the widespread recognition on the part of senior military leaders that space is a future battleground. Apart from these significant developments to improve US space mission assurance, however, it is less clear

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[1] Phillip Swarts, "The JICSpOC is Dead; Long Live the National Space Defense Center," *Space News*, April 4, 2017.
[2] Gen. John Hyten, "Space Mission Force: Developing Space Warfighters for Tomorrow," Air Force Space Command White Paper, June 29, 2016, 1.

whether USAF space operators are currently gaining and honing the skills and expertise needed to threat-react in a dynamic tactical environment.

The service's monolithic approach toward space operations career field management points to a preference for generalization, deviating from norms found elsewhere in the Air Force and further exacerbating concerns over expertise shortfalls. The USAF aviation community, in contrast, has historically favored a specialized approach to career field management, typically (but not always) institutionalized by differentiating formal specialties along with associated training pipelines, assignment management norms, and distinctive career pyramids. Indeed, in 2018 the service administered nine broad functional specialties, termed functional areas, for pilot duty alone.[3] In the conduct of space operations, however, encumbered by functionally dissimilar capabilities and a diverse array of platforms,[4] the USAF's solitary officer specialty stands in clear juxtaposition with the service's personnel model for flying operations.

Common practice within the career field is for junior officers to have two to three assignments in different squadrons at the tactical level supporting a variety of mission types.[5] The operational activities of these squadrons can range broadly from ground-based radar sensor operations to satellite command and control, ground-based electronic warfare, or space-based Rendezvous and Proximity Operations (RPO). Operators normally receive just-in-time qualification training upon arrival at their units. With the widely varying missions and tasks associated with each subsequent assignment, the ability for members to reliably lean on experience gained in previous squadrons is implausible.

To date, in a quiescent space domain with few operationalized threats, this personnel construct has worked adequately to meet the needs of the Air Force. In the future, however, analysts forecast contextual conditions to change. In-domain space threats are likely to continue to advance, and theater

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[3] Department of the Air Force (DAF), "Air Force Officer Classification Directory (AFOCD)," Headquarters Department of the Air Force, 2018, Attachment 3, 1-3.
[4] Joint Staff, "Joint Publication 3-14: Space Operations," ix.
[5] Maj Gen Martin Whelan, "Space Officer Allocation Plan," (Director of Future Operations, Headquarters Department of the Air Force).

demands for space-provided force-enhancement services will become more sophisticated. In this operational environment, space operators may require greater depth of expertise within a specific type of tactical operations than is currently institutionally built and maintained under the generalist approach for space operations manning. Rather than holding space operators accountable for combat effectiveness across all space mission types, a more successful method may be to build expertise in a subset of those missions, to focus on creating depth instead of breadth during the junior portion of an operator's career. As the nation prepares for warfare in space, the question of what degree of specialization best postures the Air Force's space cadre for success is a crucial one to investigate.

This paper examines the question of occupational specialization applied to USAF space operations. It identifies several possible futures for career field structuring, to include the status quo. For each of the options identified and in the hypothetical context of a fully-contested, militarized space domain, the thesis investigates expected benefits and drawbacks of specialization. The fundamental assumption of this thesis is that, while specialization *could* offer important advantages in relation to operational effectiveness, there are likely to be related costs and other institutional impacts that come along in the exchange. Accordingly, this thesis aims to codify the terms of the trade. Some of the questions it seeks to answer include the following:

1) What is the operational benefit realized by greater specialization in USAF space operations? What military problem is solved?
2) What is lost in terms of experiential breadth over the course of a typical career?
3) Qualitatively, what are the expected financial trades in terms of personnel, training, and operations costs?

The paper seeks to optimize a career field structural model describing not only the conditions under which operational benefits can derive from space occupational specialization, but also the circumstances that would yield those benefits at an acceptable institutional cost to the Air Force.

The analysis contained in this thesis is applied to a United States Air Force organizational framework. While its conclusions could be leveraged in the future and applied toward other organizations performing space operations, it does not formally consider hypothetical institutional schemas such as the separate "Space Corps" recently proposed in the United States Congress.[6] The enlisted space operations career field, while certainly worthy of similar study, is also outside the scope of the paper. Finally, this thesis examines career field structures within a current or near-future context. It reflects the present geopolitical landscape along with friendly and adversarial space technological capabilities that are either already operational or forecasted with high confidence by defense experts. Simply put, this thesis aims to investigate issues within space operations officer manning that the Air Force is likely to encounter in the next 10-15 years.

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[6] Gregory Hellman, "Space Corps, Budget Debates Top NDAA Conference Issues.," *Politico,* October 17, 2017.

Chapter 2

A Historical Review of United States Air Force Occupational Classification

Before examining the United States Air Force space operations career field, it is useful to provide a broader context by describing how the larger Air Force has historically viewed specialization and how the service's personnel classification system has changed over time.

The Foundations of the Air Force Specialty Classification Structure

Carved from the Department of the Army under the National Security Act of 1947, the United States Air Force initially based its personnel categorization system on its progenitor's military occupational specialty (MOS) system. In fact, until 1950, enlisted members were still referred to as soldiers, not airmen. It was not until 1951 that a three-year effort known as "Operation Searchlight" revamped the MOS schema to better fit the nascent independent air service's organizational needs.[1] The heart of the differences between the Army and the Air Force personnel systems were in the latter's much greater need for technicians and correspondingly fewer combat occupations within the enlisted ranks.[2]

The Air Force codified its first organically-derived manning structure during in the mid-1950s, complete with a new coding schema and new technology-oriented specialties.[3] It was during this period that the term Air Force Specialty Code (AFSC) was first defined, as "a combination of meaningful digits used to identify an air force specialty."[4] Air Force Manual (AFM) 35-1, "Warrant Officer and Airman Classification," straightforwardly asserted that the service's objective for specialty classification was to "identify accurately the [required] abilities of persons…as a basis for effective personnel management."[5]

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[1] Raymond E. Conley and Albert A. Robbert, "Air Force Officer Specialty Strucure: Reviewing the Fundamentals," RAND Report TR637 (Santa Monica, CA: RAND, 2009), 13.
[2] Ibid.
[3] Ibid., 3.
[4] Department of the Air Force (DAF), "Warrant Officer and Airman Classification Manual," Air Force Manual 35-1, Volume 1, Headquarters Department of the Air Force, 1956, 1.
[5] Ibid., 3.

Then, as now, the Air Force showed a concern for economically organizing its personnel system into the minimum required number of specialties to accomplish its assigned missions. AFM 35-1 dictated that each air force specialty should cover a group of positions that "require essentially the same basic knowledges, skills, and abilities."[6] Importantly, the document went on to direct that within any given specialty, "Airmen demonstrating proficiency in one position should be capable of performing satisfactorily in other positions within the same [specialty] with a minimum of amount of on-the-job training."[7] Thresholds for what constituted acceptable amounts of additional on-the-job training for follow-on positions were left undefined in this overarching regulation as a matter of practicality and organizational flexibility.

The Air Force assembled specialties using a technique it termed "functional grouping," oriented around similarities in "educational background, experience, knowledge, and training."[8] Functional grouping offered a means to keep occupational classifications relatively stable in the midst of organizational upheaval—especially within a still-young military department.[9] It also facilitated efficiency in related areas of the personnel system, such as training, professional development, and assignments.[10]

Early on in its history, the Air Force also incorporated a second foundational concept, "practical specialization," into its personnel system lexicon. Practical specialization recognized that "no one person is likely to perform all of a specialty's tasks in any one job." Rather, members utilize only a practical subset of Air Force Specialty (AFS) qualifications in order to conduct their duties, but can be quickly trained in tangential duty positions within the specialty.[11] This realization carried important implications for early Air Force career field management, since it drove the service to define the minimum set of common tasks, skill levels, and qualifications for a given specialty. It allowed training pipelines to streamline their instruction and to reasonably defer less

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[6] Ibid.
[7] Ibid.
[8] Ibid.
[9] Conley and Robbert, 4.
[10] Ibid.
[11] Ibid.

common skills to be developed separately once at a gaining assignment through unit-provided training. Finally, it eliminated "the need to develop overlapping [specialties] for all possible position combinations required in Air Force organizations."[12] At its core, practical specialization sought to "provide the degree of workforce specialization that is most efficient for almost all work situations."[13] Qualifications within a specialty were essential in filling the gaps wrought by this streamlined approach. Qualifications were expressed in "terms of knowledge, education, experience, training, and other factors"[14] required to perform positional tasks, and identified as either "mandatory" or "desired." Any individual possessing the mandatory qualifications, performing satisfactorily in any of the positions within the specialty, and meeting minimum experience requirements (as applicable) was considered qualified for award of the AFSC, even if further qualification was necessary upon the assumption of different positions or roles.

As a whole, the Air Force specialty-classification structure was intended from its inception to identify the qualifications associated with various Air Force specialties and to describe the necessary "knowledge, skills, and abilities" for Air Force positions. The system combined duties and tasks into "cohesive job clusters" with minimal overlapping skillsets that could be matched to members possessing the essential aptitudes, attributes, and qualifications. The structure permitted "training, information retrieval, counting, analyzing, and otherwise informing the Air Force of its human capital needs."[15] Ultimately, it governed the productivity of the service by "providing labels and categories that are used to bundle tasks and duties into skill sets, occupations, positions, and jobs."[16] The service's first organic classification schema grouped specialties first into career fields (the first two digits of the AFSC), then into career field subdivisions (the AFSC's third digit). Taking into account an associated skill level (the fourth digit) and any other differentiated job titles within the career field subdivision (the fifth digit) defined the full AFS. Lastly, suffixes were used to denote and

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[12] Department of the Air Force (DAF), "Military Personnel Classification Policy Manual (Officers, Warrant Officers, Airmen)," Air Force Manual 35-1, Headquarters Department of the Air Force, 1966, 5.
[13]Ibid., 5-6.
[14] Ibid., 6.
[15] Conley and Robbert, 3.
[16] Ibid.

track specific equipment types, functions, or positions associated with a complete AFSC. An illustrative example from a mid-1950s release of AFM 35-1 is shown in Figure 1. The structure of the Air Force's classification system remained substantively unmodified for nearly four decades after its inception, until tectonic shifts in the geopolitical and domestic political environments forced a change.

34	Career Field	Training Devices.
4	Career Field Subdivision.	Gunnery.
3	Skill Level	Semiskilled Level.
0	Specific AFS	Apprentice Gunnery Trainer Specialist.
A	Shredout identifying type of equipment (E–26 Type Trainer).	
34 4 3 0 A	Complete code of Apprentice Gunnery Trainer Specialist (E–26 Type Trainer).	

Figure 1: Legacy USAF AFSC Nomenclature Exemplar
Source: Adapted from "Warrant Officer and Airman Classification Manual," Air Force Manual 35-1, 1 March 1956.

Post-Cold War Drawdown and the Impact on AF Personnel Classification

The end of the Cold War and soon-to-follow changes in federal budgetary policy in the United States had a tremendous impact on the Air Force personnel system. In response to the political demands for belt-tightening in light of the perceived reduced threat, the DoD slashed the number of active duty officers across all services by 23% between 1989 and 1996, with the Air Force itself absorbing a slightly higher share at 24%.[17] To achieve these cuts, the Air Force drastically reduced its new officer accessions, by as much as 37% in 1993 compared to pre-drawdown levels, for example. The service also made use of temporary personnel management authorities granted by Congress to decrease

[17] Congressional Budget Office (CBO), "CBO Paper: The Drawdown of the Military Officer Corps," (Washington D.C.: CBO, November 1, 1999), 1.

numbers of existing officers, including voluntary separation incentives, early retirement offers, and special separation benefits.[18]

The dramatic cuts in personnel, as to be expected, were not without collateral impacts. To accommodate its slimmer stature, the Air Force took on a massive reorganization effort. It downsized from thirteen to eight major commands and deactivated 64 wings or equivalents.[19] It also consolidated all professional military education and initial training functions, regardless of mission area, under Air Education and Training Command (AETC).[20]

In addition, the specialty-code structure and the associated training for every officer and enlisted career field were reviewed and revised. Ostensibly, the intent of the reorganization was to better match the specialties with the needs of the restructured Air Force and to realign career fields that had become disjointed in the nearly forty years since the creation of the classification structure. Accordingly, career fields were sorted into "career groups" denoting a particular type of duty (e.g. operations, acquisitions, medical, etc.). Another stated goal of the restructure was to decrease the number of members serving in smaller specialties by combining similar specialties. The service wanted to create more generalists, which it thought would be needed in a smaller, more stretched force. It retained, however, the ability to identify special and unique experience sets through Special Experience Identifiers (SEI). These alphanumeric codes, distinct from AFSCs, are intended to "complement other classification tools to provide the means to record and retrieve specific experience and training to satisfy management needs."[21]

The Modern USAF Occupational Specialization Structure

Overall, the post-Cold War personnel system restructuring, in conjunction with the drawdown, reduced the number of officer AFSCs from 216 to 123. Training pipeline and personnel systems also adjusted to match this new paradigm. The overhauled classification structure was formally

[18] Ibid., 17.
[19] Conley and Robbert, 14.
[20] Ibid.
[21] "Air Force Officer Classification Directory (AFOCD)," 2018, 258.

implemented in October 1993; it has remained essentially unchanged through the present day. The updated nomenclature is described in Table 1.[22]

Table 1: Modern AFSC Nomenclature

LINE	A Character	B Identifies
1	first **(numeric**)	Career group. **1** - Operations **2** - Logistics **3** - Support **4** - Medical or Dental **5** - Legal or Chaplain **6** - Acquisition or Finance **7** - Special Investigations **8** - Special Duty Identifier **9** - Reporting Identifier
2	second combined with first character (**numeric**)	Utilization field. ***Example:*** 1**1** - Operations, **Pilot**
3	third combined with first and second character **(alpha)**	Functional area. ***Example:*** 11**B** - Operations, Pilot, **Bomber Pilot**
4	fourth (**numeric)**	Qualification level. 1 - Entry 2 - Intermediate 3 - Qualified 4 - Staff ***Examples:*** 11B**3** - Operations, Pilot, Bomber Pilot, **qualified**. 11B**4** - Operations, Pilot, Bomber Pilot, **qualified and serving in a staff position above wing level**
5	**alpha** prefix	An ability, skill, special qualification, or system designator not restricted to a single AFSC. ***Example:*** **A – Operational Warfare Instructor**
6	**alpha** suffix (shred out)	Positions associated with particular equipment or functions within a single specialty. ***Example:*** 11B3**A -** Operations, Pilot, Bomber Pilot, qualified, **B-1**

Source: Adapted from "Classifying Military Personnel (Officer and Enlisted)," Air Force Instruction 36-2101, 11.

The Air Force occupational classification structure, designated by AFSCs, underpins the service's three-pronged "human capital" system, comprised of manpower, personnel, and training elements, by "providing a language that facilitates communication within and across" the elements.[23] Because of their

[22] Conley and Robbert, 14.
[23] Ibid., 13.

relevance to the idea of occupational specialization, the three primary elements of the USAF human capital system deserve further elaboration.

Manpower

The manpower element of this system focuses on assessing organizational requirements for human resources that most effectively and efficiently enable the service to accomplish its assigned missions. The intent of the manpower element is to specify human capital requirements in terms of quantity, specialty codes, and measures of experience. Unit Manpower Documents (UMDs) are created and maintained based on these requirements, prioritized in the event of supply deficits to fall within mandated end-strength constraints.[24] Specialization affects manpower requirements in the sense that highly specialized positions necessitate strenuous qualification thresholds—placing a burden on the service to temporally and financially invest in accession, training, and assignment management efforts to furnish the needed supply of human capital.

Personnel

The personnel element manages the supply of human capital through the accession and assignment management process.[25] It aims to provide unit commanders with the "best mix of mission-ready people." According to UMD specialty and grade specifications, members are assigned "as equitably as possible" to meet AF manpower requirements. To estimate future needs, workforce sustainment models are created, which in turn "generate accession requirements, academic targets, and acceptable ranges for accessions by AFSC for future fiscal years."[26]

Depending on associated positional qualification and experience requirements, occupational specialization can significantly affect organizational agility by either hampering or enabling flexible assignment of members. Low degrees of formal specialization generally permit more leeway in identifying and designating personnel for assignment because of less stringent UMD

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[24] Ibid., 10.
[25] Ibid.
[26] Ibid., 10-11.

specifications. Furthermore, specialization can impact the accession of qualified personnel based on career field educational requirements.

Training

The training element of the human capital system involves developing the Airman to successfully execute required positional tasks and functions. Adequacy of training and the "timely progression" from entry level to follow-on qualified levels are critical to the Air Force's readiness.[27] The Air Force has evolved a complex training system to meet AFS training requirements from members' initial entry into the service and continuing throughout their careers as they progress professionally. Three generalized, overarching categories of training are used by the operational Air Force—qualification training, continuation training, and specialized training.

Qualification Training (QT) refers to "hands-on performance training designed to qualify an Airman in a specific position."[28] It can occur within a Formal Training Unit (FTU), at an operational unit, or even in the field, in accordance with published policy and guidance. Subtypes of qualification training include initial qualification training (IQT), requalification, conversion/difference qualification, multiple qualification, senior officer qualification, and mission qualification training (MQT).[29] Formal evaluations are typically required to culminate qualification training.

Continuation Training (CT) "provides crew members with the volume, frequency, and mix of training necessary to maintain proficiency in the assigned certification/qualification level."[30] Typical qualification levels include Basic System Qualification, Basic Mission Capable, and Mission Ready (MR) or Combat Mission Ready (CMR), depending on the unit's operational mission.[31]

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[27] Ibid., 11.
[28] Department of the Air Force (DAF), "Air Force Training Program," Air Force Instruction 36-2201, Headquarters Department of the Air Force, 2010, 114.
[29] "Aircrew Training," Air Force Instruction 11-202, Volume 1, Headquarters Department of the Air Force, 2010, 7-12.
[30] Ibid., 12.
[31] Ibid.

Specialized training (ST) is “training in any special skill(s) necessary to carry out the unit's assigned missions that is not required by every [operator].”[32] Examples of Air Force specialized training include variants of upgrade training (UT) for special positions such as Flight Lead, Instructor Pilot Upgrade, Mission Commander, or Forward Air Controller-Airborne. It can also refer to training covering the use of special equipment, such as targeting pods or night vision goggles. This training may be conducted separately or during QT or CT, as required.[33] Advanced Training (AT) is another ST variant, one that AFSPC in particular espouses. AT refers to exercises, events, or formal courses intended to provide qualified operators with additional skills and knowledge to enhance their expertise in their associated career field.[34] AFSPC leverages AT particularly as it relates to “mission accomplishment in a contested, degraded, and operationally limited environment.”[35]

The relationship between training, specialization, and occupational tasks is both intuitive and foundational. The more difficult, complex, critical, or risky a task, the more training is typically required to master it at an acceptable level of proficiency. In turn, the more training required to enable an individual to accomplish a given set of tasks—some of which may be “training intensive”—the less capacity exists for that individual to learn and master other tasks. The need for specialization arises from this phenomenon. It reflects the capacity limits of both an organization and the individual in training and mastering a given skillset.

