Research Report

SARAH HARTING, KOTRYNA JUKNEVICIUTE, MICHAEL SPIRTAS

Traversing the Kármán Line

Mitigating Potential Air-Space Friction

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Published by the RAND Corporation, Santa Monica, Calif.

About This Report

The U.S. Department of Defense has reorganized for space many times throughout its history, with the 2019 establishment of the U.S. Space Force (USSF) within the Department of the Air Force (DAF) as a notable recent example. The establishment of a separate armed service for space within the DAF led to a concerted effort by DAF, U.S. Air Force (USAF), and USSF senior leaders to ensure an effective relationship between the two services as the organizations evolve. To inform that relationship, USAF leaders sought to understand what potential issues could arise between the two services and how to mitigate those issues. The purpose of this report is to address that topic by describing the insights gained from a set of workshops and interviews with airmen and guardians across the DAF. Additionally, this report builds on a 2022 study of DAF organizational changes, a tactical analysis of the integration between air and space forces, and a review of governance mechanisms to inform options for managing and mitigating friction.

The research reported here was commissioned by the USAF and conducted within the Strategy and Doctrine Program of RAND Project AIR FORCE as part of a fiscal year 2022 add-on project, "Air-Space Friction Mitigation." This study is a follow-on to Michael Spirtas, Sarah Harting, Julia Brackup, Christopher Ferris, Jon Fujiwara, George Nacouzi, Michael Nixon, Joseph Piroch, Anthony Rosello, and Ryan Thulin, *Navigating the Kármán Line: Integrating Military Air and Space*, RAND Corporation, RR-A1744-1, forthcoming.

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This report documents work originally shared with the DAF on April 7, 2023. The draft report, dated June 2023, was reviewed by formal peer reviewers and DAF subject-matter experts.

Acknowledgments

We thank Steven A. Ruehl, Sr., and the USAF/A3K team for their support and guidance throughout this project. In particular, we thank Ed Leahy for his constant encouragement and feedback. We also acknowledge the diverse stakeholder community for air and space operations whom we engaged with throughout this effort—although these discussions were not for attribution, we recognize the time and willingness of those individuals to engage candidly on issues critical for the DAF. Within RAND, we thank Raphael S. Cohen, director of the PAF Strategy and Doctrine Program, for his support and guidance during the project. We also thank Paula Thornhill and Karl Mueller, who provided constructive feedback and comments on our analytic products. Any errors in this report are the authors' alone.

Summary

Issue

The establishment of the U.S. Space Force (USSF) within the Department of the Air Force (DAF) presents an opportunity to revisit air-space integration at present and in the future. A recent RAND research effort sought to understand the impact of ongoing organizational changes on air-space integration and operations.[1] This previous effort identified little U.S. Air Force (USAF)-USSF friction. The same analysis also found that a complex space organizational landscape within the U.S. government (USG) affects the DAF, given the DAF's lead role for space within the U.S. Department of Defense (DoD). Such external conditions create the potential for future internal USAF-USSF friction as the role of space and related organizational responsibilities evolve within the USG. Therefore, continued DAF efforts to focus on air-space integration and mitigate potential future friction remain important. As a follow-on to that analysis, this research effort focused on mitigating potential air-space friction and laying the foundation for long-term air-space integration. In particular, the objective of this report is to identify potential friction points and develop options that the DAF, USAF, and USSF might take to avoid, manage, or lessen the impact of future friction.[2] This report presents the results of that effort by describing the insights gained from a set of workshops and interviews with airmen and guardians across the DAF.

Approach

We facilitated and organized two structured workshops in January 2023 on air-space integration and mitigation options for potential frictions. The workshops brought together DAF stakeholders to identify and understand potential air-space friction and develop potential options that the DAF, USSF, and USAF might take to avoid, manage, or lessen the impact of future friction to ensure effective integration. Participants also discussed the effectiveness of ongoing efforts and how the USAF can better support space. We also conducted focused interviews in March 2023 with select USAF officers to understand potential frictions, mitigations, and how the USAF can best support the USSF. These interviews further informed where integration with space counterparts happens currently, potential air-space frictions, and ways to improve USSF-USAF integration.

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[1] Michael Spirtas, Sarah Harting, Julia Brackup, Christopher Ferris, Jon Fujiwara, George Nacouzi, Michael Nixon, Joseph Piroch, Anthony D. Rosello, and Ryan C. Thulin, *Navigating the Kármán Line: Integrating Military Air and Space*, RAND Corporation, RR-A1744-1, forthcoming.

[2] This research effort primarily focused on air-space integration between the USSF and the USAF; in particular, the creation of the USSF is central to the study. The authors recognize that important DoD air-space integration questions exist beyond the DAF, and those issues and potential mitigations may differ if the USSF is not the central consideration.

Key Findings

- In some areas, USAF-USSF integration is working well. For example, some workshop participants and interviewees noted the effective integration of Headquarters Air Force's programming efforts, in which USAF-USSF teams are currently collocated to develop a resource allocation plan for air and space forces. However, there are areas that require continued attention, such as professional military education and training, programming and budgeting, operations, long-term strategic planning, and space decisionmaking and understanding. Even though programming and budgeting was highlighted as an example of effective integration, some workshop participants and interviewees saw areas needing improvement to ensure integration continues over the long term while the services evolve and potentially diverge in some respects.
- In addition, multiple organizational frictions or challenges exist external to the DAF that complicate air-space integration efforts, such as between the DAF and U.S. combatant commands, defense and intelligence agencies, commercial space providers, and allies. These organizational frictions or challenges are associated with information sharing, who executes space operations, the prioritization of joint space requirements, and the integration of commercial and allied space capabilities.
- The establishment of the USSF, U.S. Space Command, and other changes in how DoD organizes for space (e.g., the recent organizational shift of the Space Development Agency from the Office of the Secretary of Defense into USSF) will continue to affect the development and fielding of space capabilities and forces, the execution of operations, and how services and combatant commands unite service components into a joint force. These major organizational changes are still unfolding and will have implications for the DAF. DAF senior leaders will have to navigate and understand these changes to inform its approach to long-term air-space integration.

Recommendations

- The Secretary of the Air Force should establish a DAF-level strategic process to identify air-space integration priorities for the DAF.
- The DAF should establish a DAF-level integration office to ensure DAF air-space integration over the long term.
- Developing multidomain expertise for airmen and guardians should remain a priority for the USAF and the USSF.
- The DAF should improve air-space decisionmaking and understanding within the USAF and the USSF.

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Introduction

The development of the U.S. Space Force (USSF) and U.S. Space Command (USSPACECOM) in a short period of time creates institutional seams that might interfere with the integration of air and space operations. A recent RAND research effort sought to understand the impact of ongoing organizational changes on air-space integration and operations.[3] That effort found little friction between the U.S. Air Force (USAF) and the USSF but recognized complex organizational dynamics remain at play given that

- the USSF and USSPACECOM are still relatively new organizations and are still evolving
- space remains vital for national security
- there is increased competition for space
- advancements in commercial space continue to impact space operations.

Furthermore, this previous RAND effort found that a complex space ecosystem extends beyond the Department of the Air Force (DAF), which has implications for air-space integration. To be sure, the DAF has an important role given its responsibilities for space within the U.S. Department of Defense (DoD), but others have shared responsibilities for space across the U.S. government (USG) (see Figure 1). Such conditions and complexities have the potential to create friction between air and space forces if they are not actively managed or if the sources of friction are not well understood. For these reasons, RAND was asked to conduct a follow-on analytical effort for the USAF to identify potential friction points and to develop options that the DAF, USAF, and USSF might take to avoid, manage, or lessen future friction. This report presents the results of that effort by describing the insights gained from a set of workshops and interviews with airmen and guardians across the DAF. The appendix in this report provides more detail of the discussions among workshop participants and interviewees for readers interested in additional background on the issues and recommendations offered in this report.

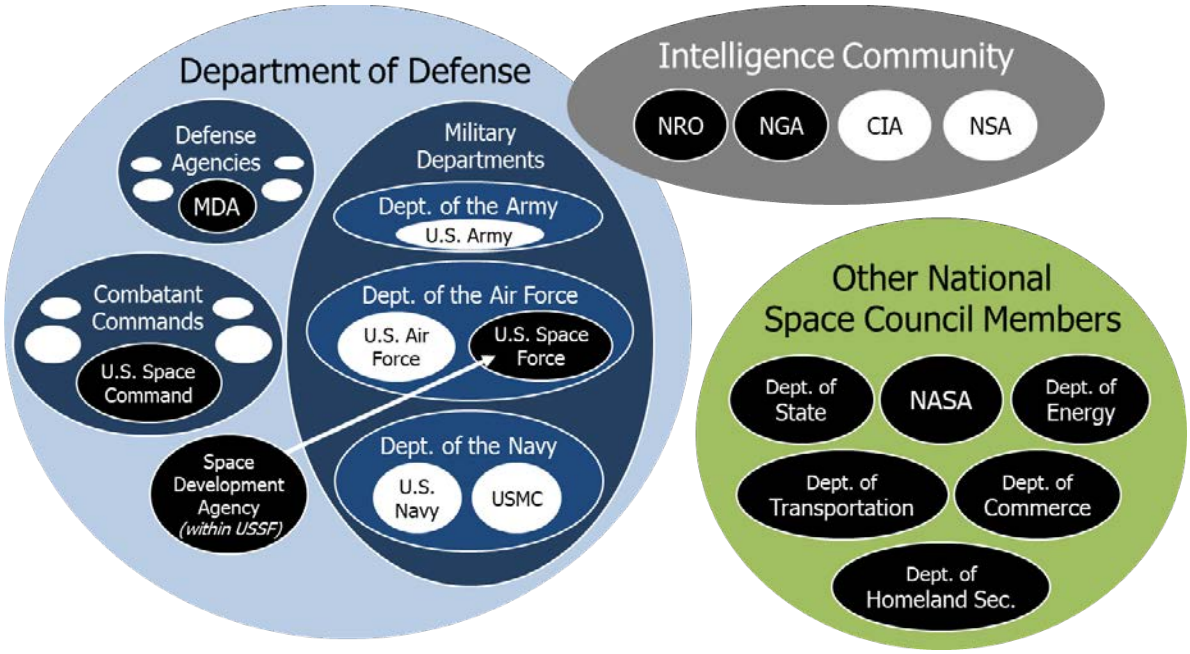
Approach

We facilitated and organized two hybrid (in-person at RAND's Arlington, Virginia, office and virtual) unclassified, not-for-attribution workshops in January 2023 on air-space integration and mitigation options for potential frictions. We also conducted focused interviews with USAF officers

[3] Michael Spirtas, Sarah Harting, Julia Brackup, Christopher Ferris, Jon Fujiwara, George Nacouzi, Michael Nixon, Joseph Piroch, Anthony D. Rosello, and Ryan C. Thulin, *Navigating the Kármán Line: Integrating Military Air and Space*, RAND Corporation, RR-A1744-1, forthcoming.

to understand potential frictions, mitigations, and how the USAF can best support the USSF. The objective of the workshops was not to seek consensus or agreement from all participants on the issues or the recommendations; the objective was to facilitate a frank and candid discussion among subject-matter experts to capture different perspectives, to understand uncertainties, and to explore the range of options for addressing air-space integration issues. The appendix in this report provides raw insights from the workshops and interview to show the variety of issues discussed. We supplemented that raw data with additional analyses, which are summarized in the main body of this report.

Figure 1. U.S. Government Space Ecosystem



SOURCE: Reproduced from Spirtas et al., forthcoming, Figure 2.1.
NOTE: Select space organizations are indicated by black ovals. The size of the ovals does not reflect organizational size or importance. The overlapping blue circle and gray oval imply that both DoD and the intelligence community develop and operate capabilities in support of military operations. The USG space ecosystem is more complex when accounting for commercial space entities and allied space organizations, which are not shown.
CIA = Central Intelligence Agency; MDA = Missile Defense Agency; NASA = National Aeronautics and Space Administration; NGA = National Geospatial-Intelligence Agency; NRO = National Reconnaissance Office; NSA = National Security Agency; USMC = U.S. Marine Corps.

The first workshop focused on DAF air-space frictions and the relationship between the USAF and the USSF within the DAF. Participants included representatives from both services and other subject-matter experts (see Table 1). Participants were asked to consider a long-term perspective and how to lay the foundation for air-space integration for the next generation of airmen and guardians.

The second workshop focused on air-space frictions external to the DAF and the DAF's relationship with the U.S. space ecosystem. Participants included services, combatant commands (COCOMs), individuals with responsibilities for commercial space, and other subject-matter experts (see Table 1). In coordination with the USAF sponsor, the participating organizations were identified

and selected based on the potential external frictions identified in the previous study.[4] The workshop remained primarily focused on USAF and USSF perspectives of those external organizational seams.[5] Participants were asked to consider how to position the DAF effectively in the near term to navigate ongoing organizational changes and ensure effective air-space integration and operations.

As mentioned above, we also conducted five follow-on not-for-attribution interviews in March 2023 with select airmen identified by workshop participants because of their experience in strategic planning, programming, and operations and their understanding of air-space integration issues. These interviews provided further information about where integration with space counterparts happens, potential air-space frictions, and ways to improve integration between the two services.