Modern Air Force Occupational Specialization Exemplars

In the Air Force today, the medical and rated officer career fields have the highest degree of formal specialization.[36] Medical specialties essentially mirror civilian sector constructs, reflecting the unique education, training and experience needed to safely care for patients in a variety of fields. In encompassing the Air Force’s largest population of operational warfighters,

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[32] Department of the Air Force (DAF), "F-16--Pilot Training," Air Force Instruction 11-2F-16, Volume 1, Headquarters Department of the Air Force, 2015, 9.
[33] Ibid., 44-67.
[34] "Air Force Training Program," Air Force Instruction 36-2201, 2010, 109.
[35] Major Keith Harrigan, Interview on Air Force Space Command Training Initiatives, Via telephone., March 2018.
[36] "Air Force Officer Classification Directory (AFOCD)," 2018, Attachment 3, 1-6, 10-21.

however, the rated officer specialty structure (identifying aircrew members serving in, or qualified to serve in, pilot, CSO, flight test positions, astronaut, air battle manager, and remotely piloted aircraft pilot positions) is informative to evaluating the service's approach toward occupational specialization for which there is no easy parallel in civilian life. In the pilot utilization field (11x), for example, there are nine distinct functional areas distinguishing fighter pilots from bomber pilots, mobility pilots, special operations pilots, and the like. Once AFSC suffixes—termed "shred-outs"—denoting platform types are included, the total number of distinct pilot specialties climbs to 101, each with its own unique training pipeline, manpower requirements, and assignment management processes.[37] For Combat System Officers (CSO; 12x), seven functional areas comprise 87 specialties. Another category of rated officers—Air Battle Managers (ABM)—has only a single functional area (13B) but includes eight specialties associated with platforms and functions like the Airborne Warning and Control System (AWACS), Mobile Air Control, the Joint Surveillance Target Attack Radar System (JSTARS), and others.[38] Beyond the numerical totals for rated career fields, it is further notable that for most rated officers, movement among different operational AFSCs is the exception rather than the rule. Once assigned to a given specialty—a platform or mission area—it is rare for a pilot, CSO or ABM to move to a different AFSC. In those unusual instances, the service typically requires dedicated training at a Formal Training Unit (FTU) or other appropriate course.

The contrast in formal specialization between the rated career fields and other Air Force operational career fields is dramatic. The cyber operations utilization field (17x), for example, has two functional areas: cyberspace operations (17D)—responsible for administration of the Air Force Network (AFNET)—and cyberwarfare operations (17S), accountable for the conduct of offensive and defensive cyberwarfare. The 17D and 17S functional areas include eight and nine career fields, respectively, denoted by AFSC shred-outs.[39] In contrast to the rated career fields, however, it is not at all uncommon for cyber

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[37] Ibid., Attachment 3, 1-3.
[38] Ibid., Attachment 3, 3-7.
[39] Ibid., Attachment 3, 8.

operators to move back and forth between the utilization field's two functional areas, as well as between shred-outs. Indeed, according to policy, no cyber professional is to have a "core" 17Sxx AFSC. Rather, members assigned as a cyberwarfare operator will have that specialty only on a temporary basis while assigned to a cyberwarfare unit and will retain a core 17D AFSC. The arrangement was driven by a purported desire to create "both specialists and generalists within the utilization field."[40] An important consequence, however, is that cyberwarfare units must rely on informal means to gain qualified members, placing a heavy burden on Air Force Personnel Center (AFPC) assignment team officers to match member skills, training, and experience with appropriate cyberwarfare billets. Reaction from the field to this approach has been mixed.[41]

The USAF Intelligence career field (14N) also values generalists. Its solitary AFSC, devoid of any shred-outs, performs intelligence activities "across the full range of military operations "supporting global integrated Intelligence, Surveillance and Reconnaissance (ISR)."[42] Air Force intelligence officers must maintain competency in four functional competencies: Analysis, Collection, Integration, and Targeting. Moreover, each officer must accumulate knowledge in six distinct intelligence disciplines—Geospatial Intelligence, Measurement and Signature Intelligence, Signals Intelligence, Open-source Intelligence, Human Intelligence, and Technical Intelligence.[43] With only one formal AFSC, the career field is not postured to rely on stove-piped formal training sequences, and instead has relied on semi-formal measures to ensure adequate expertise and experience across the force. In accordance with its own business rules, the 14N career field balances the imperative for expertise with desire for broad-based experience through what it terms a "professional initiatives" program.[44] Personnel assignments are managed at AFPC in a way that aims to expose intelligence officers to at least three of the four functional competencies. Members are informally assured of assignments in at least two of the

[40] Major Jessica Perez, Interview on Occupational Specialization within the Cyberspace Operations Career Field, In person, February 27, 2018.
[41] Ibid.
[42] "Air Force Officer Classification Directory (AFOCD)," 2018, 67.
[43] Ibid.
[44] Major Christopher Lacy, Interview on Occupational Specialization within the Intelligence Career Field, In person, February 27, 2018.

competencies—with presumed tangential exposure to a third—and are expected to achieve subject matter expertise in at least one of the competencies. Similar to the cyber operations functional areas, this approach places a heavy administrative burden on AFPC personnel to ensure compliance with career field business rules. However, as a counterpoint, the lack of rigidized qualifications and experience requirements for intelligence billets likely also grants administrative agility and flexibility.[45]

Though this thesis examines it in greater detail in subsequent chapters, it is worth briefly summarizing the current space operations (13S) career field as a point of departure to the other functional areas discussed. From the view of pure structure, space operations is most analogous to the 13B (ABM) career field. Far from the nine functional areas and 101 distinct specialties (shred-outs) associated with the pilot career field, space operations resembles ABM specialties in that it has a solitary functional area with multiple shred-outs oriented around four key space mission areas: Satellite Command and Control (13SxA); Spacelift (13SxB); Space Surveillance (13SxD); and Space Warning (13SxE).[46] Unlike the 13B functional area, however, where air battle managers typically remain tethered to a single platform or mission—and hence a single shred-out—throughout their career, it is commonplace for space operators to move in and out of various specialties within the 13S functional area, depending on assignment. Unlike the 14N career field, there are no hard and fast business rules for developing breadth versus depth in expertise and experience. Informally, the 13S assignment team advertises in its “spread the word” briefings that Company Grade Officers (CGOs) should view their second operational assignment as an opportunity to “expand [their] ops expertise,” identifying operational level command and control or classified “green door” billets as excellent fits.[47]

Conclusion

At its core, the problem of occupational specialization within the United States Air Force is an optimization question. How can the service task-organize

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[45] Ibid.
[46] "Air Force Officer Classification Directory (AFOCD)," 2018, Attachment 3.
[47] Air Force Space and Cyberspace Professional Management Office, "13S Assignment Team 'Spread the Word' briefing" (Air Force Portal, Accessed on 1 May 2018).

in such a way to train its members to accomplish assigned duties at the required levels of proficiency, while simultaneously minimizing costs and maintaining enough organizational agility to compensate for personnel system inefficiencies? The widely varying occupational specialization configurations within the Air Force arose and evolved over time because the service believed that the associated tasks involved were distinct enough to require focused training and assignment in order for members to acquire the requisite skills, judgement, and experience. Different career fields addressed the problem of specialization in different ways. Competing preferences for and against generalization heavily affected different career fields' approaches to specialization, as did other factors like the technological and operational maturity of associated disciplines, and the levels of risk associated with career field tasks. These factors are explored in subsequent chapters to help explain where the space operations career field's approach differs from the bulk of the operational Air Force, and why. The paper's key task is to assess whether those differences are still justifiable in a rapidly changing, more threatening space environment.

Chapter 3
USAF Space Operations Specialization: Past to Present

The USAF space operations career field has been subject to much of the same ebb and flow of organizational pressures experienced by the Air Force as a whole. Over time, however, the specialty has also been influenced by unique subcultures within the Air Force, by inter-service and interagency competition over operational space roles, by geopolitical competition in space, and by the developmental growing pains of a still-adolescent warfighting discipline. The net result is a career field that in some ways resembles the aviation-related operational occupations that dominate the Air Force, but that in other important ways stands distinct. This chapter traces the history of the USAF space operations career field, beginning with its inception shortly after the dawning of the space age. It assesses the impact within the career field of technology, geopolitics, domestic politics, service culture, and the role of space systems employed across the range of military operations. The chapter concludes with a description of the career field as it stands today, in context with emerging threats and looming nation-state competitions that could extend to space, endangering orbital systems and space-provided services. It considers the question, "how does the degree of specialization within the USAF space operations career field affect the service's ability to defend and fight in space?"

The History of USAF Space Operations

It is difficult to fully appreciate the present state of the USAF space operations career field without knowledge of its history. Aviation career fields still dominate Air Force lore. As a younger, much smaller occupational specialty within the youngest and smallest military department, and as a community often shrouded in secrecy, it is perhaps not surprising that the evolution of the space operations career field is opaque to so many, even to those serving within it. Yet, from the advent of space flight through 9/11 and beyond, space operations in the Air Force developed along a winding but predictable path—at the pace of technological progress, toward ends dictated by national priorities and geopolitical contexts, and within bounds permitted by supra- and intraservice organizational constructs. Three key epochs stand out: the Cold War struggle against Communist expansion, the period following the collapse of the Soviet Union as the international order reorganized itself, and the post-9/11 period in which the United States once again found itself fighting in far-flung lands, dependent on space to wage the American way of war.

The Origins of the Air Force in Space

As the Space Age dawned in America in the decades following World War II, the ever-present factor was adversarial competition with the Union of Soviet Socialist Republics (USSR). Irrespective of the stated purposes of America's various space projects—be they civil, scientific, military, or intelligence related—the underlying objective was always the same: best the Soviet Union. This dynamic focused national security space priorities toward countering the existential threat posed by the Soviet Union, and in particular, deterring its nuclear weapon delivery systems.

Initially, the Air Force had to fight for its role in space. In the mid-1950s, its leaders argued that the service should lead a "unified, DoD-oriented national space program," but President Dwight Eisenhower held strongly to his preference for a "space for peace" approach. His stated intent was a national space program that fostered scientific development while setting precedents for uncontested territorial overflight, thereby ensuring the viability of future security space systems like reconnaissance satellites.[1] Despite resistance at national levels to a "militarized" space domain, the Air Force created the Western Development Division (WDD), subordinate to the Air Research and Development Command (ADRC), in 1954. General Bernard "Bennie" Schriever was assigned as its first commander, and was tasked as his primary effort to lead the Air Force's Intercontinental Ballistic Missile (ICBM) development efforts.[2] Recognizing the natural technological parallels between ballistic

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[1] David N. Spires, "The Air Force and Military Space Missions: The Critical Years, 1957-1961," in *The U.S. Air Force in Space: 1945 to the Twenty-first Century: Proceedings, Air Force Historical Foundation Symposium, Andrews AFB, Maryland, September 21-22, 1995,* ed. R. Cargill Hall and Jacob Neufeld (Washington, D.C.: USAF History and Museums Program, 1998), 33.

[2] Gen. Bernard A. Schriever, "Military Space Activities: Recollections and Observations," in *The U.S. Air Force in Space: 1945 to the Twenty-first Century: Proceedings, Air Force Historical Foundation Symposium, Andrews AFB, Maryland, September 21-22, 1995,* ed. R. Cargill Hall and Jacob Neufeld (Washington, D.C.: USAF History and Museums Program, 1998), 15.

missiles, space rocketry, and controlled space flight, Schriever urged that WDD also assume responsibility for space development efforts.[3] In 1956, WDD subsumed the Air Force office responsible for the development of the RAND-recommended WS-117L reconnaissance satellite platform, though the effort did not get much focus or funding in comparison to the ICBM programs.[4]

The launch of the Russian Sputnik satellite in 1957 and the associated Soviet propaganda triumph, however, served as a catalyst for US activities in space. While intermediate-range ballistic missile (IRBM) and ICBM development was still a national priority, fielding a space launch capability now took on renewed importance. Schriever in effect admitted that, "Sputnik woke us up."[5]

In the aftermath of the USSR's triumph, the services scrambled to deliver the first successful American space launch. The Army, with its Jupiter C missile carrying the Explorer satellite, prevailed in delivering America's rejoinder to Sputnik on January 31st, 1958.[6] Shortly afterward, however, "concerns over inter-service rivalry and duplication of effort" drove Eisenhower administration officials to stand up the Advanced Research Projects Agency (ARPA), which it designated the "centralized agency for all DoD space research and development activities."[7]

Between the creation of ARPA and the passage of the National Space Act later in 1958, which effectively transferred US Navy and US Army space launch assets to the newly created National Aeronautics and Space Administration (NASA), the services were divested of much of their equity in space development and operations. The Air Force itself lost its nascent manned space flight program, which NASA combined with its own under the project name Mercury, and its WS-117L satellite platform, for which ARPA now assumed direction.[8] For a time, the Air Force was thus subordinated to both ARPA and NASA on space issues, though it continued to provide expertise and resources in support

[3] Jacob Neufeld, *Bernard A. Schriever : Challenging the Unknown* 100th anniversary commemorative ed. (Washington, D.C.: USAF History and Museums Program, 2005), 20.
[4] Matthew Brzezinski, *Red Moon Rising : Sputnik and the Hidden Rivalries that Ignited the Space Age*, 1st ed. (New York: Times Books, 2007), 249.
[5] Ibid.
[6] Ibid., 267.
[7] Spires, "The Air Force and Military Space Missions: The Critical Years, 1957-1961," 33.
[8] Ibid., 39.

of the both agencies' programmatic efforts—especially in regard to test, launch, and space tracking.[9]

The Air Force, however, never gave up its designs on a prime military space role. The service, following an Air Staff Review, decided in 1959 to reinvigorate its own integrated space program while simultaneously working to "responsibly support" ARPA and NASA on efforts in which those organizations had the lead.[10] The service's early efforts with the WS-117L program, in particular, gave it unique credibility in arguing for a larger role—both functional and financial—in its dealings with national security space. That program now lived on, split into multiple projects but moving forward under both Central Intelligence Agency (CIA) and ARPA auspices. The CIA, partnering with the Air Force for technical expertise, managed the WS-117L-derived CORONA project which would become America's first successful reconnaissance satellite. ARPA continued with separate space projects named Satellite and Missile Observation System (SAMOS) and Missile Detection Alarm System (MIDAS), both also grown from WS-117L.[11]

The Air Force, and in particular General Schriever, continued to criticize the fragmented approach to satellite program management. The service argued instead that unified development, exemplified through the coordination and integration of space systems within the larger Air Force strategic and air defense architecture, could achieve the "most effective deterrent posture."[12] In the fall of 1959, Defense Secretary Neil McElroy acquiesced, reversing the previous year's decision and forcing ARPA to relinquish its primary role in space system development. The Defense Department now redistributed missions to the services. The Army acquired temporary responsibility for developing military communication satellites, and the Navy received the same for navigation satellites.[13] The Air Force, in turn, regained operational control of the SAMOS

[9] Ibid., 38.
[10] Ibid., 39.
[11] Ibid., 38.
[12] Ibid., 40-41.
[13] R. Cargill Hall, "Civil-Military Relations in America's Early Space Program," in *The U.S. Air Force in Space: 1945 to the Twenty-first Century: Proceedings, Air Force Historical Foundation Symposium, Andrews AFB, Maryland, September 21-22, 1995*, ed. R. Cargill Hall and Jacob Neufeld (Washington, D.C.: USAF History and Museums Program, 1998), 29.

earth reconnaissance and MIDAS missile launch detection programs as well as the Dyna-Soar manned orbital glider program.[14] Additionally, the service picked up responsibility for space-based nuclear detonation (NUDET) detection.[15] Finally, the Air Force was given primary responsibility for launch services, payload integration, and orbital command and control of satellites.[16]

Following the U-2 shootdown in May of 1960, the Eisenhower administration conducted a federal review of strategic reconnaissance capabilities. It concluded that a separate civilian office was needed to direct and control these critical assets. Accordingly, the National Reconnaissance Office (NRO), subordinate to the Defense Department but civilian led, was created early in 1961. The SAMOS earth reconnaissance program was taken from the Air Force and reassigned to the new agency.

Stripped of its contribution in the overhead reconnaissance mission area, many in the Air Force felt the service had been excluded from the most relevant space mission set. According to General Schriever, the perception of space as an operational hinterland would subsequently persist among Air Force leadership for decades.[17] Furthermore, the creation of the NRO had secondary organizational effects. While the creation of a dedicated reconnaissance agency, thereby centralizing capability development and operations for national-level collection operations, was sensible during a period in which nuclear parity and strategic stability had not been reached, the NRO still relied on Air Force personnel for program management and operations functions. The demarcation of responsibility between the new agency and the Air Force was therefore not as clean as it appeared. "For better or worse," Schriever opined, "the nation's civilian leaders who established the NRO also created an Air Force space contingent isolated from its service counterparts in the larger communities of civil and military space flight."[18] The arrangement complicated organizational relationships and created challenges in reconciling differences in culture, command authorities, and personnel management. Similar issues persist to

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[14] Spires, "The Air Force and Military Space Missions: The Critical Years, 1957-1961," 41.
[15] Hall, "Civil-Military Relations in America's Early Space Program," 29.
[16] Ibid.
[17] Ibid., 30.
[18] Ibid.

this day—albeit to a lesser degree—at times undermining unity of effort across the National Security Space (NSS) enterprise.

In March of 1961, Secretary of Defense Robert McNamara signed DoD directive 5160.32, which assigned the Air Force responsibility for research, development, test and engineering of future DoD space missions “not yet assigned to other organizations.”[19] The Air Force, in theory, thus acquired the preeminent developmental role within the US government for “military” space missions (a category that explicitly excluded strategic reconnaissance). In reality, however, much of the service’s responsibilities dealt with “providing booster and infrastructure support to other organizations which retained operational direction of communications, navigation, weather, and reconnaissance satellites.”[20]

By 1961 the Air Force, of the three military departments, had received the lion’s share of space-related responsibilities. The service’s ambitions to achieve unilateral authorities in the pursuit of “space supremacy,” however, were thwarted. Interagency and inter-service rivalries over space roles would be the norm over the coming decades. Even within the Air Force, space remained an oddity. Its research and development organizations exercised operational responsibility for the majority of the service’s space programs and systems.[21] Significant organizational and cultural hurdles would need to be surmounted before space missions would be assigned to traditional operational commands instead of the R&D community.[22]

Early Air Force Space Occupational Specialization

The Air Force began to make strides toward professionalizing a space operations cadre in the 1960s, moving beyond its heavy reliance on technical and acquisitions personnel. Prior to the mid-1960s, it gathered the few operational officers it needed to control and track space systems from the Weapons Controller Air Force Specialty (AFSC 1744). In 1966, the Air Force upgraded and relocated space track and missile warning functions to a location

[19] Ibid.
[20] Spires, "The Air Force and Military Space Missions: The Critical Years, 1957-1961," 45.
[21] Ibid.
[22] Ibid.

within the hardened Cheyenne Mountain Complex in Colorado Springs, CO—a major move reflecting a recognition of the criticality these systems were to have for America's deterrent posture.[23] Coincident with this shift, the service updated AFM 36-1, which described all the service's officer occupational specializations. The regulation update formally established the Space Systems Utilization Field, designated 20XX. Three specialties existed within the new utilization field: Space Systems Analyst (AFSC 2025), Space System Operations Officer (AFSC 2035), and Space Systems Staff Officer (AFSC 2016, which included commanders). The 2025 and 2035 AFSCs were further decomposed into multiple specialty shred-outs.[24]

Space Systems Analyst – AFSC 2025. In 1966, the Air Force characterized the space systems analyst specialty as "employing basic mathematical laws and celestial mechanics" to 1) Conduct earth-orbiting object position predictions; 2) Adapt orbital analysis (OA) problems on computerized equipment; 3) Act as a satellite orbital consultant; 4) Manage orbital analysis operations; and 5) Conduct space object identification (SOI).[25] Given the demanding, technical nature of these tasks and the relative immaturity of computing technology to aid the analyst, the service mandated officers in this specialty have advanced mathematical education through the level of differential equations, with actual degrees in mathematics, astronautics, physics, or engineering listed as desirable.[26] The specialty distinguished OA from SOI functions by assigning an 'A' or 'B' shred-out to each, respectively. Training requirements included "completion of a formal USAF, equivalent service school, contractor factor training, or resident college course."

Space Systems Operations Officer — AFSC 2035. Differentiated from the 2025 analytical role, operations officers in the 2035 specialty instead focused on actual space system employment, to include ground-based sensor site operations. Officers in this career field were tasked with: "1) planning and organizing space sensors and space weapons activities; 2) Directing space

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[23] Paul B. Stares, *The Militarization of Space : U.S. policy, 1945-1984*, Cornell studies in security affairs (Ithaca, N.Y.: Cornell University Press, 1985), 131-32.
[24] Department of the Air Force (DAF), "Officer Classification Manual," Air Force Manual 36-1, Headquarters Department of the Air Force, 1963, 20-3.
[25] Ibid., 20-5.
[26] Ibid., 20-6.

systems control personnel; 3) Coordinating space systems warning surveillance or tactical control activities; 4) Supervising technical control of space systems or associated tactical control functions; 5) Supervising electronic countermeasure functions; 6) Supervising the cataloging of sensor observations; Developing and improving methods and procedures for employing space weapons."[27] The education requirements for this AFSC were less than that for analysts, with no mandatory background in mathematics (though technical degrees were still desired). Training course requirements were identical in verbiage to that of the 2025 AFSC. Two shred-outs for the 2035 AFSC existed: the 'A' shred-out related to the operation of space sensor systems—either optical or electronic (meaning radar); the 'B' shred-out referred to the operation and command and control of space-based weapon systems.[28]

Space Systems Staff Officer — AFSC 2016. Applicable only at the field grade ranks, the Space Systems Staff officer specialty involved "managing or commanding" space systems or space analytical activities, or alternatively fulfilling staff duties advising senior leadership on operations, training, requirements, plans, or command and control for space systems. The AFSC required previous qualification in either the 2025 or 2035 career fields.

Cold War-Era Career Field Development

From an occupational specialization standpoint, these early 20XX AFSCs demonstrated that the Air Force was, at a minimum, intent on institutionalizing space operations for the long haul. In the early- to mid-1960s, the contributions of space capabilities—other than reconnaissance—to the nation's most dire national security objectives were largely still unproven, yet the Air Force clearly forecasted the future benefits to be yielded by orbital platforms. Over the next two decades, the USAF, in partnership with the US industrial base, made dramatic advances in space capabilities related to communications, weather, navigation, and missile warning. The space operations career field slowly evolved to keep pace. In 1978, for example, the service moved away from the "space systems" verbiage of the existing AFSCs, replacing it with "space

[27] Ibid., 20-7-20-8.
[28] Ibid., 20-8.

operations,” with the intent to demonstrate a distinction between space systems’ acquirers and those who would operate them.[29]

The next major change in the Air Force space operations specialty structure occurred in the early 1980s, coinciding with the fielding of the Space Transportation System (STS, commonly known as the Space Shuttle). Prior to the tragic *Challenger* mishap in 1986, there was a planned DoD programmatic component of the space shuttle program, to be led by the Air Force.[30] Recognizing the heavy investment needed to execute this manned space flight mission set, the service created an Astronaut AFSC (2066) with two shred-outs for pilot and mission specialist. It also stood up the 2045 AFSC, a specialty it termed “Manned Space Flight Operations Officer,” with four shred-outs for manned space flight direction, control, planning, and support.[31] After the *Challenger* explosion, the DoD abandoned plans to actively control space shuttle missions. Though the astronaut AFSC was retained, the 2045 AFSC specialty transitioned to focus on unmanned (i.e. expendable booster) space launch operations.[32]

Around this time, the service also updated its legacy space operations specialties to what it viewed as a more functionally accurate task break-out. The 2035 AFS, for example, retained a focus on space system employment, but with greater granularity than existed previously. The new update prescribed four shred-outs instead of two: Ground Based Surveillance Systems, Space Systems Control, Space Command and Control Systems, and Space Weapons Systems (2035A-D, respectively).[33] The new shred-outs distinguished between ground-based space object tracking, day-to-day housekeeping functions associated with maintaining an operational satellite, operational command and control activities, and payload mission operations.[34]

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[29] USAF Occupational Measurement Center, "Occupational Survey Report: Space Operations Utilization Field," AFPT-90-20X-426 (Randolph Air Force Base, TX: Occupational Analysis Program, July 1987), 1.
[30] William J. Broad, "Pentagon Leaves the Shuttle Program," *The New York Times*, August 7, 1989.
[31] USAF Occupational Measurement Center, 1.
[32] Department of the Air Force (DAF), "Officer Classification," Air Force Regulation 36-1, Headquarters Department of the Air Force, 1990, Attachment 8, 101.
[33] USAF Occupational Measurement Center, 1.
[34] Department of the Air Force (DAF), "Officer Classification," Air Force Regulation 36-1, Headquarters Department of the Air Force, 1981, Attachment 8, 82.

Notwithstanding the brief acknowledgment in the 2035 specialty description of the need for electronic warfare (EW) countermeasures (a practice needed as much to mitigate unintentional or environmental radio frequency interference as purposeful adversary jamming), the space domain itself could not yet be described as a battlespace. Neither Cold War super power actively contested the orbital environment. Both the US and the USSR seriously studied the policy implications of weaponizing space, and both experimented technologically (at times provocatively) with anti-satellite (ASAT) technologies.[35] Neither, however, fielded a serious, operationally-tested and validated capability posing a non-reversible threat to space platforms.[36] While such capabilities may have been examined, proposed and even prototyped within R&D and policy circles, concerns of an action-reaction space arms race spiraling out of control proscribed their fielding as systems of record. Space operations duty within the Air Force 20XX utilization field continued to focus on quiescent surveillance of space and the use of space to support terrestrial missions.

The lack of an operational threat from the enemy drove the Air Force to focus on other risks in space more likely to actually imperil these "force enhancement" missions. Chief among these were the dangers posed to space systems both by the harsh orbital environment and the sheer technological complexity of monolithic, state-of-the-art satellites. These hazards, however, did not typically require lightning-quick reactions on the part of operators; in fact just the opposite was true: the approach taken by the Air Force emphasized deliberateness both before launch and during operations. In the design phase, risk mitigation measures dictated pre-mission hardening of sensitive components against electromagnetic radiation and high-energy particles. High system redundancy gave further confidence that, should something go irreparably wrong, the mission could be maintained. With resiliency against non-purposeful dangers designed into the satellites, space operators relied on detailed checklists for day-to-day operations and engineering "back shops"—including contractor experts—for when things did not go according to plan.

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[35] Michael Sheehan, *The International Politics of Space*, Space, power and politics (London ; New York: Routledge, 2007), 97.
[36] Ibid., 102-03.

Overall, space operations duty could best be described as heavily procedural and administrative, not dynamic or tactical. An Occupational Survey Report (OSR) that assessed the 20XX career field in 1987 at the request AFSPC supports this view. It examined 928 tasks within 15 distinct duty positions.[37] Regarding the "crew activities" cluster of tasks, the report detailed items "typifying the kinds of things crewmembers do: 1) make entries in event log; 2) read crew information files; 3) read message traffic; 4) brief incoming positional counterparts during changeover; 5) report equipment outages."[38] Evidently, operational units placed high emphasis—at least in their break-out of operator tasks—on reviewing, recording, and reporting status, rather than tactical mission operations, which were described somewhat fuzzily throughout the report simply as "console tasks."[39] According to the authors of the report, "the one underlying factor that [stood] out in this job analysis is the large amount of time spent by 20XX personnel in…administration [and] management."[40] As the report makes clear, the observation held regardless of rank. Company Grade Officers the three most junior ranks, were the ones performing the bulk of the technical tasks, but a plurality—more than 33 percent—of their time was spent doing administration, management, and command tasks.[41]

Crewmembers were able to spend so much of their time on administrative tasks because the job did not demand of them otherwise. The remote, procedural, and partially automated nature of tactical space operations required, on average, less undivided attention in real-time than tasks associated with flying an aircraft. As US reliance on military space platforms grew, more attention was put toward ensuring the intended space effect was in place for the user at higher and higher levels of reliability, rather than defending the platform providing the effect from attack by a nonexistent threat. Thus, even as the Cold War drew to a close, a "service-provider" culture had started to infiltrate the space operations utilization field. After the collapse of

[37] USAF Occupational Measurement Center, 10.
[38] Ibid., 14.
[39] Ibid., 46.
[40] Ibid., 21.
[41] Ibid., 44.

the USSR removed any semblance of a peer competitor in space, this mindset was to become even more entrenched.

Post-Cold War Era Career Field Development

The period following the end of the Cold War and prior to September 11, 2001, was one of transition. Globally, the international order was thrown into disarray and began reorienting itself around a unipolar, US-dominated hegemony. Within the US military, as discussed in Chapter 2, political pressure was brought to bear to downsize the force in light of the reduced existential threat. Technologically, the dawn of the Information Age—supported by rapid advances in microprocessing—facilitated heavier reliance on digital communication and integrated advanced electronics in military systems. Each of these phenomena—geopolitical, organizational, and technological—affected the evolution of the space operations career field.

In the 1990s, limited and regional conflicts dominated the security landscape. While the US recognized the need to maintain important strategic space capabilities like protected communications and ICBM warning in support of its ongoing deterrent posture, space support to geographic combatant commands now received increased emphasis. In Operations Desert Shield and Desert Storm and in the later Balkan interventions Deliberate Force and Allied Force, space provided important (if not decisive) services to coalition forces. Observers contend that Desert Storm was a "watershed event" for military space operations in that it saw a transition from the use of space power primarily to support strategic deterrence, toward its "use in support of tactical warfighting tasks."[42] Evidence of this shift in orientation is abundant. After Desert Storm, the Air Force and the Joint Staff published space doctrine documents leveraging lessons learned and codifying approaches for command and control of space forces, both globally and within geographic combatant commands.[43] And while in 1996, the Air Force Chief of Staff Ronald Fogleman identified the need to gain and maintain space superiority as a core competency of the service, the new doctrine did not heavily emphasize counterspace (also known

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[42] Sheehan, *The International Politics of Space*, 99.
[43] Ibid., 114.

as space control) operations. Rather, it highlighted integration of civil, commercial and foreign space assets into terrestrial operations.[44]

As it moved toward formalizing space doctrine and better integrating space into operations, the Air Force demonstrated a preference for space operations generalists instead of individual space system or mission-area operations specialists. An illustrative example of this tendency is the stand-up of the Space Division of the Air Force Weapons School in 1996. Inclusion of space curricula into the Air Force's most advanced course for weapons and tactics employment was a major step forward because it showed that the service recognized the operational importance of space capabilities.[45] However, rather than a Weapons Instructor Course (WIC) tied to individual platforms or capabilities (as was the case for every other course offered by the school), the Space Superiority WIC focused on broad integration of space-enabled effects with other Air Force weapon systems and operations. Graduates of the course during this epoch did not often return to AFSPC units. Instead, they were typically assigned to operational flying units around the Air Force or to joint commands and tasked with assimilating space into other organizations' operational planning and employment activities. While consistent with the Air Force's focus on seamlessly integrating space effects, the approach had consequences. Responsible for an entire domain's worth of knowledge, space weapons officers could not realistically gain the system and tactical-level knowledge exhibited by other types of weapons officers, which was honed over the course of an eight to ten-year timeframe spent operating a single platform. Arguably, because weapons officers are frequently responsible for the creation of tactical-level doctrine, space-related Tactics, Techniques, and Procedures (TTP) lagged well behind their air counterparts in terms of depth, completeness, and overall maturity. Tactical level space doctrine is still catching up today.

Another example of the Air Force's penchant for generalizing space operations can be seen in the career field mergers of the early 1990s. As discussed in Chapter 2, and in tandem with post-Cold War military drawdowns, the Air Force drastically reduced its number of Air Force Specialties,

[44] Ibid., 115.
[45] "USAF Fact Sheet: 57th Wing," 2017.

particularly those not dealing with flying operations. In the fall of 1993, the distinct 20xx space operations AFSCs were combined into a single space and missile operations functional area—13S. The new AFSC had a combined total of only five discriminated specialties: the original four space shred-outs of Satellite Command and Control, Spacelift, Space Surveillance, and Space Warning plus an additional one for Missile Combat Crew.[46]

The combination of space and missile operations had more than an administrative impact, however. As a single AFSC, space and missile officers were usually expected to perform assignments in both main areas of the career field (space *and* missiles), further reducing the amount of expertise any one officer would likely gain in each field. Most often, officers went to missiles first, and performed no space operations duties until they were at the four- to five-year point in their careers. As a result, space operators would have just three to four years to spend as tactical level space operators before the up-or-out military progression system expected them to move on to command and staff positions within the Air Force hierarchy. Despite the fact that many newly-assigned space operators came from missiles with little practical space experience, they were nevertheless at the point in their careers where the service expected them to hold some level of leadership responsibility (as a flight commander, chief of training, etc.). In place of actual operational experience or system and domain knowledge to convey leadership credibility, procedural and checklist familiarity—a mindset easily transferred from the nuclear community—often substituted. Consequently, in instances where a checklist or procedure failed to adequately dictate operator action, as with non-standard mission planning scenarios or during satellite anomalies, the Air Force deepened its reliance upon engineers and contractors trained to manage these crises.

Institutionally-driven constraints like authorized troop end strength levels and service topline budgets, in concert with a clear-eyed analysis of the post-USSR international order, made the bias toward generalists and force enhancement effects understandable—even prudent—at the time. Space

[46] Department of the Air Force (DAF), "Officer Classification," Air Force Manual 36-2105, Headquarters Department of the Air Force, 1994, Attachment 1, 53.

technology had advanced to the point where its effects were significant force-multipliers and true difference-makers in the American way of war. These effects, however, were often poorly understood by non-space professionals, and a clear need existed to broadly translate extant capabilities into codified TTP useful to theater warfighters. Training that emphasized operational breadth instead of depth supported these integration objectives. Simultaneously, it must be recognized, America no longer faced a peer adversary in space. Even more so than during the Cold War period, operational threats to space systems were negligible, and the main hazards were instead technical and environmental. The Air Force largely outsourced the mitigation of those risks— first to designers who could build in appropriate system redundancy before launch, and secondly to engineers and contractors who could be recalled after launch to troubleshoot anomalies in non-real-time. It was a solution that was both efficient (in terms of training and education qualification requirements) and operationally tolerable.

As the 1990s concluded, potential danger inherent in an organizational preference for generalists and the neglect of fundamental space control competencies lay well in the future, but such risk *was* recognized at senior policy levels. In January 2001, the Commission to Assess United States National Security Space Management, chaired by the Bush Administration's incoming Defense Secretary Donald Rumsfeld and informally known as the "Space Commission," released its findings. Given Rumsfeld's future role, the commission's report received heavy attention.[47] It warned of the "rapidly increasing US dependence on military space—and the vulnerability it creates."[48] Further, the report emphasized the need to "ensure that the president will have the option to deploy weapons in space" if necessary.[49] Organizationally, the report offered several recommendations to achieve better unity of effort within the NSS enterprise and to better prepare the country to defend against a "space Pearl Harbor."[50] Beyond sweeping re-organization schemes at the highest echelons, the commission's conclusions on career field specializations at lower

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[47] Joan Johnson-Freese, *Heavenly ambitions : America's quest to dominate space* (Philadelphia: University of Pennsylvania Press, 2009), 56.
[48] Sheehan, *The International Politics of Space*, 165.
[49] Ibid., 166.
[50] Johnson-Freese, *Heavenly ambitions : America's quest to dominate space*, 56.

levels were muddled. It advocated, for example, building a space professional cadre comprised of operators with increased "depth of experience in their field and more extensive education and training." In the next paragraph, however, the report exhorts the need for increased experiential breadth across space mission areas, asserting that "tomorrow's space professionals need a broader understanding of [space] operations."[51] The inherent tension between building breadth and depth was not addressed by the commission's report.

After the presidential transition in 2001, the DoD, led by Rumsfeld, began implementing many of the report's recommendations. As will be show in the next section, the department undertook educational and training initiatives aimed at raising baseline knowledge levels within the military space cadre related to the orbital environment, space systems, and space doctrine. Technical and operational breadth was prioritized over depth in these efforts, however, and little changed structurally within the career field organizational schema to increase operator expertise and experience in specific roles. The potential threats called out by the commission remained quite real, but it would be the better part of two decades before significant changes occurred at the operational and tactical levels of war to address the risks they posed.

Career Field Development between 9/11 and 2016

The terrorist attacks of September 11, 2001 did not significantly disrupt the trends started during the preceding decade. If anything, US reliance upon space capabilities and the imperative to optimize their use in support of theater operations only increased after 9/11 and the subsequent Global War on Terror. For the first half of the Bush administration, the Air Force's weight of effort in space continued to be focused on improving capability and capacity of space force enhancement capabilities. New generations of space-based Overhead Persistent InfraRed (OPIR), Global Positioning System (GPS), and Military Satellite Communication (MILSATCOM) satellites promised to deliver orders-of-magnitude increases in capability and capacity in their provided effects. Increasingly, effects from these satellites were relied upon in overseas tactical-

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[51] Commission to Assess United States National Security Space Management and Organization Washington, "Report to the Commission to Assess United States National Security Space Management and Organization," (Washington D.C.: 11 January 2001), 44-45.

level warfighting scenarios. For example, newer OPIR systems promised to provide nuanced battlespace characterization information derived from higher resolution IR spectral sensors that moved the state-of-the-art well beyond missile launch detection. Satellite communications, meanwhile, were increasingly available to tactical-echelon units, perhaps none more visibly then the Remotely Piloted Aircraft (RPA) that were becoming ubiquitous in theater operations. Non-reversible (i.e. destructive) threats to space systems remained negligible. The protection of GPS and MILSATCOM signals from purposeful interference were important system design considerations during this era, but countering these threats was not something that most space operators dealt with on a day-to-day basis. As Operations Enduring and Iraqi Freedom stretched on, however, institutional, technological, and geopolitical developments occurred far from the forefront of those conflicts that slowly started to influence the space operations community. Beginning at the policy level but inexorably pushing down to the operational and tactical levels, these trends continued to accelerate throughout the decade and into the next.

The Air Force Space Professional Development Program. In the 2000s, the DoD and the Air Force undertook a variety of projects to meet the 2001 Space Commission's vision for a more professionalized space cadre. In 2004, DoD published its "space human capital strategy" that set its goals for developing and integrating space personnel within the department.[52] The strategy's objectives included: "ensuring the services develop space cadres to fulfill their unique mission needs; synchronizing the services' space cadre activities to increase efficiency and reduce unnecessary redundancies; improving the integration of space capabilities for joint war fighting and intelligence; assigning the best space professionals to critical positions; increasing the number of skilled, educated, and experienced space professionals; and identifying critical positions and personnel requirements for them."[53] In support of this strategy the USAF core effort was the Space Professional Development Program (SPDP), formally established in 2006 but

[52] United States Government Accountability Office (GAO), "Report to Congressional Committees: Defense Space Activities: Additional Actions Needed to Implement Human Capital Strategy and Develop Space Personnel," GAO-04-697 (Washington D.C.: GAO, August 2004), 8.
[53] Ibid., 9.

with supporting efforts beginning several years prior. The Air Force's program comprised six initiatives, identified in

Table ***2*** below.

Table 2: 2004 Air Force Space Personnel Strategy Initiatives

Initiative	Description
Identification and classification of space personnel	Determine the unique skills that distinguish space personnel from personnel in other career specialties and identify the space-qualified personnel.
Education and training	Institute stronger, technically oriented space education and training programs.
Positions and requirements	Identify each space personnel position and determine the education, experience, and certification requirements for every position.
Certification	Design a certification program to measure progress throughout an individual's career.
Professional development	Issue career development guidance for space personnel.
Management	Establish a permanent space professional management function.

Source: Adapted from Government Accountability Office Report 04-697, "Additional Actions Needed to Implement Human Capital Strategy and Develop Space Personnel," August 2004.