Table 1. Workshop and Interview Summary Statistics

	Participants/Rank(s)[a]	Organizational Representation of Participants[b]
Workshop #1 (January 2023)	*13 total:* Military (6) • Major (1) • Lieutenant Colonel (3) • Colonel (2) Government Civilian (4) • Senior Executive (1) Other/FFRDC (3)	USAF (3) USSF (5) Air Force Research Laboratory (1) Space Systems Command (1) Mitchell Institute (1) RAND Corporation (2)
Workshop #2 (January 2023)	*19 total:* Military (11) • Major (4) • Lieutenant Colonel (3) • Colonel (2) • Brigadier General (2) Government Civilian (3) Other/FFRDC (5)	USAF (2) USSF (7) USSPACECOM, J5 (2) NSA (1) Air Force Research Laboratory (1) Space Systems Command (1) Mitchell Institute (1) RAND Corporation (4)
Interviews (March 2023)	*5 total:* Military (5) • Major (1) • Lieutenant Colonel (3) • Colonel (1)	USAF (5) • HAF, SECAF, Budget Programs Directorate (HAF SAF/FMBP) • HAF, SECAF, Air Force Programs (HAF, SAF AF/A8P) • HAF, Air Force Futures (A5/7) • HAF, Strategic Planning Integration Division (A8XP) • HAF, Global Mobility Division (A8XM)

NOTE: FFRDC = federally funded research and development center; FMBP = Budget Programs Directorate; HAF = Headquarters Air Force; SAF = Secretary of the Air Force.

[a] RAND core project team members (3) are not included in statistics.

[b] Participation from other military services and from the USG space ecosystem organizations shown in Figure 1 was limited by the workshop's focus on air-space integration issues between the USSF and the USAF.

[4] Spirtas et al., forthcoming.

[5] A limitation of this workshop was that most of the organizations included in Figure 1 were not represented at the workshop. While the central focus of this effort was on air-space integration issues within the DAF, additional engagement with the broader USG space ecosystem could be beneficial to provide a fully informed appreciation of air-space integration issues.

Potential DAF Air-Space Frictions

Within the DAF, there are some areas where integration is going well despite ongoing organizational perturbations, but there are other areas requiring continued focus. Workshop participants and interviewees identified several areas of potential DAF air-space friction, particularly over the long term:[6]

- **Professional military education (PME) and training.** With the establishment of the USSF, there are separate paths for PME for guardians and airmen to develop senior leaders with relevant knowledge and critical thinking skills;[7] however, with separate paths—and separate institutions—comes the risk that there will be less shared air-space understanding over time if there is less interaction between air and space officers as institutional seams between the two services solidify. Furthermore, USSF PME has an added challenge of balancing the development of space expertise while maintaining an understanding of other services given the USSF's predominant role as a supporting service in military operations.
- **Programming and budgeting.** Participants recognized USSF-USAF interdependences for key functions, such as intelligence, surveillance, and reconnaissance (ISR) and command and control (C2), but now the USSF and the USAF have separate service budgets and likely separate and potentially competing priorities. However, USSF and USAF programmers are currently colocated within DAF offices in the Pentagon, which has helped integration.
- **Operations.** With two distinct services within the DAF, participants felt it might be challenging to retain an integrated DAF data fabric over time.[8] Such a data fabric is viewed as integral for the integration of air and space operations. As of September 2022, the DAF established a new program executive officer role whose responsibilities include ensuring such an integrated data fabric.[9]
- **Long-term strategic planning.** The USSF and the USAF have different planning horizons, a different focus (from missions to mechanics), and different organizational structures. Since the establishment of the USSF, Air Force officers have observed more limited USSF participation in formal long-term strategic planning processes occurring within the strategic planning

[6] The appendix provides a more detailed discussion of potential DAF air-space frictions based on inputs from workshop participants and interviewees.

[7] This includes separate service paths and institutions for Intermediate and Senior Development Education (IDE/SDE) programs (Air University for the USAF compared with the Johns Hopkins University School of Advanced International Studies for the USSF). For more background on USSF PME efforts, see Secretary of the Air Force Public Affairs, "Space Force to Partner with Johns Hopkins University SAIS for Service-Specific IDE, SDE," U.S. Space Force, October 26, 2022. For related RAND research exploring USAF and USSF workforce and PME efforts, see Lawrence M. Hanser, Jennifer J. Li, and Chaitra M. Hardison, *Designing a New Framework for the U.S. Space Force Workforce*, RAND Corporation, PE-A575-2, 2023; and Lawrence M. Hanser, Jennifer J. Li, Carra S. Sims, Norah Griffin, and Spencer R. Case, *Air Force Professional Military Education: Considerations for Change*, RAND Corporation, RR-A401-1, 2021.

[8] The term *data fabric* refers to a common set of data services or architecture that is used by both services to foster greater consistency and interoperability between the services.

[9] Secretary of the Air Force Public Affairs, "DAF Announces New Integrating Program Executive Officer, ABMS Execution Construct," press release, U.S. Air Force, September 19, 2022.

division (A8).[10] (In comparison, the services were described as tightly integrated in programming efforts given their colocation in programming offices.) While participants understood why strategic planning efforts would diverge among the services given different service priorities, they expressed concern as to whether there was adequate alignment and integration within the DAF to subsequently inform programming, acquisition, and budgeting efforts. Participants argued that, with the exception of the SECAF and their related operational imperatives (OIs), there is no one to champion and help ensure integration and alignment at the SECAF level. While the SECAF's OIs are driving integration between the two services in key areas or functions, participants saw the value in a more permanent integration role that ensures deliberate intraservice integration and alignment efforts across planning, programming, acquisition, budgeting, and operations.

- **Space decisionmaking and understanding.** Participants argued that this is an area of potential friction because there are multiple users of space and limited space knowledge across DoD writ large. Participants also noted a lack of data-driven processes and feedback between space users (for example, airmen or others who require space support for air or joint operations) and space providers (DoD, defense or intelligence agencies, or commercial space providers), which can result in competing missions, different focal points, and requirements challenges.
- **Prioritized efforts for the integration of allied space capabilities.** There is limited clarity surrounding the air-space prioritization of efforts with foreign partners. Workshop participants saw a real need and opportunity for coordinating with allies and partners regarding space and recognized important steps underway to take a more "allied by design" approach.[11] However, participants noted that insufficient clarity about how efforts are prioritized introduces the risk of ad hoc decisions versus aligned ones, which might result in conflicting or competing priorities.