The SPDP demonstrated a service preference for space generalists across the efforts undertaken in support of its six initiatives. The program, implemented by the Space Professional Management Office (SPMO) at AFSPC, sought to maximize the credentialed space professional community, which it defined as "the collective group of…space-experienced scientists, engineers, program managers and operators, [including] officer, civilian, and enlisted personnel."[54] Space professionals across all these diverse communities were certified under a singular three-tiered structure corresponding to imprecise training, experience, and educational criteria. No specific qualifications were listed under training requirements—the program defaulted to whatever was required for members' "mission/position requirements." Experiential criteria were equally vague, based on (for all but new accessions) the cumulative years

[54] Department of the Air Force (DAF), "Space Professional Development," Air Force Policy Directive 36-37, Headquarters Department of the Air Force, 2006, 5.

of “space duty” assignment time, regardless of career field. Educational requirements were based entirely on a three-sequence set of courses—Space 100/200/300—targeted at new accessions, six- to seven-year Captains, and Majors preparing to become staff officers.[55]

Scoping the program so broadly helped to ensure that the Air Force reached the widest group of members possible, supporting the DoD objective of increasing the “bench” of space-knowledgeable and space-experienced personnel within the department. The drawback of such a wide-ranging approach, however, was the diffusion of focus across multiple disciplines (e.g. operations, intelligence, acquisitions) and doctrinal space mission areas. In its desire to promote, track, and manage space professionals, it treated the domain monolithically. In choosing to certify space professionals within only three broad tiers, distinctions between different types of mission areas, assignments, and skill sets were blurred and abstracted. Overall, the program traded true space expertise for space cognizance.

Aspects of SPDP that did try to reinforce specialization tended to be ineffectual or haphazardly implemented. For example, to further the space education and training initiative, the Air Force stood up the National Security Space Institute (NSSI) in October 2004. NSSI was comprised of two main schools. The Space Professional School was responsible for Space Professional broadly-focused continuing education courses such as Space 200 and Space 300. The Space Operations School (SOS), however, was all about specialization. It was dedicated to focused instruction on advanced space concepts and deployment training for space operations crewmembers.[56] By offering focused curricula within specific mission areas, the Space Operations School intended to build on the knowledge imparted to members during Undergraduate Space Training (UST, also known as Space 100 during this time), qualification training, and broad continuing education courses like Space 200 and 300. The excellent course offerings at the Space Operations School, however, were limited in class size and frequency, enrollment was typically voluntary on the part of

[55] Air Force Space and Cyberspace Professional Management Office, "SPDP Certification" (Air Force Portal, Accessed on 1 May 2018).
[56] "USAF Fact Sheet: Advanced Space Operations Squadron," 2018.

those of who attended, course completion was not required for progression within students' units, and the courses lasted only two to three weeks in duration. Therefore, while the curricula had (and have) an exemplary reputation within AFSPC, they were considered "enrichment" by the larger 13S operational community, and their content was incorporated into squadron-level continuation or specialized training only by exception. No refresher training or education on the school's content generally occurred, and any advanced knowledge gained by students understandably tended to atrophy over time.

Next, an attempt to track and manage space personnel assignment placement based on differentiated "space experience codes" (ECs), while well-intentioned, also fell short of achieving the intended result. SPMO electronically collected data on each identified Air Force space professional and organized it into a Space SURF (Single Unit Retrieval Format) record (see Figure 2). As AFSPC commander General Lance W. Lord put it in 2004, the Air Force needs to be able to "track [cadre] members by who they are personally, plus what their attributes are in terms of where they've been, what their assignments were, what kind of focus they've had in the business—whether they're missile warning specialists, or launch specialists, or what kind of training they've had."[57] While Space SURFs duplicated much of the same information found in standard AF personnel system documents, their value was in assigning, tracking, and reporting aggregate EC data over the course of a member's career. Therefore, in theory, assignment managers and commanders could discern how much experience a space operator had, for example, in satellite communications (SATCOM) operations versus ground-based space surveillance, and use that information in matching member skills to billets.

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[57] Peter Grier, "The Space Cadre," *Air Force Magazine*, June 2004, 58.

Space Experience Codes (ECs)			
[A - Acquisition O - Operations S - Staff] - General Duty Category			
[A -J] - Mission Code		[0 - 9] - Experience Identifier	
A - Satellite Systems	7: NRO Spacelift	**H - Space Warfare C2**	4: IG / OGV
0: Multi Systems Knowledge	**D - Warning**	0: Multi Systems Knowledge (1-5)	5: AFOTEC
1: Sat C2	0: Multi Systems Knowledge	1: Space AOC	6: AFTAC
2: MILSATCOM	1: Ground Based Warning	2: Theater AOC	**J - Space Staff**
3: PNT	2: Space Based Warning	3: Warfare Center (Old SIDC/SWC)	0: Executive Officers
4: AFSCN	3: Fusion Centers	4: SOF	1: Assignments
5: Orbital Analysis	**E - Space Control**	5: Near Space	2: Joint
6: ORS	0: Multi Systems Knowledge	6: Wargames	3: Safety
7: USNDS	1: Ground Based Surveilance	Following ECs are Exer Deps Only	4: Program Element Monitor
B - Nuclear	2: Space Based Sit. Awareness	A - RED FLAG	5: Plans and Programs
0: Multi Systems Knowledge	3: Optical Surveillance	B - BLUE FLAG	6: Research and Development
1: Missile Systems	4: Fusion Centers	C - BLACK DEMON	7: Information Operations
2: Missile MX	5: Space Control Offensive	D - UFG	8: Other
3: Missile Testing / Technology	6: Space Weather	E - KEY RESOLVE	
4: Command and Control	7: Space Control Defensive	F - SPACE FLAG	
5: Codes	**F - ISR**	G - VIRTUAL FLAG	
6: EWO	0: Multi Systems Knowledge	H - AUSTERE CHALLENGE	
7: Policy & Strategy	1: Environmental Monitoring	I - VIGILANT SHIELD	
8: Safety	2: SBR	J - ARDENT SENTRY	
9: Plans & Prog / PPBE / PEM	3: Other	K - GLOBAL THUNDER	
C - Spacelift	**G - Missile Defense**	L - GLOBAL LIGHTNING	
0: Multi Systems Knowledge	0: Multi Systems Knowledge	M -PACIFIC SENTRY	
1: Range Systems	1: Missile Defense	N - PANAMAX	**SCPMO POC:** DSN 692-2427
2: Launch Systems	2: Program Mgnt	**I - Space Test / Eval / Educ / Trng**	Comm: (719) 554-2427
3: SLEC-P	3: Test (Flt/Grnd)	0: Multi Systems Knowledge	**Email:** afspc.spmo@us.af.mil
4: Spaceflight	4: COCOM Engagement	1: Student Time	**Webpage:** http://go.usa.gov/NGR
5: ORS		2: Test	
6: Range Weather		3: MAJCOM / NAF Training Shops	

Figure 2: Space Experience Codes
Source: Air Force Space Command Space Professional Management Office, 2015

In practice, the Space SURF construct suffered from several implementation flaws that limited its influence on personnel placement. First, it relied on units and members to update billet requirements and individual experience codes. For example, commanders could tie specific ECs to individual billets in their squadron, in effect requiring that an individual possess certain skill sets in order to be eligible for a given job. In practice, the process of maintaining up-to-date ECs at the billet and individual member level was inconsistently followed by the command. Feedback processes to confirm accuracy were similarly erratic. Furthermore, even if correctly applied, the EC schema was not always descriptive of the skills and experiences gained by individuals. This stemmed from two factors—the lack of detail within EC categories, and structural limitations within the career field itself for denoting skill levels. For example, identifying someone with an experience code of A3 (Position, Navigation and Timing, PNT), per Figure 2, is ambiguous in that it does not describe whether that individual has experience in controlling the GPS satellite bus, the GPS payload, or supporting GPS theater users through Navigation Warfare (NAVWAR) planning and analysis. The 2nd Space Operations Squadron (2 SOPS) performs all these activities, but not every individual is certified in each activity during their time at the unit. Further, the actual skills and knowledge possessed by an individual leaving 2 SOPS would vary heavily based on what duty positions he or she held. In this way, the EC structure did an excellent job of identifying where someone worked, but not always what that member did at the unit. Beyond the level of granularity in the EC categories, the 13S career field as a whole had very few descriptors and qualifications identifying special skill sets and experience levels—especially ones that translated from assignment to assignment. Experience and skill levels were often conveyed in oversimplified ways such as the number of years in a particular assignment, rather than qualitatively meaningful terms showing purposeful upgrades in responsibility and expertise over time. The few standardized positional upgrades that existed, for example from Vehicle Operator to Crew Commander, could vary drastically in terms of scope and responsibility depending on the unit and space system in question. An accurate and rapid conveyance of information related to experience and expertise was therefore difficult to achieve through Space SURF or even AFPC records alone. Lastly, and perhaps most importantly, ECs were simply not used often in the assignment process. Rather, assignment managers emphasized factors such as time on station at a given duty location, the imperative to provide sufficient numbers of operators to critically undermanned units, the member's individual desires, and the enterprise-driven desire for operational breadth (e.g. experience in different mission areas). Attempts to match background, qualifications, and experience to individual billets often received short shrift in comparison to these other leadership-driven priorities, thereby diminishing further the potential benefits offered by ECs. The Space SURF model turned into a tool used primarily for administrative purposes, highly valued for its ability to generate reports and aid staff in teeing up senior leader decisions for shaping the force, but largely neglected in the personal development and placement of individual operators. As a result, any specialized expertise that developed over the course of a member's career was largely accidental.

Overall, the Space Professional Development Program was a step forward for the Air Force in managing and tracking its space cadre. It succeeded in promoting military space activities as a professional field across the operations, acquisitions, and intelligence disciplines. It was effective in setting and raising broad knowledge and experiential baselines at pre-defined career points, grounded in the Space 100/200/300 courseware and SPDP tier certifications based on mission-ready status and number of years spent in space assignments.[58]

SPDP fell short, however, in creating a system that encouraged true expertise in space operations. Overly broad ECs, shortfalls in robust advanced education and training opportunities, and a lack of meaningful upgrade pathways in crew positions all combined to create a system that favored breadth over depth. In a structure that did not require specialists, the path of least resistance was to create generalists. Arguably, when SPDP was created, this outcome was acceptable and even desired. Leaders of that era from AFSPC to the Air Force Secretariat promoted the idea of space generalists, even to the extent of heavily endorsing cross-flows between the acquisitions and operations disciplines, for example.[59]

In a space domain possessed of few operational threats, depth of experience within the 13S space operations career fields was not yet a prized attribute. By the end of the 2000s, however, the Air Force would come to the conclusion that aspects of the 13S functional area—ICBM crew duty—*did* need more focus, albeit for reasons not related to an external threat. In 2009 the Air Force took steps to begin re-separating the space and missile operations specialties following a pair of surety incidents that caused DoD and service leadership to lose confidence in the Air Force's custody of the nuclear mission. In 2013, the split become official as ICBM-coded operators moved into a new career field—nuclear and missile operations (13N), and missile organizations were subordinated to Air Force Global Strike Command instead of AFSPC. In an after-action assessment of the two surety incidents, an Air University study

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[58] Air Force Space and Cyberspace Professional Management Office, "SPDP Certification."
[59] House Armed Services Committee, Strategic Forces Subcommittee, *Statement of Peter B. Teets, Undersecretary of the Air Force*, Congressional Hearing Testimony, July 22, 2004.

found that while multiple causes lay at the root of the failures, “the foremost issue [was] declining…expertise in the Air Force ranks.”[60] The study’s authors recommended that “the Air Force…provide and encourage an educational and experiential path that leads to technical competence for Airmen who are then likely to become better…commanders in the days ahead.”[61] At the time of the career field split, service officials cited similar rationale: “Space and Missile Operations have become more and more technical in application and execution—each in their own unique ways. This split will enable each career field to continue cultivating technical expertise via separate…avenues in order to be more effective and efficient.”[62] Going forward, as geopolitical and technological developments began to undermine the premise of uncontested space superiority, some would begin to question whether even more expertise was needed within the operational space community.

Toward a Weaponized Space Domain. In the mid-2000s, the threat environment for US space systems changed perceptibly. The seminal event was a Chinese direct-ascent ASAT test in January 2007 in which China targeted and destroyed its own defunct satellite, successfully demonstrating the weapon’s capabilities, but creating thousands of pieces of persistent, hazardous debris in the process.[63] Both in its execution and its aftermath, the Chinese ASAT test exemplified the competitive, contested, and congested character of military space operations that USAF leaders would increasingly identify as a critical vulnerability for the American way of war. Global concerns over the weaponization of space increased after the US conducted a reciprocal intercept of its own malfunctioning satellite in February 2008, ostensibly to eliminate the risk of toxic fuel harming humans on the ground upon vehicle atmospheric reentry.[64]

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[60] Michelle Spencer, Aadina Ludin, and Heather Nelson, "The United States Air Force Minot and Taiwan Nuclear Weapons-Related Incidents: An Assessment," Air University, April 2011, 25.
[61] Ibid., 26.
[62] Office of the Secretary of the Air Force Public Affairs, "AF Splits Space, Missile Career Field for Officers," February 15, 2013.
[63] James Clay Moltz, *Asia's Space Race : National Motivations, Regional Rivalries, and Rnternational Risks* (New York: Columbia University Press, 2012), 35.
[64] *CNN Special Report: The War in Space - The Next Battlefield*, Cable News Network, 42 minutes, November 29, 2016, Television documentary.

According to news reports and interviews with senior defense and Air Force officials, development of advanced counterspace technologies increased rapidly after 2010 by potential US adversaries like China and Russia. Threats included non-kinetic capabilities like Electronic Warfare (EW) systems, direct-ascent ASATs, and satellites capable of Rendezvous and Proximity Operations (RPO). Depending on payload capability, RPO-capable satellites can maneuver close and station-keep next to a target satellite with a range of potential effects, some entirely peaceful (e.g. satellite servicing), some provocative (e.g. non-cooperative inspection), and others nefarious (attack). Systems in the latter category are typically referred to as orbital ASATs. According to news reports, the US observed foreign activities and tests demonstrating many of the above capabilities between 2010 and 2016.[65]

This round of space weapon development between the US and peer-competitors was different from previous experimentation with ASATs during the Cold War. Previous efforts took place in the context of nuclear stalemate between the US and the USSR. Actual ASAT employment was forestalled at that time by the inherent escalatory nuclear risk of attacking space systems viewed by both nations as primarily supporting strategic capabilities (missile warning, protected SATCOM, etc.). In the mid-2000s, the geopolitical situation was different. The United States had proven it possessed a significant asymmetric advantage in *conventional* conflict through its use of space. Negating critical US space capabilities could be construed by adversaries as a feasible and sensible way to reduce that advantage. Further, in a limited-war context, the threat of nuclear retaliation by the US for an attack in space was likely not credibility and therefore had diminished deterrent value. Finally, foreign advances in counterspace technology coincided with periods of increased tension with China and Russia in places like the South China Sea, Crimea, and Syria. In combination, these factors within the international security environment made the potential threats to space systems loom large to policymakers and defense leaders. As the degree of security competition and associated possibilities of armed conflict with peer adversaries increased, so did concern about the NSS community's readiness to defend critical space assets.

[65] Ibid.

As late as 2015, most of the angst surrounding space security remained isolated within policy circles and on operational and strategic level staffs. The recognition of space as a war-fighting domain was not yet widespread at junior ranks and lower echelons. Nor were space control concepts widely incorporated into USAF space operator procedures or qualification training. In isolated pockets like the Joint Space Operations Center (JSpOC)—an operational-level US Strategic Command (USSTRATCOM) command and control (C2) node—and within the space weapons and tactics community, operators were thinking about how to defend space, but these concepts were far from mature. The cultural bias towards checklist discipline and a service-provider mindset built up within the career field since its inception would prove difficult to overcome—especially at lower levels where awareness of geopolitical, policy, and intelligence information could be in short supply. Moreover, ASAT system countermeasures, in many cases, were wholly inadequate to defend against the emerging developmental threats, should they be operationalized and fielded. Given historical procurement timelines for national security space systems, an industrial solution to the foreign ASAT problem looked to be years away.

Conclusion

By 2015, the USAF space operations career field reflected the convergence of geopolitical, organizational, and technological influences. The specialty moved through its first quarter century during a period of Cold War great power competition in which nations most prized space for its strategic reconnaissance and missile warning value. As a niche capability within a department fighting for its national role in space, the Air Force relied heavily upon a highly technical space operations cadre and Air Force Systems Command's acquisition professionals. Space operational career fields were differentiated between space tracking analysis (modern-day Space Situational Awareness, or SSA) and space system operations. Space operations grew more routine over time, and with the lack of a bona fide operational threat, the career field evolved to favor checklist-driven operations oriented around remote configuration and maintenance activities focused on optimizing system availability.

As micro-processing technology advanced and the US military entered the Information Age in earnest during the 1990s, space systems showed themselves to be force multipliers in a series of limited, conventional conflicts. Simultaneously, the end of the Cold War precipitated a total force drawdown in personnel, resulting in a systemwide reduction in Air Force career field specialties and a resulting bias toward occupational generalists. Despite policymaker recognition of critical US vulnerabilities in space, and in the face of a drive to "professionalize" the DoD's space cadre, the checklist-oriented, service-provider mindset and a career-development model favoring breadth over depth remained preeminent in this organizational environment.

In the mid-2000s, space operations entered an era characterized by increased adversarial competition on orbit. Rhetoric from US national security leaders increased, citing the imperative for the US to improve its defensive posture in space. Yet, for the time being, change occurred only on the margins of the 13S career field. Inhibited by a dearth of system capability and a lack of technical and tactical personnel expertise, by 2015 it was clear structural change was needed.

Chapter 4

Recent Career Field Developments and the Case for Specialization

By 2015, it was clear the status quo for national security space operations would be inadequate to meet the nation's forecasted challenges in leveraging and defending on-orbit capabilities. When considered together, analysis shows these challenges derive from four fundamental and interrelated factors: 1) *Increased integration* of space effects across the full Range of Military Operations (ROMO) and at all levels of war; 2) *Proliferated threats* capable of denying American space superiority; 3) Increased reliance on *tactical level decision-making* for mission effectiveness; and 4) A *dynamic operational environment* in which operators must make decisions under fluid, time-compressed conditions.

The first two factors, discussed at length in previous chapters, drive the other two, which deserve further elaboration. The *tactical* character of future military space operations reflects the combination of increased integration of space capabilities and proliferated threats that will increasingly force decision making at lower levels. This phenomenon will exist in both a force enhancement context (i.e. supporting geographic combatant command terrestrial conflicts) and from an in-domain space protection perspective. For example, OPIR-derived battlespace characterization information can now aid theater intelligence fusion centers on time scales supportive of theater dynamic targeting processes, a capability unheard of when OPIR satellites were first designed to provide strategic missile warning of ICBMs. Release criteria for these lower intensity events, however, is typically neither as discrete nor as intuitive as for a missile launch. Increased judgment and expertise are therefore required by the tactical level space operators and intelligence analysts who must decide whether battlespace characterization information is valid, releasable, and value-added to theater (i.e. conforming to collection managers' desires). Moving into space itself, an in-domain example of tactical-level decision making would be a satellite operator needing to threat-react in real-time to a ground-based or space-based ASAT. In contrast with the checklist-driven, procedural mindset that might have driven satellite flyers of years past to "safe" the spacecraft when faced with anomalous indications and await further instructions, saving a satellite from an attack (versus a system malfunction or environmentally-driven anomaly) may require immediate and decisive action. Such action must be based on tactical-level expertise and judgment—grounded in procedure where possible, but also tempered by the training, experience, and knowledge of the operator. Furthermore, tactical-level decision making is itself made more difficult in time-compressed and fluid conditions, where operators must make rapid choices in the face of incomplete and changing information. Whether supporting a time-sensitive targeting operation in theater or evading a quickly approaching ASAT, time will be of the essence, further exacerbating the need for expert, experienced operators.

As shown in the previous chapter, the NSS enterprise has not evolved to the point where this vision of the future operating environment is supported by the joint space force as currently constructed. This chapter examines the nature of these shortfalls in context with USAF and DoD initiatives designed to overcome them— some of which are already being implemented. It questions whether these efforts are sufficient to appropriately posture the force to accomplish the military tasks demanded by the future operating environment. Finally, it studies whether occupational specialization in the space operations career field could beneficially augment the other changes already underway—and if so, in what areas.

Linkages between Broader Concerns and Space Ops Career Field Issues

Many predicted problems within the NSS enterprise seemingly exist independently from concerns over USAF space operator readiness but are, in reality, coupled. For example, notwithstanding countermeasures for communications jamming on certain SATCOM satellites, resilience has largely been ignored as a major design attribute for US space systems and architectures. Moreover, fielding active (weaponized) space systems capable of offensive and defensive counterspace operations has been proscribed by both US policy and technological immaturity. Next, achieving unity of effort between the Title 10 (military-centric) and Title 50 (IC-centric) aspects of the NSS community has long been a vexing problem. Lastly, the US is currently unable to rapidly reconstitute space systems—regardless if lost to malfunction or malevolence. This is due to NSS reliance on a boutique, "one-off" industry model for space system procurement, a shortfall of space launch capacity, and the high costs and long timelines associated with launch.

All of these problems are in various stages of mitigation. The US will consider and incorporate—as a matter of policy—the resiliency-related concepts of disaggregation, protection, distribution, diversification, proliferation, and deception into its future space system architectures.[1] Such measures will undoubtedly help reduce the vulnerability and brittleness set to confound the US in a militarily contested space environment. The National Space Defense Center (NSDC) stood up as an operational-level command and control center in 2016 and is focused on bringing together DoD and IC efforts to defend against space threats and to maintain common battlespace awareness.[2] Its formation was expressly intended by senior interagency leaders to help bridge the organizational seams between the DoD and the IC. Meanwhile, a strong push for agile space acquisition processes, in combination with greater competition brought on by a renaissance in the commercial satellite and launch industries, promises to boost US responsiveness in fielding and replacing critical space systems.[3] Lastly, the Trump administration's 2018 National Space Strategy, through its pledge to "prepare to meet and overcome any challenges that arise" in an orbital environment that "our competitors and adversaries have turned…into a warfighting domain," implies a US policy environment that is tolerant and even supportive of fielding advanced systems capable of conducting spaced-based surveillance, reconnaissance, and active defensive operations.

While the problems described above would likely exist independently of challenges in the 13S career field, many of their *solutions* are clearly linked to concerns over space operator readiness. Spacecraft with ground-commanded onboard countermeasures, for example, would rely on tactical space operators

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[1] Office of the Assistant Secretary of Defense for Homeland Defense & Global Security, "Space Domain Mission Assurance: A Resilience Taxonomy," White Paper, September 2015, 6.
[2] Swarts, "The JICSpOC is Dead; Long Live the National Space Defense Center".
[3] Sandra Erwin, "Battle Brewing in the Pentagon over Military Space Investments," *Space News,* December 4, 2017.

for their activation. Offboard countermeasures and defensive counterspace platforms would similarly require experienced tacticians and operators. This reliance on skilled personnel will further extend to the operational level of war and higher, where battle-management command and control (BMC2) nodes will need knowledgeable and experienced personnel to assimilate a complicated operational picture and to direct lower echelon forces in a dynamic operational environment. With few exceptions, then, it appears concerns about the space operations career field must in some way be alleviated—either debunked as invalid or ameliorated through purposeful action. To assess which course of action is appropriate, this thesis next unpacks the hypothetical risks associated with contemporary 13S career field management in context with the predicted future operating environment.

Space Operations Career Field Deficiencies and Associated Risks

As seen above in Chapter 3, the USAF space operations career field evolved over time to favor experiential breadth and a service-provider culture. This evolution was not purely accidental; nor was it entirely negative. A preference for generalists and a focus on ensuring space-enabled effects for terrestrial warfighters were both reasonable and even appropriate perspectives in a post-Cold War geopolitical environment in which no serious adversarial threat to space systems was present. This structure facilitated organizational agility (in regard to personnel assignment), and also enabled a broader base of space professionals available to integrate with theater users. Both characteristics, however, are potential liabilities in the future space operating environment. They contribute directly to interrelated career field shortcomings in the areas of technical and system knowledge, doctrinal maturity, and training quality that, in aggregate, degrade readiness to operate in the challenging space environment of the future.

Technical and System Knowledge Gaps

The space operations career field, in deed if not in word, tends to build space generalists. Officially, the specialty's career pyramid published by AFPC advertises either breadth or depth as viable goals for an operator's (typically a

Captain's) second assignment.[4] The idea is that under such a model, at least some individuals in any given unit would possess increased subject matter expertise related to the space domain, organization's mission, or platforms. In practice, however, building deep system, mission area, and technical knowledge across the career field at junior grades would require purposeful direction on the part of assignment managers—a team of only two mid-career officers. It would be necessary to track members' education, training, and experience over time, to decide which operators should be chosen to pursue depth over breadth, and then to assign those members accordingly. Such a deliberate approach is not in place. Some members do self-nominate or are vectored by their commanding officers or career field development teams toward follow-on assignments that dovetail with previous experience, but such occurrences are neither systemic nor normalized.

The idea of accumulating depth is further complicated by the way the career field tracks and groups experience sets oriented around organizations rather than functions or tasks. An illustrative example is the mission code 'A' in EC listing (Chapter 3, Figure 2). This code, which clusters experience identifiers under the heading of "satellite systems," is misleading in that it only captures satellite systems operated by the 50th Space Wing at Schriever Air Force Base (AFB), Colorado—as evidenced by the fact that platforms associated with space-based missile warning (460th Space Wing) are listed elsewhere (mission code 'D'). Furthermore, even within mission code 'A,' the functional missions of the systems listed are sufficiently different that experience with one would not necessarily transfer to another. Operating the GPS constellation has little in common with overseeing MILSATCOM platforms, for example; each has different mission areas, different orbits, and different ground and space equipment. Even if an assignment manager wanted to build a member's experience within these very different missions, the option would be untenable, since two consecutive three-year assignments at the same base and wing are typically antithetical to USAF business rules. Structurally, then, the EC listing,

[4] Air Force Space and Cyberspace Professional Management Office, "Space Operations (13S) Career Pyramid" (Air Force Portal, Accessed on 1 May 2018).

while extremely valuable for data-mining applications, demonstrates limited use for institutional attempts to build tactical depth and expertise.

The overall result of a bias toward breadth is that space operations are treated monolithically both institutionally and within the minds of many Airmen. Culturally, "space guys"—as space operators are frequently referred to by officers outside the career field—are distinguished by the domain in which they operate, rather than a more granular description like a space mission area of expertise or a given space weapon system. Contrasting this convention is the typical aviation norm wherein pilots most often describe themselves to other Airmen by their rated specialty (for example, fighter pilot, bomber combat system officer, mobility navigator), if not their specific platform (e.g. F-22 pilot). The "space guy" moniker, however informal and willingly assumed by the men and women of space operations, is symbolic of a prominent perspective held within the Air Force towards the career field. The tacit implication is that the service views tactical-level space operators as accountable for an entire warfighting domain's worth of knowledge and operational expertise, not just a single space mission area or weapon system. This expectation is unrealistic, unattainable, and has real consequences for the levels of expertise commonly achieved by USAF space operators. As jacks-of-all-trades, space operators are often masters of none. In a non-tactical, static space environment this condition might be acceptable. In a tactically-oriented, dynamic domain it creates significant risk.

Warfighting Doctrinal Immaturity

The operational risk incurred by inexpert, inexperienced space operators is further underscored by doctrinal deficiencies. This immaturity derives from both the lack of expertise as discussed above, but also from the specialty's service-provider mindset. Doctrine—authoritative but non-prescriptive operational and planning guidance—is in short supply beyond cursory mentions in most Air Force-level 3-series doctrine annexes. The single space-focused doctrine document, Annex 3-14, numbers approximately 80 pages of content and encompasses all space mission areas. By comparison, the counterland air operations Annex 3-03 has over 90 pages and is one of several air-oriented doctrine annexes maintained by the Air Force.[5]

Tactical-level space doctrine, commonly referred to as TTP, is in an even more inferior state in comparison with USAF aviation communities, particularly in regard to fighting and defending in-domain. Doctrinally, the Air Force space cadre concerned itself in the post-Cold War period with optimizing the integration of space capabilities into joint warfare, an orientation reinforced by the prevailing conflicts of the day. Particularly after September 11, 2001 and the ensuing interventions in Afghanistan and Iraq, the USAF space operations community set aside the specter of major combat operations between space-faring peer adversaries. The space operations community, wanting to maximize its support of these efforts, focused on maximizing its service provision for terrestrial commanders engaged with less capable state and non-state adversaries. In an operating environment that was neither tactical nor dynamic, the importance of tactical warfighting expertise was not emphasized. In fact, it was common for space wing leadership, even down to squadron commanders, not to be mission ready qualified in any of the platforms for which they had responsibility. Disqualification of a senior leader from operating an organization's primary weapon system would be viewed negatively in many other Air Force operational career fields and would reduce those leaders' credibility. Within the space operations community, however, this situation was viewed as acceptable because technical and system proficiency was not prioritized as an essential part of the job. Overall, as a result of this mindset, the lesson espoused by early air power theorists like Sir J.C. Slessor of Britain, that the "struggle for air superiority is part and parcel of all air operations against a first-class enemy" had not yet found its parallel in USAF space operations.[6] Space systems were vulnerable, yes, but mostly to the harsh physical space environment and to man-made technological failures—not the enemy.[7] The 2007 Chinese ASAT test was certainly a wake-up call, but many

[5] Department of the Air Force (DAF), "Counterland Operations," Air Force Doctrine Document Annex 3-03, Headquarters Department of the Air Force, 2017.
[6] John Cotesworth Slessor, *Air Power and Armies* (Tuscaloosa: University of Alabama Press, 2009), 10.
[7] Hyten, "Space Mission Force: Developing Space Warfighters for Tomorrow," 3.

perceived even that destructive event as merely a test, not representative of the actual or near-future threat environment.

Shortcomings in the Training of Space Operators

Examining the training offered by the 13S career field, circa 2015 (pre-SMF), offers additional insight into important differences between the space operations training model and that of other Air Force operational specialties. Certainly, the physical environments, mission requirements, and technical parameters differ mightily between space and aviation operations. Nonetheless, as emerging threats bring tactical space warfighting concerns to the forefront, the categorical dividing line distinguishing traditional air-minded Air Force combatants from the "space-minded" operators who support them is blurring. Accordingly, an assessment of how the USAF space operations training model compares with that of its combat aviation counterparts may offer important clues. In particular, it could identify differences that point directly to future readiness challenges that will confront the service in a contested space domain.

Introductory training. In line with the specialty's tendency toward occupational breadth, procedural discipline, and a service-provider mindset, officers begin their space operations careers with general knowledge of the space domain and its various mission areas, specific knowledge on checklists for which they have been qualified, but limited technical, system, or tactical expertise. They first attend Officer Undergraduate Space Training (OUST), a three-month course which encompasses fundamentals on all space mission areas. OUST is a knowledge-based curriculum, with proficiency primarily assessed via written examination and little hands-on application of concepts. Following this initial phase of training, operators proceed to their permanent bases for qualification training on the systems they will operate. In USAF aviation career fields, in contrast, pilots are split into multiple paths—fighter/bomber, airlift/tanker, turbo-prop multiengine, and helicopter—during the "track select" portion of Joint Specialized Undergraduate Pilot Training (JSUPT) to gain additional familiarization with the skills, tactics, and knowledge they will need for their eventual operational flying assignments. Next, student pilots are subsequently sent to Initial Qualification Training, in which they receive hands-on training in their operational platforms. In contrast with this model, space operators proceed directly from OUST to a combined IQT/MQT at their operational bases, with no intermediate steps either in a tracked training course (according to a specific mission area, for example) or at a dedicated Formal Training Unit (FTU) for IQT. IQT is at times absent altogether.

Space operator qualification training also tends to be highly scripted, with scenarios configuration-controlled, often at the group level. Because orbital systems are high-demand, low-density platforms, actual operational equipment is not made available for training use—a key difference from training in aviation career fields. Instead, units depend on simulators, which vary significantly in realism and capability, depending on the platform. Currently-fielded tactical-level simulators are limited in their ability to replicate dynamic scenarios. Operators rarely react to a thinking adversary—live or virtually—during this type of training.

Another important attribute of officer space operator training that reflects its lack of emphasis on tactical-level knowledge and expertise is that the number of subordinate qualifications and certifications is generally low compared to the service's aviation career fields. Rather than needing to maintain distinct qualifications for different activities (such as mission category, munition type, or flight profile), space operators most often receive qualification only in a given operator position, typically focused on operation of the vehicle, operation of the payload, or command of an entire crew. Task differentiation between officer and enlisted operators, depending on system, can be minimal. At times, the only distinction might be the level of responsibility for reporting certain statuses or in approving certain procedural steps for execution. Finally, detailed training programs for individual operator positions do not exist as Air Force level instructions specific to individual Mission Design Series (MDS), as is standard for aviation communities. The disparities in the initial training approaches between the aviation and space operations career fields are noteworthy because they support the conclusion that space operations qualification training programs are not treated with the same rigor and importance as those in the aviation community. As a result, it is reasonable to question whether they receive a lower degree of quality assurance during development or less senior leader oversight during implementation.

Member development. Until very recently with the implementation of SMF, continuation training in space operations looked much the same as qualification training. Qualified operators received periodic recurring training according to an annual plan of instruction that specified tasks to be trained at a given frequency in order to maintain qualification currency. Evaluations were similarly re-administered on a periodic basis unless otherwise accelerated or directed by a commander. Similar to qualifications, currencies in space operations were not tracked at the same level of granularity as in aviation career fields. In contrast with the 19 different pilot currencies tracked by F-16 squadrons, for example, the number of formal currencies tracked in a space operations squadron was typically much less.[8] High granularity in qualifications and currencies generally corresponds to high requirements for occupational expertise. It implies task groupings and knowledge areas that are sufficiently diverse, difficult, or important to require separate evaluation. It is worth asking the question, when looking to the future of USAF space operations, whether tasks and knowledge areas will need to be parsed more finely in order to effectively train and evaluate proficiency.

Next, space operations upgrade opportunities were also much fewer. Crew positions on space operations floors were based most directly on a member's rank and the associated responsibilities that member held for system command and crew oversight, rather than accumulated tactical experience or technical expertise. Moreover, the career field tended to conflate operational and administrative growth paths for its leaderships. The typical positional flow for a space operator newly assigned to a space operations squadron was to spend one to two years as a dedicated operator before "upgrading" to a day-staff position in the squadron (e.g. as a flight commander, chief of training, etc.), where he or she might sit only one to two proficiency shifts per month. Regardless of a member's operational prowess, "crew-dog" duty was not recognized as a path to make career advancements. Top performance review stratifications typically went to those on day staff who had more opportunity for leadership exposure and to help work high-priority projects outside the daily

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[8] "F-16--Pilot Training," Air Force Instruction 11-2F-16, Volume 1, 2015, 28-30.

grind of operations. While administrative positions are also prized in other USAF operational career fields, the devaluation of tactical-level expertise was not nearly as drastic.

Finally, specialized and advanced training programs in the space operations community were quite limited. What opportunities that existed were primarily educational in nature, not application-oriented. Of the few tactical-level, hands-on advanced training events in which space operators did participate, such as RED FLAG, most did not permit participants to operate their primary MDS during the exercise (the 21st Space Wing's counter-communication system [CCS] at RED FLAG and various space units' participation in the Air Force Weapon School's Mission Employment exercises are notable exceptions).

The space operations career field's tacit preference for breadth in combination with the lack of an adversarial threat to force expertise at tactical warfighting levels has left the USAF unprepared to win space. Technical and system expertise is low, with high reliance on engineers, civilians, and contractors once checklist steps have been exhausted. Doctrinally, TTP for space warfighting for most MDS's is immature if not altogether nonexistent. The comparatively low number of qualifications, currencies, upgrades, and advanced training opportunities in the space operations community reflects the same low valuation on task expertise and technical knowledge. Space operations training programs reinforce procedural reliance, a culture of service provision, and a preference for experiential breadth.

The Space Mission Force: Is it Enough?

By 2015, AFSPC decided the shortfalls in space operations readiness had become untenable in light of the growing threat environment. AFSPC began laying the groundwork for a major shift in its organizational and training models to build higher levels of expertise. It called its new construct the Space Mission Force (SMF). In a white paper outlining SMF, published in 2016, AFPSC Commander General John Hyten wrote:

> Today, our space operators are trained to mitigate environmental and manmade risks to complex and capable space systems. As the military threats to these systems grow, our training must shift to counter these threats. Our space forces must demonstrate their

ability to react to a thinking adversary and operate as warfighters in this environment and not simply provide space services.[9]

SMF Described

SMF introduced three key concepts that were fundamental departures from the traditional space operations model: the Ready Spacecrew Program (RSP); Advanced Training, and the Space Mission Task Force (SMTF). Modeled after the Ready Aircrew Program that governs CT and ST in the USAF aviation community, RSP significantly deviates from traditional AFSPC training constructs. It looks to add rigor and accountability in the maintenance of currencies, but its real focus is on generating continual improvement in the skill and proficiency of space operators. To do this, SMF aims to provide advanced training "beyond current [operator] expertise and limits," then rely on a rigorous debrief process to facilitate growth and learning.[10] RSP intends to eventually incorporate opposition forces (OPFOR) and high-fidelity Live, Virtual, and Constructive (LVC) training, further addressing existing deficiencies in the current training model. Lastly, SMF "dismantles the traditional divide between the operational crew force and day staff" assigning all operators as part of crews subordinate to a Space Mission Task Force (SMTF).[11] Similar conceptually to the proven Air Expeditionary Task Force model, the new SMTF force-presentation construct enhances readiness by optimizing available operator experience to conduct the space combat mission. When not deployed in place as part of an active SMTF, operators are in a "dwell" cycle, available to perform advanced training and perform other service-related, developmental, or administrative tasks.

As the SMF concept matures, AFSPC is looking to add many of the best-of-breed practices found throughout other USAF training programs. For example, in an updated guidance memorandum published in Spring 2018, AFSPC Commander General Jay Raymond directed his forces to develop MDS-specific volumes for training, standardization and evaluation, and operations. The move reinforces the increased priority for tactical level expertise and

[9] Hyten, "Space Mission Force: Developing Space Warfighters for Tomorrow," 3.
[10] Ibid., 4-5.
[11] Ibid., 6.

provides standard expectations for currency intervals (called "lookback" times) and qualification regression criteria.

Residual Concern

SMF is a major step forward toward reversing the space operations community's service-provider culture and its predisposition for occupational breadth. As described previously, these factors led to shortfalls in technical knowledge and expertise, doctrinal immaturity, and training deficiencies. SMF explicitly emphasizes and celebrates a warfighting culture in which tactical and technical expertise are valued operational traits. As currently constructed, however, SMF does uphold one major assumption from the legacy space operations model that, if proven false, endangers the program's very worthwhile goals.

Under SMF, by leaving the career field specialization structure and assignment management processes unchanged, the space operations specialty assumes that its members can accumulate the required knowledge and expertise to reach desired levels of proficiency within the span of a single assignment. The career field structure (a single AFSC with 4 largely irrelevant shred-outs), combined with unmodified assignment patterns of junior officers that permit and even encourage occupational breadth, make it likely that many operators will get their first introduction to a given weapon system or even to a mission area on their second or third operational tour. If the underlying assumption proves to be invalid, then SMF will be unsuccessful in meeting its goal of adequately preparing the nation's predominant space cadre to fight and win in space.

Specialization as a Potential Solution

The observation that the United States Air Force structures the space operations career field differently than its aviation-oriented counterparts is, in and of itself, an insufficient argument for change. After all, real and significant dissimilarities exist between the air and space domains and the conduct of their associated operations. Therefore, the basis for these differences in career field specialization should be assessed in order to ascertain if it makes sense for the space operations career field's approach to remain in place going forward. Three measures dominate the subject of military occupational specialization: 1) Risk to life, systems, or mission; 2) Degree of task complexity; and 3) Degree of time compression in operational scenarios. The higher each of these measures, the stronger the case for specialization in order to build sufficient levels of expertise within the force. Each is examined in detail below.