Discussions with workshop participants and interviews also highlighted that the *level of air-space integration* (understanding of whether integration is necessary, how much integration is needed, and where it needs to occur) varies across these different potential friction points. For example, with respect to programming and budgeting, USSF and USAF programmers are colocated within Pentagon offices informally referred to as the "engine room," which was described by some as effective and by others as necessary. This colocation of teams working on programming and budgeting for the two services allows for informal interaction between the services, but some also noted that there still might be a need for more mandated process meetings or efforts. In comparison, for long-term strategic planning, some argued that there is less of a need for colocation but instead a periodic effort to ensure that strategic priorities are aligned to inform resource planning.

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[10] For related RAND research on strategic planning in the U.S. Air Force, see Michael J. Mazarr, Jeffrey Eggers, Diana Gehlhaus, Raphael S. Cohen, Caitlin Lee, Rebeca Orrie, Michael Spirtas, Laura Werber, and Sean M. Zeigler, *Strategic Planning and the U.S. Air Force: Characteristics of Success*, RAND Corporation, RR-2013-AF, 2017; and, Raphael S. Cohen, *Air Force Strategic Planning: Past, Present, and Future*, RAND Corporation, RR-1736-AF, 2017.

[11] For example, efforts are underway within the Secretary of the Air Force International Affairs and Space Systems Command International Affairs. See Space Systems Command International Affairs, "Allied by Design," fact sheet, undated, and Secretary of the Air Force International Affairs, "SAF/IA Strategic Lines of Effort," fact sheet, undated.

Discussants noted that USSF and USAF long-term strategic planning efforts are now delinked and disjointed, with no SECAF-level integration division, lead, or periodic USSF and USAF strategic deep dives to ensure alignment.[12] Discussants acknowledged that DAF strategic planning efforts have continually changed,[13] and with a new service, strategic planning continues to evolve within the DAF. One interviewee noted that in the 2020–2021 time frame, a deep-dive process was created within the Air Force to align with and respond to the Chief of Staff of the Air Force (CSAF) action orders.[14] For example, Action Order D was focused on force design implementation, whereby the plans and requirements directorate (A5) would produce the design and A8 would use that design to develop a resourcing plan for it.[15] The interviewee described the deep dive as intended to "bring Action Order D to fruition."[16] The deep-dive process would include multiple touchpoints throughout the planning year at different levels (starting at the working level and progressing to include MAJCOM commanders, the CSAF, and SECAF). The Chief of Space Operations (CSO) was also involved, fostering synergy and cross talk between the services, but with more limited USSF participation in recent years as the USSF focused on its own planning efforts. While recognizing different priorities between the services, discussants argued for a need to reinvigorate cross talk for long-term strategic planning at various levels to ensure alignment from strategies to resource allocation. Discussants highlighted the SECAF's OIs as a place where cross talk occurs; they also recognized the OIs as near-term efforts that might end with leadership turnovers compared with a more structured long-term process.

When discussing how air forces can better support space forces now and in the future, airmen made several observations. Discussants argued that air support to space is constrained by such factors as access requirements (security clearances) and the limited number of airmen in USSF offices (and vice versa). Such factors create conditions that lead to stovepiped efforts, with one airman noting, "DAF can't do much in terms of talking about capabilities if they can't even have the conversation."[17] However, participants also recognized that both services have limited staff resources, particularly the USSF. This makes it challenging for both services to support each other effectively even though the need is recognized by each.

[12] Discussants expressed concern that greater disjointedness would hinder strategic integration between the two services. However, the authors have limited evidence to support this concern.

[13] For more on how DAF strategic planning efforts have changed over time, see Cohen, 2017.

[14] Air Force News Service, "CSAF Releases Action Orders to Accelerate Change Across Air Force," U.S. Air Force, December 10, 2020; Secretary of the Air Force Public Affairs, "Brown Modifies Action Orders to Lock in Gains, Accelerate Change," U.S. Air Force, February 18, 2022.

[15] Air Force News Service, 2022.

[16] USAF officer from strategic planning integration division, phone interview with the authors, March 3, 2023.

[17] USAF officer from strategic planning integration division, phone interview with the authors, March 3, 2023.

Potential Air-Space Frictions External to the DAF

Beyond the DAF, multiple frictions could impact integration and operations, given the complexity of the USG space ecosystem and the different roles and responsibilities within it.[18] The DAF is recognized as having an important role in organizing, training, and equipping responsibilities for space within DoD, but related responsibilities for space are disaggregated across multiple organizations (services, COCOMs, defense and intelligence agencies), which can contribute to frictions if not well understood.[19] Two areas highlighted by workshop participants are (1) efforts by the USSF and USSPACECOM to develop service components for space, which have introduced some confusion over C2 for regional and global operations and also have implications for the integration of air-space operations, and (2) identifying and prioritizing DoD requirements for space across multiple organizations (services, defense and intelligence agencies), which some argued has created some duplicative efforts and coordination challenges. Given this complex organizational landscape, workshop participants and interviewees identified multiple potential air-space friction points external to the DAF:[20]

- **Information-sharing.** Participants noted that the high levels of classification often associated with space requirements and capabilities create barriers to entry for other nonspace officers or personnel (within DoD, but including allies and partners as well) who are integrating space operations with their own.
- **Doctrine.** Participants identified current tension between the USSF and USSPACECOM regarding who should be responsible for developing joint doctrine for space operations (Joint Publication [JP] 3-14).[21]
- **Authorities.** While essential for the coordination of space operations, some participants argued that certain authorities are unclear and complex because they cut across intelligence agencies (NRO) and COCOMs (USSPACECOM). Discussants cited DoD space policy (Department of Defense Directive [DoDD] 3100.10) and doctrine (JP 3-14) as examples in which there is still some lack of clarity about the relationship between NRO and

[18] We acknowledge that the methods used in this analysis did not capture perspectives from most of the organizations external to the DAF that are included in Figure 1 (USG space ecosystem). Additional engagement with the broader USG space ecosystem could change or expand on the analysis in this report.

[19] For more background on the organizational responsibilities for space, see Spirtas et al., forthcoming.

[20] These friction points were identified collectively by workshop participants in a discussion facilitated by RAND researchers. (See the appendix for a more detailed description of the comments made by participants when discussing these topics.) All participants in the hybrid workshop were able to see a shared screen that showed three columns: friction, the source of the friction, and the potential implication. RAND researchers facilitated a discussion among participants to identify frictions based on participant experiences and observations, why it was a friction and the source of the issue, and the potential implication for air-space integration. The resulting summary table was continuously refined based on participant input and discussions. The workshop notes and the resulting summary table displayed to participants were used to inform this report.