Risk to life, systems, or mission. One striking difference between USAF air and space operations with implications for occupational specialization is the element of human physical danger—both on the part of combatants and civilians. Space operators do not (under the current paradigm) employ lethal capabilities against human targets, nor are they typically exposed to serious corporeal hazards. Notwithstanding the US astronaut program, Air Force space operators do not work in the unforgiving orbital environment. Rather, they operate space systems remotely from the terrestrial environment, often removed from war zones altogether. While the relatively few numbers of space operators deployed around the globe may be placed at bases that face active threats from indirect fires or stand-off weapons, only in the rarest of circumstances would an Air Force space operator expect to see combat close at hand, and then almost certainly outside the conduct of space operations. Similarly, at home station, space operators are held at mortal risk by potential enemies capable of ranging the homeland and allied nations with destructive attacks and who possess an interest in attacking critical US military capabilities during times of war. In this regard, however, space operators are no different than other military personnel across all services and specialties who happen to work at strategically important locations.

In relation to occupational specialization, jobs with attending threat to human life—either the worker's own or others collaterally placed in harm's way—are perceived as higher-risk. Such risk is often mitigated through intensive personnel vetting, focused training, and stringent qualification or certification standards. Because of the investments in time, money, and human capital required to implement and validate these risk mitigation steps, occupational managers frequently employ administrative protocols to systemize the processes and distinguish the personnel associated with these outlays. Formal occupational specialization often results. As seen within a diverse array of career fields including medicine, aviation, law enforcement, and the military, occupational specialization is used as an efficient means to inculcate and regulate a workforce with the right mix of skill-sets and credentials when risk to human life is present. Therefore, one historical explanation why the space operations career field has remained undifferentiated within the USAF is the fact that lives are rarely endangered by space system employment.

While not rising to the same risk threshold as threats to human life, the potential for damage or destruction of military systems and the denial or disruption of those platforms' missions is also an important consideration for occupational specialization. The high-value, low density character of many space assets and the timelines historically involved in replacing them once lost make mission assurance a primary concern. Similarly, given the high degree of modern operational reliance on space systems by combatants, loss of mission can potentially endanger lives and mission success in the terrestrial battlespace. Historically, however, the Air Force has relied on means other than functional occupational specialization to ensure the operational availability of space systems. Rather than train space operators to quickly and unilaterally react to a wide-range of scenarios using accumulated judgment and expertise, the service has instead oriented toward a deliberate, heavily procedural approach that automates as much of the functionality for space service provision to planning software, off-console technical experts, or to the spacecraft itself. In a contested space domain with adversaries intending deliberate harm to US systems, greater expertise on-console will be required.

Task Complexity and Difficulty. When tasks are complicated or challenging, greater personnel knowledge and expertise are needed, all else being equal. This may in turn drive specialization requirements. SMF was constructed under the premise that some future operational space tasks will be harder and more intricate than the current baseline. A contested domain will place additional demands on operators in functional areas related to BMC2, Space Situational Awareness (SSA), and both Offensive and Defensive Space Control. Next, as space capabilities increase in utility to theater users (e.g. via battlespace characterization, on-call tactical ISR, or electronic warfare/non-kinetic platforms), greater expertise will be needed to seamlessly integrate these capabilities into theater operations. Finally, as space technology in general advances in capability, new platforms (e.g. on-orbit servicing) may come online that require increased technical expertise within the space cadre.

Time Compression. In the future, the Air Force can no longer afford to assume that space is uncontested. Previously, this contention allowed the service to lean away from tactical "threat reactions" executed by space operators, and more towards technical "anomaly resolution" efforts performed by engineers. Within this construct, the default conclusion for space operators when presented with off-nominal system behavior has been the assumption of a fault or reaction to adverse environmental conditions. Accordingly, if the system has not already responded to the situation using autonomous fault-detection and response logic, space operators train to "safe" the spacecraft themselves by using procedural steps to place it in a stable configuration. Subsequently, an Anomaly Resolution Team (or similarly-named group) forms to carefully and methodically identity the root cause of the problem and to develop a corrective fix action.

In the future, the Air Force will need to rely on the judgment and expertise of its most junior tactical operators in order to react within the constrained decision cycles afforded by adversary counterspace capabilities. In this context, the objective should be to build "fluid expertise"—the type of skill that allows operators to think on the fly, making decisions quickly and automatically.[12] Advanced training will help with this goal, but ultimately, so does cumulative experience.

Conclusion

The current specialization construct within USAF space operations is a result of deliberate decision-making regarding training and career field structure, a benign threat environment, highly-technical systems, and a minimal need to react dynamically to tactical situations. Absent a robust military threat or the need to rapidly identify and address anomalous indications, a bias toward occupational breadth made organizational sense because it granted significant administrative agility and required less investment. The trade-off, however, is that expertise declined, and the ability to

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[12] Lee G. Bolman and Terrence E. Deal, *Reframing Organizations : Artistry, Choice and Leadership*, 6th edition. ed. (Hoboken, New Jersey: Jossey-Bass, A Wiley Brand, 2017), 13.

react in real-time atrophied, if it ever really existed, in favor of a service-provider mindset in which true system and technical expertise were, by default, outsourced to defense contractors and long-term government civilians.

The predicted threat and operating environments alter the context in a way that technical and tactical expertise will become essential attributes for space operators. A key question with implications for career field specialization is whether or not the SMF construct, built on the premise of operators gaining just-in-time mission area and platform competence, is viable. The answer will come down to the diversity, difficulty, and complexity of future space operational tasks. If tasks are sufficiently different, challenging, and complicated that operators cannot reliably attain the needed degree of expertise, then arguably a change in the model for occupational specialization is called for. The next chapter investigates the types of tasks that may be called for in a future space operations paradigm, how they might be grouped together into specialties, and how those specialties can be organized, trained, and equipped over time.

Chapter 5:
Models for USAF Space Operations Specialization

With the history of the space operations career field as context and the probable needs of the future operating environment in focus, the question remains of just how specialization might assist the USAF space operations career field better achieve its mission. This chapter assesses alternatives for space operations career field specialization. First, it investigates how knowledge and task requirements might be effectively grouped into specialties. Next, in a continuum ranging from least to most disruptive to the current paradigm, three specialization models—the status quo, semi-formal career field specialization, and formally differentiated AFSCs—are examined and assessed. This thesis discusses details associated with organizing and training space operators within the construct of each model and describes each option's associated strengths and weaknesses.

Grouping Task and Knowledge Requirements

Chapter 4 of this thesis highlighted the need for greater expertise at tactical levels of the space operator career field. Improvements in training processes, particularly those enabled by the SMF, should contribute to reducing this deficiency. However, the premise that space operators will accumulate sufficient expertise and experience within a single assignment—as required by the career field's breadth-oriented human capital management approach—remains dubious. Some degree of occupational specialization, then, may yet be required. The conclusions reached in the previous chapter suggest that such specialties might best be clustered around distinct positional tasks or knowledge requirements that have high degrees of associated risk, difficulty and complexity, or time compression.

Using empirical data to identify such groups is difficult for several reasons. First, SMF is only in its nascent stages. Though the adversary threat environment is real and worsening, tactical-level TTP associated with defending space is still being developed and vetted by operational wings. Actual execution of many tasks that have been developed with the future environment in mind is also stymied by the lack of an operationalized threat and by low quality training aids (e.g. simulators). Precisely because of these limiting factors and because the entrenched procedural mindset and bias toward breadth and administrative duties has not yet shifted, assessment of what tasks are likely to require occupational specialization is limited primarily to thought experiment, rather than direct observation or statistical analysis. The concepts of risk, difficulty, and time compression, therefore, guide the development of hypothetical structures for space operations career field specialization.

High-Risk Space Operations

National security space operations perform certain operational functions that, if interrupted, pose strategic-level risks to the national security of the United States. As space transforms into a potentially weaponized domain, these risks only increase. This section describes several aspects of the current and future space operating environment with associated risk that is mitigated through higher levels of operator expertise.

Support to Ballistic Missile Defense. One of the earliest applications of military space systems remains one of its most important. Both ground-based and space-based strategic Missile Warning (MW) operators are accountable to report with 100% accuracy ballistic missiles inbound for the United States homeland and defended areas overseas within stringent timing standards. As ballistic missile technology diffuses to greater numbers of potential US adversaries throughout the world, the range of threats to which these operators must be ready to respond rapidly is also growing. Because of its existential, no-fail nature, the United States Air Force must supply this mission with well-trained, expert operators.

The most important skillset for operators in this mission area is the ability to accurately and rapidly analyze and assess data collected by operational systems, arrive at a decision—at times using ambiguous information—about whether an event meets “releasable” criteria, then clearly communicate the threat to downstream fusion, warning, and operations centers. Beyond this principal task, system technical expertise is also required. Ground-based missile warning operators should be technically well-versed in the radio frequency (RF) signal transmittal and reception equipment chain of their phased-array radars, as well as the TTP associated with managing a limited supply of radar energy to meet collection requirements. Space-based missile warning operators, for their part, must be equally familiar with the technical characteristics of their space-system architecture, both in orbit and on the ground. Lastly, system-of-systems knowledge is required for true missile warning expertise. The strategic and theater missile warning and missile defense architectures are complex, distributed systems. Understanding the organizational relationships, functions, and primary, secondary, and tertiary interconnections among nodes within this system afford space operators the opportunity to move beyond procedural reliance, where appropriate, in order to maximize readiness for this critical mission area.

Space Support to Critical Theater Operations. While perhaps not as exigent as the missile warning mission area, space-enabled services such as PNT, MILSATCOM, overhead ISR, and weather sensing all underpin the modern American way of warfare. Space missions support critical terrestrial theater operations in which US and allied servicemembers are placed in harm's way and dependent on those space services for mission accomplishment. The potential for space platforms to fail to meet user needs equates to risk that requires management. Each of the above-mentioned space mission areas carries its own set of operational challenges, as well as distinct areas of dependence on operator expertise. One overarching trend, however, seems inescapable: in both the commercial sector and the national security space enterprise, space services are growing more diverse, more capable, and more tailorable to user requirements. As a result, terrestrial users and their weapon systems are growing more reliant and more sophisticated in their requirements for space services. Accordingly, in the future, space operators must be well-versed in the missions, employment considerations, and even the vernaculars of down-range users in order to properly configure and control space systems to meet those requirements.

Preservation of Vital Space Missions and Systems. If space systems are crucial to American military success, then so are their protection in the face of would-be attackers. Mitigating the risk associated with the loss of important space platforms or the disruption of their missions means evading, enduring, or otherwise countering adversary action. Architectural resiliency and the ability to reconstitute space systems rapidly will help in this regard. Where gaps remain, the space operations career field must provide trained and expert space operators proficient in defensive space control TTP.

Operations with Spaceflight Safety Hazards. Spaceflight safety is another risk area increasingly requiring active management on the part of trained space operators. Responsible space-faring actors must protect the space domain from debris. Space, a global commons, is becoming more congested due to debris and increased human activity. In parallel, emerging technologies and applications—such as on-orbit inspection, satellite servicing, assisted space vehicle repositioning, and maneuvering to evade threats—are poised to increase the amount of actively maneuvering space objects.

The combination of these factors, the general increase in congestion along with higher levels of actively maneuvering traffic, raises the likelihood of a mishap, and one mitigation step for the resultant risk is increased levels of flight safety expertise by USAF space operators. In the United States, Space Traffic Management (STM) is currently a military mission, though the function may shift to a civilian agency in the future. Regardless, if another organization takes on the STM role, the USAF will still need individual space operators trained in maneuver planning and collision avoidance techniques. Technical knowledge of astrodynamics in both inertial and relative reference frames, as well as training on techniques for preventing and reacting to emergent, unsafe situations on-orbit, will be required.

Operations with Political Sensitivity. Space operations that could be interpreted as geopolitically provocative carry risks that must be managed—both at senior decision-making levels and at tactical units where those decisions are carried out by space operators. Tactical expertise and experience are critical in managing the risk associated with sensitive operations, because operators with these skills promote decentralized execution of these missions. Operational experts permit rapid achievement of commander intent within designated constraints and restraints, while minimizing the potential for errors. In a future environment in which increasingly aggressive space control and reconnaissance activities are possible, but where precedents and normative behaviors for these space operations are still being established, maximizing the proficiency of operators will be an important commodity.

Challenging and Complex Space Operations

Space operations of the future will also be more intellectually and functionally strenuous. They will rely less on demand-response type checklists and more on accumulated knowledge and task proficiency. Specific examples of knowledge and task areas that could prove to be especially challenging for operators in a future space operating environment are:

- Composite Space Force Package Planning and Mission Command
- Advanced Digital Communications
- Cross-platform Operations
- Defensive Countermeasure Employment
- Space Electronic Warfare
- Navigation Warfare (NAVWAR) Planning
- Battle Management, Command and Control of Space Forces
- Battlespace Awareness Information Integration
- Space Battle Damage Control and Mitigation
- Responsive Space Support to Theater Operations
- Non-routine Satellite Telemetry, Tracking, and Control (TT&C) Activities
- Collection Management and Space-based ISR

These knowledge and task areas are inherently complex and technical. The training and education investment required for members to master them will be significant. Therefore, creating specialty areas to properly manage training pipelines and downstream officer assignments makes sense, in order to both ensure sufficient supply of expertise and experience, as well as appropriate return on training investment.

Time-Compressed and Dynamic Space Operations

As previously discussed, future space operations will take place increasingly under temporally-shortened and fluid conditions, placing greater dependency on operators' accumulated knowledge and experience to act (and react) in real-time. With respect to future space operations, these conditions are most likely to manifest within three general scenarios: tactical threat reactions, time-sensitive support to theater operations, and dynamic or reactive offensive target engagement.

Resultant Specialty Areas

After examination of the above factors' influence on space operations, clusters of positional task and knowledge requirements emerge. Grouping these clusters into areas of specialization allows for the development of the higher levels of operator expertise demanded by the future space environment. These proposed specialties are Orbital Combat Operations (OCO), Electronic Space Operations (ESO), and Space Battle Management (SBM). SBM, which serves both in-domain and terrestrial users, can be further bifurcated into Space Warfighting BMC2 and Command and Control, Computers, Communication, and ISR (C4ISR) Support to Terrestrial Operations. Each proposed specialty area is described in further detail below.

Orbital Combat Operations

A crucial aspect of America's ability to succeed militarily in a contested space domain will be its ability to evade and engage on-orbit threats. The early days of aerial combat required dedicated focus and specialization to build expertise among the "pursuit" aviation community, and that imperative persists today in modern USAF fighter aviation. A similar emphasis will be required to instill such expertise and experience within the USAF space operations cadre. This proficiency will be challenging to inculcate for several reasons, necessitating the creation of a specialty. First, the relative immaturity of defensive space control systems and subsystems, once fielded, will likely necessitate operators with deep technical understanding of their capabilities and limitations. Furthermore, to counter adversary ASATs, sufficient understanding of astrodynamics in both inertial and relative coordinate reference frames will be necessary to plan and execute evasive and engagement maneuvers. Solid familiarity with both threat systems and space control TTP will be essential. Finally, the technical difficulties and complexities of orbital combat are compounded by elevated risk profiles associated with the potential loss of critical space systems, should defensive counterspace activities fail, and dynamic, compressed timelines accompanying attacks initiated with little indication or warning. The risk levels, technical intricacy, and time-compressed character of emerging orbital combat operations are convincing arguments in favor of creating an occupational specialty.

Electronic Combat Operations

Another area ripe for specialization can be found among space operations that involve the contested transmission and reception of RF electromagnetic energy. Operations of this type include space electronic warfare (including its subcategory Navigation Warfare, or NAVWAR), the characterization of RF interference, and the provision of space-based PNT signals to terrestrial users. Threats to RF satellite communications have proliferated, even as commercial and national security SATCOM and broadcast packages have grown in diversity and pervasiveness. MILSATCOM systems once thought to be immune (or at least resistant) to purposeful interference via technical design characteristics are, in the future, likely to be threatened by US adversaries. In turn, the US has acknowledged its own ground-based counter-SATCOM electronic warfare platform.[1] Threats to space-based PNT systems like the Global Positioning System have likewise spread and grown in capability in recent years.

The prevailing trend seems clear. Space-based signals and associated communications will be commonplace electronic warfare (EW) targets in future conflicts. Therefore, the space operations career field should build the requisite expertise to effectively attack and defend across the RF portion of the electromagnetic spectrum. As space-enabled communication systems grow in sophistication and complexity, the technical expertise required by space professionals to engage and protect these systems is also increasing—especially as relates to state-of-the-art electronic attack techniques or protecting against peer adversaries. Technical fluency in radiofrequency principles and digital communication schemas will be operational prerequisites, as will deep familiarity with both EW threats and targets. Time compression, another factor driving the need for occupational specialization, also plays a role in these operations. With space EW increasing in frequency and scope, adversary defenders and attackers will improve their proficiency. EW engagements of the future are likely to be dynamic affairs between thinking and reacting opponents

[1] David Martin, *60 Minutes: The Battle Above*, 25 minutes, April 26, 2015, Television Documentary.

rather than static and complacent targets. EW combatants must be spectrally agile, situationally aware, and highly responsive. They must be proficient in the cat-and-mouse employment of EW TTP, EW countermeasures (CM), and EW counter-countermeasures (CCM).

Space Battle Management

The last area of potential specialization for the space operations career field is Space Battle Management (SBM). The term battle management is admittedly broad, as demonstrated by its official DoD definition: “the management of activities within the operational environment based on the commands, direction, and guidance given by appropriate authority.”[2] But in the context of a contested space domain, the phraseology—especially the inclusion of the word battle—carries important meaning, however inexact. In the existing USAF Air Battle Management (ABM) career field, 13B, “management of activities” includes everything from the gathering, processing, and sharing of decision-quality information, to the control of airspace, to the direction and tasking of assigned and supporting forces. Transferring these concepts to the space operations environment means moving beyond the traditional Space Situational Awareness construct that is too often confined to space traffic management responsibilities, even if doing so is doctrinally inappropriate. Space Traffic Management is important, just as airspace control and deconfliction are important to ABM, but it does not comprehensively address the full spectrum of warfighting tasks.

At a fundamental level, SBM describes the tasks and knowledge associated with: 1) gathering, organizing, and sharing of battlespace-related information to support the execution of space operations; 2) decision making based on that information; and 3) the subsequent direction of assigned and supporting forces to achieve the decisionmaker’s intent. Beyond these common elements, the skill and knowledge level requirements associated with this process are diverse and dependent on application. Therefore, it is worthy of consideration to further divide this function into two sub-specialties representing different lines of effort, but managed as a single specialty: SBM

[2] Joint Staff, "DoD Dictionary of Military and Associated Terms," 27.

that supports in-domain superiority operations and SBM that supports terrestrial applications.

Space Warfighting BMC2. The impetus for the recent changes in the training and presentation of USAF space forces revolves around space warfighting and its perceived criticality to national security. Accordingly, it makes sense to have an occupational specialty associated with managing this activity. All three specialization criteria—risk, complexity, and time compression—are abundantly present in space warfighting BMC2, demanding higher levels of expertise. The materiel, mission, safety, and political risks associated with directing the defense of critical space assets (or, in contrast, attacking adversary space assets) require management. Ensuring operators are sufficiently trained and experienced helps mitigate this risk. This requirement comes into focus when taking into account the challenging knowledge and performance requirements associated with controlling ISR and space control platforms of various types, understanding the capabilities, limitations, and TTP of each platform, as well as the best available methodologies for communicating with each. The ability to synthesize many disparate sources of information and to present that information effectively to military decisionmakers are also skills that require honing over time. Though not as demanding as that seen in the OCO specialty area, operators in the space warfighting BMC2 sub-specialty must also have a working knowledge of astrodynamics in order to direct effectively the interruption of adversary kill-chains or the United States' own orbital engagements. Lastly, given the dynamic and time-compressed character of future space combat, space battle managers will be similarly challenged as other specialties to take or facilitate action within shorter decision cycles.

Space C4ISR Support to Terrestrial Operations. As space capabilities increase in utility and become more tightly integrated with theater users at lower echelons, the need for close coordination and synchronization between space operators and down-range warfighters will also grow. To be effective at future multi-domain operations, space operators will need to increase their expertise at dynamically integrating space effects to meet user requirements. This is especially true for emergent, high-risk situations such as dynamic targeting scenarios, theater ballistic missile defense operations, or major combat operations. Members of this space operations specialty would operate primarily from the continental United States, but should expect to deploy periodically to supported combatant command areas of responsibility to provide needed space operations expertise. Deployed SBMs within this specialty would embed in tactical units and operations centers where such knowledge and skills are needed (for example, at theater Air Operations Centers). With their deployments successfully complete, SBMs would return to their deployed-in-place locations as part of US Strategic Command-apportioned Space Mission Task Forces, further armed with knowledge and experience related to integration of space capabilities.

This specialty would encompass operators of space systems performing missions in direct support of combatant command and combat support agency terrestrial mission sets. These space mission areas include Strategic Missile Warning, Theater Missile Warning, OPIR Battlespace Awareness and Characterization, Space-based ISR, Space-based weather sensing, Space-enabled PNT, MILSATCOM, and Operational-Level Command and Control.

Models for Space Operations Occupational Specialization

The preceding portions of this thesis examined the idea of occupational specialization within the space operations career field. The Air Force stands to reap substantial operational gains from such an approach. The analysis, so far, has been performed in an administrative vacuum. The costs associated with organizing, training, and equipping a career field based around multiple specialties versus the current breadth-oriented baseline have not yet been characterized.

While a complete quantification of the relative trade-offs associated with specialization—to include personnel and financial costs, as well as potential impacts to other Air Force missions—are outside the scope of this thesis, it *is* possible to predict the general outlines of the shapes such tradeoffs would take. The remainder of this chapter examines three possible implementation models associated with occupational specialization: the baseline approach, a semi-formal specialty model, and a formally differentiated AFSC construct. It describes each in terms of career field structure, initial training and education requirements, officer development, and potential higher-order administrative effects.

Model #1: Baseline Specialization Approach

The first space operations specialization alternative is the simplest—to make no transformative career field changes.

Model Description and Structure. In choosing to keep the current specialization model for Air Force space operations, senior leadership could be acting under one or more rational premises. First, Air Force leaders could assess a lowering of the currently predicted threat environment, rendering it insufficiently dire to risk the substantial administrative upheaval within the AF personnel system that might be required of more drastic scenarios. Discounting the danger posed by emerging threats in space would fly in the face of recent rhetoric from the service's highest ranks, but such shifts in the geopolitical security environment are theoretically possible. One potential catalyst for a downgrade in threat level would be a thawing on the diplomatic front. As a case in point, in its 2010 National Space Policy directive, the Obama administration stated its intent for the United States to "pursue bilateral and multilateral transparency and confidence-building measures to encourage responsible actions in, and the peaceful use of, space." The policy went on to state that the United States will "consider proposals and concepts for arms control measures if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies."[3] To date, however, the United States has not agreed to any proposed codes of conduct or legally binding agreements in space, variously citing the lack of verification mechanisms, exemptions of significant threatening capabilities like ground-based ASATs, and even disagreements on fundamental concepts, such as "what constitutes a space weapon and a peaceful use of space."[4,5] Though work continues on prospective codes of conduct—for example, in the European Union as well as by advocacy groups

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[3] Office of the President of the United States, "National Space Policy of the United States of America," 7.
[4] Micah Zenko, "Policy Innovation Memorandum No. 10: A Code of Conduct for Outer Space," (New York, NY: Council on Foreign Relations).
[5] Timothy Farnsworth, "Space Code Process Called 'Unsuccessful'," *Arms Control Association*, March 2016.

outside of government channels—the prospects for the US to join a multilateral agreement restraining activity in space appear to be dimming. In early 2018, the Trump administration published its own national-level interagency space policy document, which it termed the National Space Strategy. The unclassified fact sheet describing the document outlines a strategic approach that clearly deviates from its predecessor in its more strident tone, asserting America's goal of achieving "preeminence" in space.[6] Although it does not explicitly reject the previous administration's objective of enhancing behavioral norms in space, the new strategy appears to rely instead on a traditional punishment deterrence model. It contains no language concerning international norms, transparency, or confidence-building measures, proclaiming instead that America "recognizes" that its "competitors and adversaries have turned space into a warfighting domain." It further declares that "interference or attack" upon critical space systems will be "met with a deliberate response at a time, place, manner, and domain of [the United States'] choosing."[7] The current domestic political environment, therefore, appears to favor strategic options that recognize a high likelihood, if not inevitability, of conflict in space. In sum, while not impossible, the publicly stated policy positions of the current US administration reduce the likelihood that Air Force leaders would discount the possibility of orbital conflict, thereby preempting the requirement to invest in improving the tactical expertise of their space cadre.

Even with a clear and capable threat from potential adversaries, other factors might be able to reduce vulnerabilities in space, obviating, or at least reducing, the need for change in operator specialization structures. Instead of relying on highly proficient tactical space warfighters, senior leaders could look to architectural solutions, industrial base efficiencies, or to system design attributes to deny adversaries the benefits of striking US space systems. As previously discussed, DoD policy identifies three classes of space domain mission assurance measures: Resilience, Reconstitution, and Defensive

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[6] "President Donald J. Trump is Unveiling an America First National Space Strategy," White House Fact Sheet, news release, March 23, 2018.
[7] Ibid.

Operations.[8] Notably, of these three categories, the first two are less reliant on operator proficiency than the last, and therefore do not require career field specialization. Boosted resilience and improved responsiveness in replacing critical space systems would be a major step toward disincentivizing possible attacks in space, in turn reducing the strategic vulnerability currently challenging the nation. In an environment where "denial deterrence" is achieved by the United States, the impetus for highly proficient tactical space operators is minimized, making the status quo specialization model more palatable.[9] Resilience and reconstitution are now national priorities within the national security space enterprise, but they are a long way from being a reality. The pace at which progress is made toward these other pillars of space mission assurance may have implications for the focus placed by AF senior leaders on defensive operations and space operator tactical proficiency.

A third reason USAF leadership might choose to forego major changes to the service's space operator career field model is a lack of resources. Increased specialization is unlikely to come without a price. Improved tactical-level expertise, to be gained through an elevated training and operational focus on complex tasks grouped into specialties, will cost the Air Force financially in terms of both manning and training investment. The impact will be measured in more than dollars, however. Organizational agility is also likely to be affected by increased occupational specialization, since more rigorously applied standards for qualifications and specialty-specific operational experience will limit the assignment options for space operators. In a constrained fiscal and administrative environment, AF leaders will be faced with hard choices. It is reasonable to conceive that maintaining the status quo for space operations career field specialization and accepting a higher degree of operational risk may be acceptable trade-offs.

Implementation Details. As the status-quo option, implementing this specialization model would be straightforward. Training, education, and

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[8] Office of the Assistant Secretary of Defense for Homeland Defense & Global Security, "Space Domain Mission Assurance: A Resilience Taxonomy," 4.

[9] Daniel Byman and Matthew C. Waxman, *The Dynamics of Coercion : American Foreign Policy and the Limits of Military Might*, RAND studies in policy analysis (New York: Cambridge University Press, 2001), 78.

assignment management processes would remain unchanged. The DoD space operations community would rely on the other two legs of the space mission assurance triad—resiliency and a rapid reconstitution ability—to deter, withstand, or recover from adversary attacks in space. Enhancements to operational readiness would still be possible under the SMF construct. Such gains would be further enabled by improvements to advanced training infrastructure. Furthermore, to the extent that future space platforms can be designed to provide unambiguous indications to space operators allowing the rapid execution of pre-built checklists for defensive operations, the space operations community would not be defenseless. Unquestionably, however, if senior leaders determine the status quo option space operations specialization option to be the "least worst" choice, then defensive operations against a capable and determine adversary will be sub-optimized. During times of increased geopolitical tension, higher-than-desired levels of risk may be incurred.

Model #2: Semi-formal Specialization

Representing the middle ground between the status quo and significant career field structural changes rests the second alternative. This option would maintain a single Air Force Specialty Code consistent with the current baseline, but would aim to achieve greater tactical expertise by applying greater rigor in experience tracking, enforcing higher qualification standards for certain operational roles, using existing schemas for experience and skillset differentiators to greater effect, and placing greater responsibility in the hands of unit commanders and assignment team managers for hiring and placing the right individuals in the right jobs.

Model Description and Structure. The current, singular 13S AFSC functional area would be retained. Formally defined qualifications, in combination with Special Experience Identifiers (a widely-accepted USAF enterprise-wide schema), would supplant Space Professional Experience Codes (an AFSPC-unique administrative tool) as the system of record to track granular occupational experience. As discussed in Chapter Two, AFPC uses SEIs to "complement other officer classification tools," thereby permitting the recording and retrieval of members' specific training and operational experiences to help satisfy career field manpower requirements.[10] By instruction, unit commanders are held responsible for awarding SEIs, thereby shifting the responsibility for characterizing and tracking member experience and expertise from a headquarters staff to a squadron, where it belongs.[11] This semi-formal specialization model is distinct from the current baseline in that it recognizes that in order to meet readiness requirements, the space operations career field must build experience and expertise in its members over the course of multiple assignments. Rather than make significant changes to the career field structure or to formal training pipelines, however, this option looks to leverage more informal means to accomplish that goal.

The key components of the model are: 1) targeted specialized training, including both Upgrade Training and Advanced Training, to inculcate greater levels of knowledge and skills over the course of a member's tactical career; 2) more granular qualifications and upgrade certifications that, once-earned, denote meaningful expertise and experience attained by the member; 3) rigorous tracking of these qualifications and upgrades through SMF's Ready Spacecrew Program and through the award and maintenance of SEIs; and 4) high levels of engagement by commanders not only to hire space operators with the right qualifications and experience for their units, but to develop purposefully their members' abilities so they can prepare for their next assignment and progress in operational responsibility.

The semi-formal specialization model would rely on business rules and lower-echelon organizational policies to track member experience and expertise, to ensure that members are purposefully trained in accordance with career field goals and readiness requirements, and to facilitate follow-on assignments that are consistent with member expertise and experience. It would do so with the dual objectives of further developing the member and meeting operational requirements. The model accomplishes this goal, however, without sacrificing administrative flexibility. Formally differentiating space operations AFSCs into multiple functional areas would administratively restrict movement of space operators between specialty areas. By contrast, in the event that insufficient

[10] "Air Force Officer Classification Directory (AFOCD)," 2018, 258.
[11] Ibid.

specialty-experienced operators or new accessions are available for assignment, or if the career field must address rapidly evolving operational requirements, the semi-formal specialization model would allow commanders to accept risk by taking on inexperienced or inexpert operators with different experiential backgrounds.

Implementation Details. Under a semi-formal occupational specialization model, initial accession and training would remain the same as with the current baseline. All new 13S career field members would attend OUST, followed by IQT/MQT, as discussed in Chapter 4. The building and tracking of the requisite expertise and experience needed for success in the future operating environment would happen under the purview of the SMF and Ready Spacecrew Program.

For the semi-formal specialization model to be viable, qualifications, currencies, and operational roles must be established under SMF that reliably and meaningfully distinguish different levels of expertise. This thesis has argued that any reasonable argument for space operations occupational specialization is predicated on the idea that sound operational judgment and expertise are traits accumulated over time through training and experience. If this is indeed the case, then it should be possible to define qualifications, certifications, and operator roles according to demarcated levels, based on a member's demonstrated abilities and tactical proficiency in a realistic environment. Such a construct is nothing new in the Air Force's aviation community, where upgrade certifications to Two-ship Flight Lead, Four-ship Flight Lead, Instructor Pilot, and Mission Commander are standard operator development pathways that correspond to real and meaningful increases in expertise and responsibility. Similarly, qualifications and currencies for specialized equipment (e.g. targeting pods, night vision goggles) or mission types (e.g. operational reconnaissance) are also standard and expected approaches to develop operational skills past the point required for Basic Mission Capable or Mission Ready qualifications.[12] Under SMF, SMTF dwell cycles and Advanced Training events like SPACE FLAG are the appropriate places to perform these

[12] "F-16--Pilot Training," Air Force Instruction 11-2F-16, Volume 1, 2015, 44-69.

specialized upgrades or qualifications, just as RED FLAG and other training sorties are frequently used for the same purpose in the aviation community.

Another prerequisite of the semi-formal specialization model will be rigorous recordkeeping of members' training and operational experiences. This must go beyond administrative currency tracking (although this too, is clearly essential), to include qualitative descriptions of a member's functional skill and knowledge level. The semi-formal model depends on SEIs for this task. SEIs are extremely tailorable, with the Air Force reporting over 46,000 distinct codes possible as of April 2018.[13] They are also changeable at a much lower level than career field specifications, requiring only the recommendation of the career field manager (typically an O-6) and the concurrence of AFPC staff to add or remove. SEIs appear on standard Air Force records, like the Officer SURF, in contrast with ECs that are denoted only within the AFSPC-generated Space-SURF. Commanders should be held accountable for updating and maintaining their officers' SEIs under the semi-formal specialization model, thereby ensuring the most complete picture possible of an operator's knowledge and functional skill levels.

Such thoroughness will be essential when it comes to managing space operator assignments. Under the semi-formal specialization model, commanders, AFPC assignment managers, and other career field leaders will build depth of expertise within the career field by ensuring tactical operators are tracked to follow-on assignments that keep them in the same operational specialty area, such as those described in this thesis or otherwise defined by Air Force space operations leadership. By mapping required and desired qualifications and SEIs to unit manpower billets, commanders and assignment managers can be confident that they are suitably placing members into jobs that both meet operational requirements and offer developmental growth opportunities for members.

Model #3: Formally differentiated AFSCs

A final option for space operations specialization is the development of fully differentiated career fields. This alternative would separate groups of complex tasks into formalized specialties that are managed rigorously to

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[13] "Air Force Officer Classification Directory (AFOCD)," 2018, 258.

throughout accession, training, professional development, and assignment management processes.

The model would act as a forcing function to enable space operators to gain comparatively greater experience and expertise in performing high-risk, difficult, or dynamic tasks associated with each of the specialty areas described above. While sharing overlapping elements (for example, satellite TT&C for space-based systems), each specialty would stand alone based on the functional and mission-oriented distinctions found among OCO, ECO, and the distinct SBM sub-specialties of space warfighting BMC2 and C4ISR support to terrestrial operations.

Model Description and Structure. This option extends the precepts of the semi-formal specialization model by formally and rigidly establishing different AFSCs for the OCO, ECO, and SBM specialty tracks. It is the least flexible of the three alternatives discussed in this paper, but it also the most enduring. AFSCs can be changed, but not easily. Semi-formal specialization, as discussed above, would depend on "business rules" set by the career field manager, the career field development team, or a major command commander to govern occupational specialization. In contrast, formally differentiated AFSCs would shift authority for major career field changes to the Headquarter Air Force level at the Pentagon— specifically to the Deputy Chief of Staff for Manpower, Personnel, and Services (AF/A1) and to the Assistant Secretary of the Air Force for Manpower & Reserve Affairs (SAF/MR).[14] A differentiated career field model, because it would need to be formally approved at the service's highest levels rather than under the purview of subordinate echelons, represents a higher degree of institutional change. With formal approval issued by the service's headquarters would also come advocacy for, and provision of, the necessary resources to properly organize, train, and equip each newly created space operations career field.

Career fields could be formally differentiated at one of two levels within the AFSC schema. First, career fields could be distinguished at the lowest possible level—that is, by suffix or shred-out. Alternatively, different space

[14] Department of the Air Force (DAF), "Utilization and Classification of Military Personnel," Air Force Policy Directive 36-21, Headquarters Department of the Air Force, 2017, 2-3.

operations *functional areas* could be instantiated by varying the first three characters of the AFSC (e.g. 13S, 13T, 13U). Advantages and disadvantages exist for each approach. Under the variable shred-out approach, for example, the OCO, ECO, and SBM specialties could replace the existing, dysfunctional space operations shred-outs 13SxB, 13SxD, and 13SxE. This option offers greater organizational agility, because members' AFSC shred-outs are administratively changeable at lower approval levels compared with functional areas (also known as "core identifiers").[15] Disadvantages of this approach, however, include the preclusion of further formal sub-specialization. For example, the two sub-specialties proposed under space battle management would have to be tracked outside the AFSC schema, placing them at risk for experiencing the same blurring of task and knowledge requirements that are impeding the development of expertise in the baseline career field model. Indeed, as discussed in Chapter 2, 13S suffixes are not currently used by assignment managers to enforce the building of experiential depth within the space operations career field.

In contrast, identifying specialties at the higher, *functional area* level, while offering less administrative flexibility, has several advantages. First, this specialization approach would fence off distinct sets of operational knowledge and task requirements, driving dedicated resourcing for manning and training, and helping to facilitate stability and predictability within each specialty. Next, over time, dedicated advocacy for each specialty would more easily develop within the institution. Finally, functional area delineation would still permit meaningful demarcation of sub-specialties, either based on platform, or by mission area (as seen with the SBM sub-specialties described above). On balance, formalized space operations specialties delineated primarily by *functional area* rather than *shred-out* appear to be the most favorable choice within the formal specialization option. Moving forward, this thesis proceeds under that supposition. The resultant career field structure is presented in Table 3. Four space operations functional areas are shown, replacing the extant 13S model. The alphanumeric coding is notional, but the descriptions

[15] Department of the Air Force (DAF), "Classifying Military Personnel (Officer and Enlisted)," Air Force Instruction 36-2101, Headquarters Department of the Air Force, 2013, 17-18.

correspond to the specialties already proposed above. Importantly, these functional areas would be most applicable during the first half of a space operator's career. For most field grade duty positions, such as headquarters staff assignments, any variant of space operational background would be suitable.

Table 3: Notional Space Operations Formalized AFSC Descriptions

13Txx	Orbital Combat Officer
13Uxx	Electronic Combat Officer
13VxA	Space Battle Manager – Space Warfighting BMC2
13VxB	Space Battle Manager – Space C4ISR Support to Terrestrial Operations

Source: Author's Own Work.

Implementation Details. In the same way that different USAF pilot AFSCs share certain common knowledge, task-performance, and physical qualification requirements, so too would a differentiated space operations career field model also leverage commonalities to capture organizational, training, and administrative efficiencies. For example, members from both the SBM and OCO functional areas might receive common coursework on inertial astrodynamics. Each career field would also have unique training and educational requirements, distinct operational roles, and differently-managed career progression models. Notional tactical operator progression flows are shown in Figure 3.

During initial training, all future space operators would still attend a rigorous OUST course in order to gain a common, generalized understanding of space operations. During phase one of this course, trainees' educational backgrounds, observed performance, and individual desires would be evaluated to determine the most appropriate operational functional area for each member. Similar to the tracking that occurs during Joint Specialized Undergraduate Pilot Training, members would move on from OUST to a second "track-select" training phase corresponding to the knowledge, tasks, and tactics required for the OCO, ECO, or SBM sub-specialties.