[21] There are various levels of military doctrine, with joint doctrine at the top of the hierarchy. Joint doctrine is developed by the Joint Staff, who leverage inputs from the combatant commanders, services, and others. The joint doctrine for space operations is JP 3-14, *Space Operations*, Joint Chiefs of Staff, April 10, 2018, Incorporating Change 1, October 26, 2020. Each military service also produces doctrine linked to joint doctrine that provides specific guidance for military operations. Since its establishment, the USSF has been developing doctrine for space operations, which is intended to inform revisions to joint doctrine. Theresa Hitchens, "Enhancing 'Lethality': First Space Force 'Operations' Doctrine Cements Role Within Joint Force," *Breaking Defense*, August 3, 2023.

USSPACECOM during crisis or conflict regarding the control and use of requested space assets.[22]

- **Space science and technology (S&T).** While the DAF's service lab (Air Force Research Laboratory [AFRL]) has taken a "one lab, two services" approach, other military services within DoD retain space capabilities and service labs.[23] This friction is associated with the need to coordinate across labs and budgets to support S&T for space.
- **Componency.** The USSF and USSPACECOM have developed separate functional components for space that are designed to provide unique capabilities and support for space operations.[24] Participants argued that this results in joint community confusion over C2 for regional and global space operations and changes to the integration of air-space operations. While this is primarily a space-to-space point of friction between the USSF and USSPACECOM, it has a direct impact on the USAF because of USAF responsibilities for the C2 of air and space operations.[25]
- **Tactical ISR.** Participants identified this as an ongoing area of friction because of the heavy demand for tactical ISR across DoD, multiple capability providers (services, commercial entities, intelligence agencies), and a lack of clarity surrounding roles and responsibilities. This results in issues over coordination for timely integration of ISR capabilities in joint operations and introduces the risks of duplication and redundancy (high demand, multiple providers). This issue predates the USSF and has been a challenge for DoD for multiple years because of the demand for tactical ISR. The creation of the USSF puts the service in a more central role for coordinating ISR requirements for DoD.
- **Communications equipment.** Participants argued that the supply, demand, and integration of communications equipment is a point of friction between services and COCOMs because of the high demand for communications and competing priorities. They highlighted satellite communications (SATCOM) as an area of particular concern and focus for the USSF.

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[22] DoDD 3100.10, *Space Policy*, Office of the Under Secretary of Defense for Policy, August 30, 2022; JP 3-14, 2020. See also Theresa Hitchens, "'And We Will Do That': NRO, USSPACECOM Still Fleshing Out 'Strategies' During Conflict," *Breaking Defense*, August 4, 2022.

[23] Even with the USSF having a lead DoD role for space, DoD policy (DoDD 5100.01) assigns space-related functions to the Army and Navy as well, such as providing support for space operations and unique ISR capabilities. Furthermore, when the USSF was established, senior leaders determined that these services would retain their space capabilities. The friction identified by the participants was not pushback against multiple services with space capabilities, but instead focused on the supported/supporting dynamic between the service labs conducting S&T for these capabilities to ensure that efforts and resources are integrated and aligned. For more background, see DoDD 5100.01, *Functions of the Department of Defense and Its Major Components*, Office of the Secretary of Defense, December 21, 2010, Incorporating Change 1, September 17, 2020; Ben Werner, "Shanahan: Space Force Won't Take Over Navy, Army Space Assets," *USNI News*, March 20, 2019; Theresa Hitchens, "Navy Seeks to Up Space Game, Including via Space Force," *Breaking Defense*, September 1, 2022; Carrie David Campbell, "Army Space Capabilities Keep Soldiers Shooting, Moving, Communicating," *U.S. Army*, January 23, 2023.

[24] The USSF is establishing service component commands for the geographic combatant commands with a near-term focus on mission analysis but a long-term vision of "command and control of space assets" (Amanda Miller, "Space Force Stands Up Its First Geographic Component Command, Prioritizing the Pacific," *Air and Space Forces Magazine*, November 22, 2022). In comparison, USSPACECOM established two functional components for the tactical control of space forces: Joint Task Force-Space Defense and Combined Force Space Component Command (Space Operations Command Staff, "USSPACECOM establishes a Combined Joint Task Force," webpage, Space Operations Command, November 15, 2022).

[25] For more background on how this affects C2 of air and space operations, see Spirtas et al., forthcoming.

- **Joint space requirements.** Despite the USSF responsibility for space within DoD, joint requirements for space must be coordinated across many organizational entities (services, COCOMs, defense and intelligence agencies). Furthermore, the demand for space is high across the USG, introducing challenges for managing limited resources to address multiple competing priorities. While there are concerted efforts underway between the USSF, intelligence community, and others to develop joint requirements for space,[26] workshop discussants noted that there are related challenges for information-sharing about requirements across the community (including with allies and partners) because of the high levels of classification often associated with space capabilities and operations (as discussed above).
- **Commercial integration.** Advancements in commercial space capabilities have changed the nature of space operations, but coordinating the integration of commercial space into military operations remains challenging because multiple integration offices and cells exist within and beyond DoD.[27]

Despite the frictions identified above, discussants recognized that a concerted effort is being made across many of these frictions to manage and lessen their impact. Additionally, integrated and coordinated efforts are treated as paramount for several DoD governance functions, such as "Tank" meetings with the Secretary of Defense, the Chairman of the Joint Chiefs of Staff, members of the Joint Chiefs of Staff, and the Deputy Secretary of Defense's Management Action Group (DMAG).[28]

Discussants noted that the DAF has an essential role in identifying air-space integration priorities for the USSF and the USAF to manage internal and external friction, but, at present, there is no strategic-level or DAF-level board (e.g., Air-Space Board) or process that exists to do so. In the absence of such a top-down effort, participants expressed concern for the DAF's ability to effectively manage and coordinate USSF and USAF efforts to lessen the impact of current or potential frictions between the services or external to the DAF.

Recommended Way Ahead for Mitigating Potential Air-Space Friction

To address these current and potential frictions, participants and interviewees explored a variety of options.[29] Several mitigation options are cross-cutting and address more than one friction. Several were mentioned more than once. Several were also recognized as ongoing efforts, and participants highlighted them because of their importance for air-space integration. Also, the type of options varied, from new processes, tools, organizations, to training and more. We reviewed the issues and options identified by workshop participants and interviewees to develop a coherent set of next steps

[26] Brandi Vincent, "Space Force, Intelligence Agencies Close to Completing New Strategic Review," *FedScoop*, June 2, 2022.

[27] Workshop participants cited commercial space integration cells within the following organizations: USSF, USSPACECOM, NRO, NGA, and NASA.

[28] For more background on DMAG, see Kathleen H. Hicks, "Governance Structure for Deputy Secretary Managed Processes," Deputy Secretary of Defense Memorandum for Senior Pentagon Leadership, March 11, 2021.

[29] See the appendix for a more detailed discussion of the array of mitigation options identified by discussants for potential DAF air-space frictions, as well as frictions external to the DAF.

for the DAF to navigate ongoing external frictions while laying the foundation for effective long-term air-space integration within the DAF.

We offer the following recommendations:

- **The SECAF should establish a DAF-level strategic process to identify air-space integration priorities for the DAF.** Through engagement with multiple stakeholders, we identified a variety of potential air-space frictions that could affect integration between the two services. But a starting point for any mitigation efforts should be an effort to set priorities.[30] A DAF-level strategic process for identifying priorities would provide top-down direction within the DAF to drive internal efforts, as well as those externally focused and relevant for the USSF's lead responsibility for DoD space.
- **The DAF should establish a DAF-level integration office to ensure DAF air-space integration over the long term.** Discussants identified some notable successes in air-space integration, specifically at the programming level and those associated with the SECAF OIs. However, in both cases, these successes were attributed to ad hoc efforts that could potentially change with new leadership or staff turnover. A more formalized mechanism or structure could lay the foundation for air-space integration over the long term. This office or mechanism would do the following:
  - Establish and execute a USAF-USSF long-term strategic planning process with quarterly deep dives that commence with a SECAF outbrief to ensure alignment between the services.
  - Mandate other USAF-USSF process meetings as needed for programming, budgeting and operations to avoid relying on ad hoc, disjointed efforts.
- **Developing multidomain expertise for airmen and guardians should remain a priority for the USAF and the USSF.** In 2018, the Air Force initiated a "Multi-Domain Warfare Officer (13O) career field" for training "operational-level C2 personnel specialized in executing command and control of multi-domain operations."[31] While that career field was phased out in early 2022, the CSAF reiterated his commitment to strengthening multidomain expertise.[32] Within USAF PME, there is a dedicated "Joint All Domain Strategist" track for a select number of officers,[33] as well as a concerted effort to educate airmen on joint all domain operations as part of PME courses.[34] Discussants saw these PME efforts as valuable, worthwhile, and worth continuing to some extent in both the USAF and the USSF while

[30] For example, a couple of the issues that we identified could be viewed as competing—such as improving space decisionmaking and understanding and integrating allied space capabilities—which might make it difficult to address both with the same level of attention and effort. DAF and USSF leaders might have to prioritize which effort requires greater attention in the near term—working with like-minded allies or bridging ties with other USG organizations that do not fully understand the USSF.

[31] Secretary of the Air Force Public Affairs, "Air Force to Phase Out 13O Career Field, Strengthen All Airmen Joint Capabilities," *Air Force*, February 17, 2022.

[32] Secretary of the Air Force Public Affairs, 2022.

[33] Air Command and Staff College, "Joint All Domain Strategist," webpage, Air University, January 18, 2021.

[34] 505th Command and Control Wing Public Affairs, "Air Force Begins Process to Incorporate Critical JADO Principles into PME Courses," webpage, Air University, June 21, 2022.

balanced with the necessary training required for specialties. Discussants also identified several related efforts that would be worthwhile to increase knowledge of air-space operations and joint operations:

  - Continue to develop multidomain expertise within the DAF to increase shared air-space expertise.
  - Ensure that courses with material on the integration of air and space operations are included and introduced at early stages in the officer's career.
  - Continue USSF and USAF exchange officers at various career levels.
  - Continue to develop and normalize force presentation models for air and space.
  - Coordinate force design efforts across the USAF and the USSF (potentially leveraging service global force management cells to serve in that integration role) to ensure that force presentation models do not affect the ability to integrate air and space operations with joint operations.

- **The DAF should improve air-space decisionmaking and understanding within the USAF and the USSF** through the following steps:

  - Identify and explore areas critical for joint operations for which the knowledge pool for space can be expanded through additional billets or through declassification (or reduced classification) of select information. Workshop participants noted that both approaches must adequately weigh costs and risks.
  - Where possible, continue to support service billets that place airmen in USSF offices and vice versa ("keep those doors open to allow the bridge to remain"). The asymmetry in service size between the USSF and the USAF will preclude this from being a widespread effort. However, the DAF should identify key functions (e.g., planning, programming, operations) in which such exchanges and the sharing of expertise are necessary.
  - Continue to build metrics and tools for space operations, including the incorporation of warfighter inputs and feedback loop. Such tools and feedback loops will help to improve broader understanding and utilization of space (e.g., how much space is "enough" to accomplish certain missions?).

These recommendations imply greater centralization and coordination of air-space responsibilities within the DAF, at least in the near term, to drive service integration. However, if implemented, this more centralized approach should be periodically revisited to determine whether the desired level of integration can be achieved with a more decentralized approach implemented through the services. To be sure, there are trade-offs to consider regarding the level of centralization and the relationship between the SECAF and service chiefs to achieve DAF effectiveness and service integration.

Furthermore, as acknowledged at the onset of this report, the focus of this study was on air-space integration within the DAF and specifically between the USSF and the USAF, given the creation of the USSF. The recommendations stemming from this analysis are derived from this central DAF focus. However, with the multitude of organizations responsible for space within the USG, there is a complex landscape of organizational roles and missions that is much bigger than the DAF. For this reason, there remains the possibility that a broader assessment of USG roles and missions for space

may yield insights that render this report's specific air-space recommendations ineffective for addressing more significant issues across DoD.

Appendix

Additional Insights into Air-Space Frictions and Mitigations

This appendix provides more detail of the potential frictions and mitigations identified by workshop participants that were broadly summarized in the body of this report.

The first part of this appendix focuses on the first workshop, which focused on the internal DAF relationship between the USSF and the USAF. Select points raised during subsequent interviews with airmen are also reflected in this appendix. In both the workshop and interviews, participants were first asked to identify what they see as potential points of friction between the two services. Table 2 summarizes those discussions. (Note that the table is not an evaluation or analysis of those discussions. Additionally, the points captured below do not necessarily reflect consensus among participants but are listed to show the full range of points that were raised.)