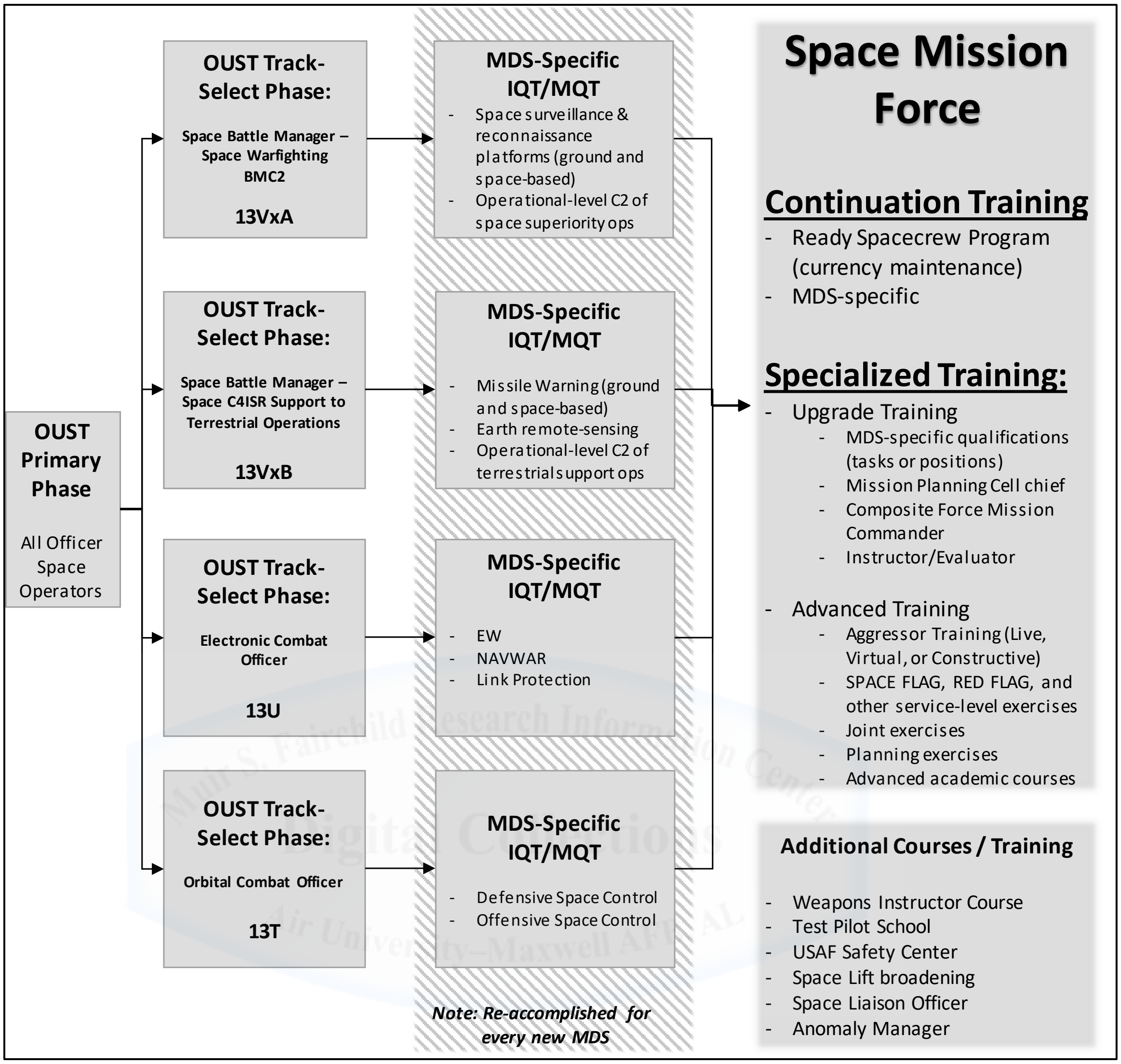

Figure 3: Tactical Space Operator Training and Progression
Source: Author's Own Work.

Space operators would emerge from this second phase of OUST steeped in the technical knowledge and generalized TTP required to execute their operational mission. Platform-specific qualification training on their operational MDS would happen next, in the same manner as the baseline IQT/MQT framework. Following operator platform qualification, the SMF training construct discussed in Chapter Four would take effect. Continuation, Upgrade, and Advanced Training would occur during dedicated dwell periods between SMTF activation cycles. Over the course of an operational assignment, operators would receive opportunities to upgrade in operational role and responsibility, as well as to attend advanced training events, including broadening events offering exposure, not proficiency, in other space operations career fields. Administratively, during dwell periods, the member might take on additional organizational roles (e.g., flight commander), helping to ensure basic officer professional development needs are met in parallel to operational development. Upon completion of a first operational assignment, a space operator would be reassigned to a different unit with open billets corresponding to his or her AFSC and experience level. Qualification training would be re-accomplished in the follow-on unit via a full IQT/MQT course or difference training, as appropriate, depending on the new MDS to be operated by the member.

This pattern would continue over the first two to three assignments (eight to ten years) of a space operator's career, promoting operational depth within the member's assigned specialty. Depending on organizational requirements, a non-SMTF assignment—for example, space lift, instructor, test, aggressor or institutional requirement position—might be offered as a third assignment. Only in rare cases would a space operator be permitted to complete less than two operational assignments within the same specialty. Upon reaching the eight-to-ten year career point, the emphasis on tactical depth would dramatically lessen. Within the Field Grade Officer ranks most space operator billets would accept any space specialty, but the intent of specialization will have been met. The USAF will have infused systemized expertise and experience at tactical levels across the force.

Additional Administrative Considerations for Implementing Specialization

The specialty areas described above—OCO, ECO, and SBM—represent groupings of task and knowledge requirements that deliver solid returns on training and personnel investments in order to address areas of future space operations that will demand high levels of expertise. Any choice on how to specialize, however, has secondary and tertiary consequences that need consideration. While this thesis has focused on the potential operational benefits of specialization, administrative consequences stemming from such a decision would have broader implications for how the Air Force organizes, trains, and equips the space operations mission.

Unit Composition. As described above, the OCO, ECO, and SBM specialties correlate most directly to functional task requirements and technical knowledge areas, not a specific platform type or discrete space mission areas. This construct will drive the need for composite squadrons comprised of space operators with varying occupational career fields. Electronic Combat Officers, for example, would be likely to form the backbone of any dedicated space EW unit, but they would also be appropriately placed as part of a MILSATCOM unit requiring protection of its links. Similarly, Orbital Combat Officers would form the bulk of any squadron dedicated to space-based space control, but they would also need to be part of units flying non-counterspace platforms in order to best apply their expertise toward protecting those systems from attack. Commanders at all levels will need to be cognizant of the dynamic created by operators with multiple career fields present within individual units. It is a common enough occurrence in other operational communities, and leaders there have figured out how to manage the associated challenges. As a new phenomenon within the space operations career field, however, it would be important for leaders there to purposefully develop, prepare, and protect the careers of all operators assigned to a unit, regardless of specialty.

"**Neglected" Missions.** The OCO, ECO, and SBM specialties do not explicitly address certain missions currently performed by 13S space operators under the baseline career field management approach. In particular, some of the mission sets currently categorized as "Satellite C2," but comprised of protected SATCOM, wideband SATCOM, and GPS constellation operations do not wholly fit under the ECO, OCO, or SBM construct. This is by design, and reflects ongoing explorations by AFSPC to outsource ("commercially provision") the routine TT&C operations for these platforms to contractors, thereby freeing up USAF operators to concentrate on the space warfighting mission.[16] The resourcing decisions about which satellite control missions will be outsourced are still not final. Should the Air Force decide to keep space operators performing these missions, the OCO, ECO, and SBM specialty models will allow sufficient expertise to perform the TT&C function, though it would represent a

[16] Mike Gruss, "U.S. Air Force Targets 2016 for Outsourcing WGS Operations," *Space News*, March 13, 2015.

drain on resources from those specialties. In such a scenario, the career field could source TT&C operators from any of the OCO, ECO, and SBM career fields, relying on IQT and MQT—as with every space system—to train operators on the specific equipment and procedures required to perform the TT&C function.

Additionally, the space-lift (launch) mission area is not addressed within the specialties described in this thesis. USAF launch operations are dominated by contractors and civilians. Much of the activity performed by military personnel on America's launch ranges, such as preparing boosters for launch, is actually that of career acquisition officers, not space operators. Nevertheless, space operators do currently perform certain range control operations associated with monitoring of launch operations and flight safety. If the current trend, initiated by the commercial space launch industry, continues its present push toward automated range systems, the Air Force should evaluate the continued role of space operators in this mission set, just as it has done with satellite TT&C operations.[17] Indeed, given the roles and responsibilities involved with the mission, if the Air Force were to continue entrusting junior officers to oversee the space launch range mission, an entirely different career field might be a better choice. The Airfield Operations career field (13M) already expertly trains its personnel in functions like flight safety, airspace deconfliction, and airspace monitoring. Expanding these roles to include oversight of range operations would be more efficient than an entire curriculum of qualification training for space operators that has little to do with the space warfighting mission. If AFSPC determines space operators should continue to perform the space range operations mission, then under the specialization models described in this thesis, such an assignment should be made to members only on their third ops tour as a broadening opportunity.

The Cost of De-emphasizing Breadth. Occupational specialization, by definition, prioritizes depth of knowledge and expertise over experiential breadth. While this research asserts that such a prioritization is necessary in a

[17] O. "Rusty" Powell, Devin Dickens, and Jack Lyle, "Space Launch Automation and Integration: A Common Architecture for Mission Assurance, Safety, and Launch Operations," Paper presented at the 33rd Space Symposium, Colorado Springs, Colorado, April 3, 2017.

contested and weaponized space domain, it would be foolish to neglect the costs associated with reducing opportunities for members to have a broad set of operational experiences during their first eight to ten years in the Air Force. The largest potential downside of specialization is that space operators will lack needed familiarity with key space missions when they reach more senior ranks and are performing staff or command functions. Such concern is legitimate, but the risk can be mitigated in several ways. First, generalized space knowledge will still be instilled through the Space Professional Development Program. Courses like Space 200 and Space 300 will continue to grow members' understanding across all mission areas at key touchpoints in their career. Next, during SMF dwell cycles, in lieu of an advanced training evolution, operators could be detailed on a temporary duty basis to other units to gain exposure to other space operations specialties, platforms, and mission areas. Finally, for a select few officers, those identified as having high future leadership potential, AFPSC could consider a deliberate broadening program at more junior ranks. The USAF Mobility Air Force (MAF), for example, has a competitively selective program that allows a small number of aviators to crossflow between the tanker and airlift communities. Importantly, MAF officers who choose not to participate in the program are equally competitive with those who do in terms of promotion potential.[18] AFSPC could invest in a similar program with the understanding that it may detract from its focus on building tactical expertise, but with the goal of offering future leaders broader hands-on exposure to the Air Force's space missions.

Summary of Specialization Models and a Possible Hybrid Approach

The three specialization alternatives discussed in this chapter each carry associated opportunities and drawbacks, a summary comparison of which is presented in Table 4. As discussed in Chapter Two, the question of specialization in USAF space operations is, in essence, an optimization problem. The operational benefit to be gained by specialization must offset the administrative costs and drawbacks associated with such an approach.

[18] Col (USAF Retired) Joseph L. Prue, Interview on Implications of Space Operations Specialization, In person, 1 Mar 2018.

This thesis argues that improved mission assurance capability in space is an operational imperative. Improved defensive operational capabilities, enabled by higher levels of operator expertise—gained through improved training and TTP but enabled by occupational specialization—represent one way to assure national security space missions. If the baseline occupational approach is retained, then increased reliance on architectural resiliency or a means to rapidly reconstitute space capabilities will be required. So far, neither of these capabilities has been demonstrated, meaning without an improved ability for defensive operations, US national security is placed at risk.

Table 4: Specialization Model Comparison Summary

OPTION 1: BASELINE MODEL		**OPTION 2: SEMI-FORMAL SPECIALIZATION MODEL**		**OPTION 3: FORMAL SPECIALIZATION MODEL**	
Pros	**Cons**	**Pros**	**Cons**	**Pros**	**Cons**
• Least disruptive	• Highest operational risk	• Less disruptive than formal model	• More vulnerable to subversion than formal model	• Greatest potential for lasting change	• Most disruptive
• Least upfront investment		• More agile than formal model	• Less dedicated resources than formal model	• Most dedicated resources	• Least agile
• Most agile			• Sacrifices experiential breadth	• Most management control	• Sacrifices experiential breadth
					• Possible hidden higher-order effects

Source: Author's Own Work

Semi-formal specialization offers a methodology for improving operator expertise while retaining some organizational ability to accept risk in assigning less-experienced operators when warranted. The model, however, would be less institutionalized at senior AF levels, and therefore more vulnerable to disruption based on changing leadership philosophies or a shortfall of system-wide controls governing operator training and development within each specialty. Furthermore, because this model is less institutionalized, career field leaders may be less able to secure resources needed to properly organize, train, and equip the desired specialties. Lastly, special experience identifiers, upon which the semi-formal model depends to track and assign space operators to maximize expertise, have a mixed record of success in the Air Force. A 2009 RAND report indicated that less than 4% of all Air Force officers had SEI codes associated with their records, despite the thousands of code combinations created expressly to track experience and expertise.[19] The formal specialization model, for its part, offers the highest likelihood of truly lasting change in the career field. It will be the most disruptive administratively, however, and higher-order negative impacts may be concealed, perhaps for years.

Should Air Force leaders decide that space operations occupational specialization is indeed appropriate, one potentially appealing method for implementing the change would be to use a sequenced, hybrid approach employing both the semi-formal and formal models. Starting first with a semi-formal specialization model would lessen the administrative disruption inherent in the formal model, while allowing commanders and assignment team members flexibility in assignment management while career field leaders work out inevitable kinks in training, development, and member tracking. This could be especially valuable as AFSPC works to mature the SMF construct in parallel. An eventual transition to formalized career field differentiation would be made easier by this phased approach.

[19] Conley and Robbert, 31.

Chapter 6
Areas of Future Study and Conclusions

Areas of Future Study

This thesis did not cover all scenarios or address every line of inquiry related to space operations specialization. From training tools to doctrinal mission areas; manpower trade-offs to longer-term space operator promotion viability, there are additional areas worthy of examination and study. The dependency of occupational specialization on SMF training programs is an example of one such area. All of the specialization models described in this thesis are designed to work hand-in-glove with SMF. Continuation Training, Specialized Training, and Advanced Training as well as the meaningful upgrade pathways incorporated into the SMF are essential to achieving the developmental growth needed to build expertise within each specialty. One limitation hampering both the building of specialized expertise and the broader implementation of SMF, however, is a shortfall in rigorous live and virtual training at the tactical level. Space operators of the future will require frequent access to training environments that replicate both their own platform's tactical-level employment, those of other friendly platforms in the operating environment, as well as those of potential threats. The same elements of risk, difficulty, and time compression that drive the need for specialization must be replicated in training. Anything less is unrealistic and is likely to fall short in building required levels of proficiency. Until the Air Force invests in the development and fielding of advanced space training infrastructure, the broader success of any specialization model—not to mention SMF—will be limited.

Irrespective of the specialization approach the Air Force ultimately selects, it should also re-examine how it defines and organizes its space mission sets. Recent efforts to explore the out-sourcing of the so-called Satellite Command and Control mission area, for example, are positive. Satellite tracking, telemetry, and control, in and of itself, delivers no useful effect—just as a pilot taking off, flying to a location, and landing an aircraft accomplishes very little by those acts alone. Satellite command and control, like the operation of ground-based space surveillance radars, is a basic "spacemanship" skill that must be instilled through training and mastered through experience. It is not, however, a stand-alone military mission. Similarly, the control of space ranges in support of the space launch mission is another activity to which dedication of highly trained space operator human capital is wasteful. Space operators are neither the best qualified airmen for that job, nor do they fit with the Air Force's stated goal of maximizing space combat potential. Divesting space launch duties to other career fields or contractors would avail more space operators for duties more in line with the service's space warfighting goals.

Conclusions

In many ways, the most apt descriptor for the United States Air Force space operations career field in the Spring of 2018 is *turbulent*. The disruptive influence from multiple, disparate forces has upended the stable glidepath on which the specialty has guided, with minimal disturbance, for nearly twenty years. The largest disruptor is geopolitical in nature, and is, as a nation, partly self-induced. In failing to address the growing vulnerability of national security space systems—even as it became ever more reliant on these very platforms—the United States invited the highly-capable phalanx of space threats now confronting the nation. The global diffusion of space technology, spurred by explosive growth in the commercial sector, has added additional risks and opportunities to this volatile mixture. Since at least 2007, it has been clear the US must prepare to defend its interests in space, but since that time institutional challenges have distracted from this imperative. Now the service is playing catch up, but the overall trend appears inescapable: in the next conflict with peer adversaries, space could, in all likelihood, become a weaponized warfighting domain.

The question then, is not *should* the United States must be prepared to fight in space, but *how* does it optimize its readiness to do so? The DoD identified three main focus areas for space domain mission assurance—resiliency, reconstitution, and defensive operations. Defensive operations is primarily the purview of the Air Force's space operations cadre. To successfully posture itself to defend space, the service has to overcome the inertia imposed by an entrenched space operations culture that values experiential breadth, reliance upon procedure, and a service-provider mindset in place of a warfighting attitude. In response, in 2016, AFSPC directed the implementation of the Space Mission Force construct. SMF is focused on building tactical, in-depth warfighting expertise across USAF space operations, something it intends to accomplish primarily through a revamped force presentation model and rigorous training in realistic threat environments.

If successful, SMF will bring important gains, but what it will not do, as currently constructed, is change an important underlying premise governing the specialty. The space operations career field is managed according to the fundamental assumption that manpower requirements can be met by assigning any space operator to any tactical-level space operations billet. With the right training, and within the span of one assignment, that operator should be able to perform with enough proficiency to meet the demands of the operating environment. In the context of the future space operations environment, this assumption is dubious.

Future space operations are expected to entail high risks to critical systems and missions, to require operators to demonstrate high levels of knowledge and task proficiency in technically challenging areas, and to force rapid operator decision-making due to time-compressed, dynamic conditions. In such an environment, higher levels of average operator expertise are needed—levels that may not be attainable under a model in which operators receive just-in-time qualification training prior to beginning an operational assignment.

The potential solution to this concern is further occupational specialization; several options exist to achieve it. This thesis describes a semi-formal model based on retaining the singular career field structure but increasing the rigor and granularity with which operator expertise is tracked and used in the assignment management process. Alternatively, a formally differentiated career field model would create new AFSC functional areas, mirroring the approach used throughout the rest of the operational Air Force.

The space operations specialties proposed in this thesis— Electronic Combat Operations, Orbital Combat Operations, and Space Battle Management—are oriented around clusters of tasks and knowledge areas that are characterized by high degrees of risk, difficulty, or time compression. Rather than tracing directly to platforms or to mission areas, they instead focus on providing the skills and knowledge necessary for space operators to be successful in the future space operating environment across multiple systems and missions. The approach implies composite squadrons comprised of space operators with varying specialties, assigned to operational roles based on the positional skillsets and knowledge required. It also relies on a multi-pronged development and training approach encompassing career field occupational training, system-specific qualification training, and ongoing continuation, specialized, and advanced training to grow operational and doctrinal expertise over time.

The specialization option selected by Air Force leaders depends on the relative weight they afford the benefits and drawbacks of each model. Maintaining the status quo, or something close to it, requires the least investment but poses the most operational risk over the long term. The semi-formal model retains some organizational agility and flexibility in the development and assignment of operators but is more susceptible to disruption as leaders move on or business rule enforcement breaks down over time. The formal model offers the greatest opportunity for lasting change, but will require significant upfront investment and a tolerance for administrative disruption.

If the desired outcome of specialization is transformative change in line with the broader cultural goals of SMF, then formalized specialization would seem to represent the best long-term approach. A hybridization of the semi-formal and formal models, starting with the former as a way to control career field disruption but transitioning to the latter as part of a well-scoped strategy, could be very effective. The result would be tactical-level space operators who are more proficient in their assigned operational roles, who are better prepared to integrate their platforms' effects into joint and coalition multi-domain warfare, and who are fully qualified to conduct defensive operations within the space domain to preserve America's critical orbital systems.

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