Table 2. Potential DAF Air-Space Friction Points Identified by Participants and Interviewees

#	Potential Friction	Participant Description and Discussion
1	PME and training	• The USSF and the USAF now have separate PME paths and will have less of a shared understanding of service culture over time. • Separate PME paths could make it harder to train and maintain space expertise in the USAF. • Space literacy and understanding in the USAF is decreasing, and cross-service (USAF-USSF) awareness and understanding may be decreasing, as well. • While essential for developing service culture and identity, separate PME and training in the USSF and the USAF might complicate DAF efforts to align service efforts if a unified vision for the relationship between the services is not articulated in the near term. • All services should have some level of space expertise, given that requirements for space will originate from the COCOMs staffed and commanded mainly or entirely by non-USSF officers.
2	Workforce planning	• Some participants observed a sense of disjointedness between USSF and USAF long-term goals with respect to workforce planning. • There is limited effort to integrate complementary management structures, which results in a lack of coordination across the mixed (civilian, contractor, and military) workforce and duplicative career fields. • This also risks leading to oversight and supervising challenges and potential operational implications, including a lack of understanding of responsibilities.

#	Potential Friction	Participant Description and Discussion
3	Concept and doctrine development	• USSF and USAF organizations leading these efforts operate very differently and have limited coordination with each other (e.g., force design efforts are ongoing within both services, however with limited coordination). • This introduces the risk of siloed activities and challenges in communicating the air-space relationship.
4	Programming and budget	• Services share interrelated missions and programs but have separate Program Executive Officer chains. • Though budget frictions are not yet an issue, without transparency about programmatic and financial decisions, frictions between the services may emerge in relation to budgetary priorities and associated resourcing decisions. • The current colocation of USSF and USAF programmers is a key reason why limited friction exists today.
5	Operations, including C2 and ISR	• As service organizational seams solidify, it becomes harder to retain an integrated DAF "data fabric" (a common set of data services or architecture that is used by both services) that is essential for air-space operations. • Although the USAF-USSF supporting-supported relationship is well defined now (according to participants), the USSF continues to develop and evolve to include moving beyond its natural role as a de facto supporter. • Furthermore, there is a need for a feedback loop for space to limit friction—the USSF would like to better understand how other services are using space data and capabilities (to inform such questions as "how much space is enough?"), and the USAF would like to maintain an understanding of the technical aspects of space. • The lack of an operational feedback loop may complicate efforts to execute joint operations, resulting in mission failure or degradation.
6	Long-term strategic planning	• The USSF and the USAF have different planning horizons, a different focus (from missions to mechanics), and different organizational structures. • Since the establishment of the USSF, the USSF is no longer involved in the USAF long-term strategic planning process, and there have been limited USSF-USAF strategic deep dives to align efforts. • There is no integration "champion" at the SECAF level to prioritize and coordinate efforts across the services.
7	Space—from decisionmaking to understanding	• There are multiple users of space and limited space knowledge across DoD writ large. • There is a lack of data-driven processes and feedback between space users and space providers, which can result in competing missions, different focal points, and requirements challenges.

After identifying these potential frictions, participants then discussed potential steps that could be taken to lay the foundation for air-space integration for the next generation of airmen and guardians. In discussing potential mitigations, participants noted that some mitigations were cross-cutting and addressed multiple frictions. Table 3 describes the proposed mitigations and how the participants these mitigations relate to the frictions.

Table 3. Internal DAF Mitigations Identified by Participants and Interviewees

#	Mitigation	Participant Description and Discussion	Frictions Addressed (Table 2)
1	Linking and integrating long-term strategic planning efforts and processes to drive decisionmaking and ensure USSF-USAF alignment	• This would arguably be most effective at the DAF level. • The DAF could also establish a strategic board or process to identify DAF air-space integration priorities and to develop priorities with external USG stakeholders. • The DAF should establish a DAF-level integration office to further ensure DAF air-space integration. • Such an integration office could establish and execute a USAF-USSF long-term strategic planning process with quarterly deep dives commencing with an outbrief to the SECAF to ensure service alignment for strategic effort. • In the interim, there should be a mandate that other USAF-USSF process meetings are needed to avoid ad hoc, disjointed efforts.	All; cross-cutting
2	Increasing space metrics and tools to improve data-driven decisionmaking and space understanding	• In addition to improving decisionmaking, space metrics would offer the necessary data points to conduct a space campaign analysis. • Beyond the internal benefits that a data-driven space campaign analysis would have, it would also showcase and help communicate the role that space plays on behalf of the nation.	All; cross-cutting
3	Increasing DAF senior-level communication on the cross-service impact of budgetary changes and program requirements or interdependencies	• Although processes are important, there also needs to be an understanding of why decisions are made. • Budgetary decisions should be driven by a cohesive strategy articulated by DAF senior leaders. • DAF senior leaders should communicate overlaps, opportunities for the USAF and the USSF to support each other, and a shared understanding of changing requirements or cuts to manage friction between the USSF and the USAF.	Friction 4
4	Clarifying, communicating, and normalizing the force presentation models for air and space	• Prior to the establishment of the USSF, space elements within the USAF operated more ad hoc, but now the USSF is actively (and understandably) developing its own processes and force presentation models. • As these efforts progress, the USAF will need to understand how the USSF presents forces and may have to adapt. • The adoption of a DAF-level strategic process and integration office (see Mitigation #1) could help to align such efforts.	Friction 3
5	Promoting shared air-space expertise	• The DAF can promote cross-domain expertise by developing DAF multidomain officers (this was recognized as an ongoing effort) and injecting air and space into distance learning and earlier into careers. • This effort would include space-related courses and exchange officers within both services. • Related to PME, joint training and education of the two services on their operational overlap at present and in the	Friction 1 and Friction 2

#	Mitigation	Participant Description and Discussion	Frictions Addressed (Table 2)
		future would promote cross-domain awareness and understanding.	
6	Resolving and clarifying the organizational C2 relationship of air-space operations	• Steps to identify the links between air and space should be taken in the Air Operations Center to outline future support activities and the needs for effective air-space operations. • There is a need for additional training and exercises to understand how these space capabilities are provided and used (e.g., what combatant commanders need imagery for, how that imagery is provided, and how that imagery is used).	Friction 5
7	Developing and socializing visual representations of information flows for space (from S&T through operations)	• There should be increased accesses (billets) to expand the level and amount of shared knowledge for space. • The DAF must maintain the bridge that currently exists between the USAF and the USSF as both services evolve, and service billets and exchange officers within the services can increase cross-service awareness.	Friction 7

The second part of this appendix focuses on the second workshop, which focused on air-space frictions external to the DAF and the DAF's relationship with the U.S. space ecosystem. In both the workshop and interviews, participants were again asked to identify what they saw as potential points of friction between the services and organizations external to the DAF. Table 4 summarizes those discussions. (Note that the table is not an evaluation or analysis of those discussions.)

Table 4. Potential Air-Space Friction Points External to the DAF Identified by Participants and Interviewees

#	Potential Friction	Participant Description and Discussion
1	Information-sharing	• There are high security requirements for space capabilities, which inhibit integration and coordination for DoD and industry and limit overall space awareness. • Although classification may be necessary in certain cases, it may inhibit operations by preventing cross collaboration.
2	Doctrine	• It is not clear who "owns" JP 3-14 (*Space Operations*); some observe a tension between the USSF and USSPACECOM, which could have impacts on the joint force.[a]
3	Authorities	• Authorities are integral to the coordination of space operations and affect the roles and responsibilities for space operations. • However, some argued that the roles of the USSF, USSPACECOM, and others (NRO) are not clear: There is some confusion around who presents space forces to a theater and how some forward deployed capabilities in one theater could be used to support another under certain conditions.[b] • As these authorities evolve, additional friction can emerge if there is lack of clarity over responsibilities.
4	S&T for space	• The Army and Navy have retained space capabilities, which introduces the need for lab coordination for space S&T to align efforts and budgets.
5	Componency	• The USSF and USSPACECOM have separate components, and the service components for space are new. • Having separate components could create joint community confusion over C2 for regional and global space operations and changes to the integration of air-space operations. • USSPACECOM's recent commercial integration strategy has created some tension and confusion within the USSF as it pertains to space operations. • The USSF is currently a very lean organization with limited manpower, which may introduce challenges for establishing and supporting space components across the COCOMs.
6	Tactical ISR	• There is a heavy demand for tactical ISR and multiple providers, with participants noting some lack of clarity surrounding roles and responsibilities. • Specifically, tactical ISR is not just about imagery—there is an entire system and backbone that needs to be supported (such as the bandwidth to allow for the imagery to be transferred from one place to another on a timely basis)—and some of the roles and responsibilities for those supporting pieces can be unclear. • A lack of clarity regarding roles and responsibilities can result in coordination issues or duplicative efforts for the timely integration of ISR capabilities in joint operations.
7	Unaligned and competing priorities, interests, and incentives for	• Some COCOMs may buy commercial equipment if they feel the services are not providing what they need. • SATCOM is another competitive space that needs to be aligned, particularly to support the commercial layer that is evolving given the integration of commercial assets and capabilities.

#	Potential Friction	Participant Description and Discussion
	communications and datalinks	• This highlights the importance of operational testing of commercial data and systems for military use.
	Joint space requirements	• Establishing and coordinating joint space requirements across multiple USG and DoD organizations can introduce duplicative efforts, issues meeting space demands, and challenges with C2 for space.
	Commercial integration	• Commercial integration is a potential friction point because there are multiple integration cells or offices within the USG that can be included within the USSF, USSPACECOM, NRO, NGA, and NASA. • This leads to issues regarding coordination for timely integration and concerns whether sufficient folks are trained to execute and understanding of responsibilities. • There are some foreign-owned commercial companies that provide critical elements of space infrastructure, and the DAF is still struggling to understand how to leverage these foreign systems.
	Allied integration[c]	• There is little clarity surrounding the air-space prioritization of country efforts. • There is no set requirement for cooperation with allies. • All of this can lead to ad hoc decisions versus aligned ones and result in conflicting and competing priorities.

[a] There are various levels of military doctrine, with joint doctrine at the top of the hierarchy. Each of the military services also produce doctrine, which are linked to the joint doctrine, that provide more specific guidance for military operations. As a new military service, the USSF has been working to develop its doctrine for space operations, which it intends to use to inform revisions to joint doctrine for space operations. However, joint doctrine is also intended to take into account the perspective of the combatant commanders whose operational views may differ from service leadership. For recent updates USSF doctrine for space operations, see Hitchens, 2023.

[b] This issue has also been publicly reported. For example, see Amanda Miller, "NRO Director: Agency Will Accept Instructions from Space Command," *Air and Space Forces Magazine,* August 4, 2022.

[c] Allied integration was identified as a friction in the second workshop but was later determined to be an internal DAF issue and treated as such in the main body of this report.

After identifying these potential frictions, participants discussed how to position the DAF effectively in the near term to navigate ongoing organizational changes and ensure effective air-space integration and operations. In this case, participants focused on how the DAF can align internal efforts to better position itself for managing internal and external frictions. For this reason, all mitigations proposed by participants were DAF-focused and viewed as cross-cutting. Table 5 describes the suggested mitigations and their alignment with the frictions.

Table 5. Cross-Cutting DAF Mitigations Identified by Participants and Interviewees

#	Mitigation	Participant Description and Discussion	Frictions Addressed (Table 4)
1	Taking a pause in major DAF organizational changes	• The DAF could take a strategic pause in further organizational changes to create time and space to sort out roles and responsibilities. • The SECAF could direct and prioritize efforts to sort out roles and responsibilities that are contributing to confusion.	All; cross-cutting
2	Promoting norms and intraservice trust	• DAF senior leaders could foster service independence and trust for the USSF, its leadership, and between the USAF and the USSF to allow the USSF to mature, shape concepts, doctrine, and efforts. • Disagreements related to the USSF and its operations are scrutinized at very senior levels because of a perceived lack of trust to do the right thing and risk hindering service growth.	All; cross-cutting
3	Implementing new processes and structures to identify and promulgate air-space integration priorities	• The DAF could implement new processes and structures to identify and promulgate air-space integration priorities. • Such efforts could include the establishment of a DAF-level strategic process and integration office.[a] • Without such top-down efforts, integration efforts between the services may be ad hoc and not aligned.	All; cross-cutting
4	Increasing space expertise within DoD/DAF/HAF senior levels	• Tying back to classification challenges with space operations and capabilities, participants argued that increased DAF efforts to educate DoD and others on space efforts and activities would help resolve challenges by improving feedback, policy, and planning. • Classification challenges could also be addressed with increased billets for special accesses and the creation of a broader knowledge pool for space. • Collectively, these efforts would help educate personnel on space and provide greater awareness of opportunities that exist to increase space knowledge.	All; cross-cutting

[a] This suggestion was proposed during both workshops.

Abbreviations

C2	command and control
COCOM	combatant command
CSAF	Chief of Staff of the Air Force
DAF	Department of the Air Force
DMAG	Deputy Secretary of Defense's Management Action Group
DoD	U.S. Department of Defense
GFM	global force management
HAF	Headquarters Air Force
ISR	intelligence, surveillance, and reconnaissance
NASA	National Aeronautics and Space Administration
NGA	National Geospatial-Intelligence Agency
NRO	National Reconnaissance Office
NSA	National Security Agency
PME	professional military education
S&T	science and technology
SATCOM	satellite communications
SECAF	Secretary of the Air Force
USAF	U.S. Air Force
USG	U.S. government
USSF	U.S. Space Force
USSPACECOM	U.S. Space Command

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