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Proposed Analytical Products for the Air Force Warfighting Integration Capability

Developing and Presenting Options for Future Force Design and Capability Development

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Preface

Over the past several years, the U.S. Air Force has made a series of organizational changes to strengthen its capacity at the enterprise level to conceptualize and shape future force design and capability development over the longer term. One important step came on October 3, 2017, when the Secretary of the Air Force and the Chief of Staff of the Air Force issued a memorandum announcing the formation of the Air Force Warfighting Integration Capability (AFWIC) to "orchestrate future force design" and "deliver the integration, understanding and consistency required to guide and direct future [Air Force] force transformation" (U.S. Air Force, 2017).

In January 2018, the Vice Chief of Staff of the Air Force asked RAND Project AIR FORCE (PAF) to undertake a project to assist AFWIC in developing its approach to future force design (and integration with strategy, planning, programming, budgeting, and execution processes) to ensure its successful implementation. In subsequent discussions, PAF's tasking was refined to focus on the scope and structure of AFWIC's written and other products to support decisionmaking.

The research reported here was commissioned by the United States Air Force and conducted within the Resource Management Program of PAF as part of a fiscal year 2018 project, titled Designing Integrated, Effective, and Timely AFWIC Products.

The audience for this report is primarily the AFWIC leadership and team members, but it also should be of interest to other senior leaders in the Air Force who interact with and depend on AFWIC.

RAND Project AIR FORCE

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cyber forces. Research is conducted in four programs: Strategy and Doctrine; Force Modernization and Employment; Manpower, Personnel, and Training; and Resource Management. The research reported here was prepared under contract FA7014-16-D-1000.

Additional information about PAF is available on our website: www.rand.org/paf.

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Summary

The Air Force has long faced a challenge integrating force design and capability development planning with programming. The consequences of not executing the integration function well can be serious and far-reaching, leading to imbalances in capabilities, vulnerabilities in subsystems, and insufficient funding for investment in new capabilities. Prior to the establishment of the Air Force Warfighting Integration Capability (AFWIC) in January 2018, the Air Force operated within a decentralized structure in which design and planning choices came to senior leadership from a bottom-up process driven by major commands (MAJCOMs) in their designated roles as core function leads. A bottom-up process has the advantage of placing decisionmaking close to operators and their deep knowledge of mission needs. However, this approach limits thinking about integrated force design constructs and consequently limits Air Force leaders' freedom to make trades between investments in new capabilities and divestments in legacy systems to build an Air Force suited to a changing security environment and national needs.

Over the past several years, the Chief of Staff of the Air Force (CSAF) and other Air Force leaders have recognized the need to improve both the quantity and quality of the Air Force's enterprise-level analysis and decisionmaking on future force planning. For AFWIC to succeed and endure, senior leaders will need to create favorable conditions for independent analysis of new concepts in support of the Joint Force and their practical implications for Air Force near-term planning, programming, budgeting, and execution.

In February 2018, the Vice Chief of Staff of the Air Force (VCSAF) and Deputy Chief of Staff for Strategy, Integration and Requirements (AF/A5) asked RAND Project Air Force (PAF) to assist AFWIC in conceptualizing and executing analytical and other products to support future force design and capability development and their links to planning and programming. To this end, PAF team members spoke to AFWIC leaders, key AFWIC staff, other Air Force stakeholders, and individuals familiar with integration efforts in the Army, Navy, and Marine Corps. The team also traced the Air Force's experience with standing up organizations similar to AFWIC and considered whether organizations or processes developed for integrated force design in the other services might have relevance and benefit to AFWIC. Finally, the PAF team

synthesized the historical lessons of force planning and current organizational imperatives facing AFWIC. This synthesis provided the basis for developing a roadmap of analytical and other product elements that could enable AFWIC to forge and sustain its integrating role in future force design. In this report, we present our major findings, recommendations, and vision for AFWIC's analytic process and products.

Major Findings and Recommendations to Guide Implementation

Experience in the Air Force and other services suggests lessons and steps that AFWIC and Air Force leadership can take to create conditions for the success of the new organization. Major findings and associated recommendations are summarized in the following sections.

Senior Leadership Must Play a Major Role

The success of enterprise-level future concept development requires advocacy by—and continuous engagement with—the highest levels of senior leadership, including the Secretary of the Air Force (SECAF), CSAF, and VCSAF. The following steps can help foster this engagement:

- AFWIC should have frequent, direct access to the SECAF, CSAF, and VCSAF. The objective of the meetings would be to obtain approval and increase confidence in AFWIC's problem framing, assumptions, methods, and analytical tools. These meetings should be vigorous discussions of substance, not merely cursory meetings to approve coordinated products. Although senior leaders cannot participate directly in the analysis, the more they are involved in the foundations of the analysis, the more confidence they will have in the results and the more equipped they will be to advocate for those results. The meetings will need to be more frequent than CORONA meetings. Such meetings also will need to be structured more like working meetings. Although senior leaders have enormous demands on their time, the centrality of these activities to the future Air Force should compete for time on their schedules.
- AFWIC activities should be a discussion topic at all CORONA meetings, with the CSAF leading those discussions. Because future CSAFs and VCSAFs will be drawn from the pool of CORONA participants, CORONA engagement will facilitate continuity despite changes in senior leadership.
- The Air Force should consider making AFWIC a direct report to the CSAF, led by a three-star general. This arrangement would help ensure that both the CSAF and AFWIC have the necessary engagement, both in substance and frequency. However, this might be difficult to implement under the current structure. An alternative would be for the AFWIC's two-star director to establish a regular meeting with the CSAF.

AFWIC Analysis Should Be—and Should Be Seen to Be—of the Highest Quality

Significant changes to concepts of operations (CONOPS) and force structure will elicit institutional resistance, both within and outside the Air Force. The quality of AFWIC's work, the consistency of its analysis, the transparency and timeliness of its consultations, and the ability of its senior leadership to advocate for the results will be critical to success. Furthermore, findings will necessarily come from multiple lines of analysis and evidence, placing a burden on AFWIC to demonstrate what integrated analysis looks like across MAJCOMs and other functions. To meet this objective, we recommend the following:

- AFWIC should aim to become the organization within the Air Force with the highest standards for quality of analysis. No critique of a proposed future CONOPS or force structure option should come from a source outside AFWIC or the Air Force that was not already identified and assessed within AFWIC. To achieve this, AFWIC and its leadership should
  - cultivate a culture of skepticism and introspection within the organization
  - expose analysis to rigorous internal and external reviews to reveal weaknesses in evidence and logic
  - be frank in expressing any uncertainties and limitations of the analysis to senior leadership.
- The products of the analysis should be—and should be perceived to be—Air Force products rather than AFWIC products that have been foisted on the MAJCOMs. Two steps can help achieve this:
  - AFWIC should involve MAJCOM personnel early and often in AFWIC activities so that they have ownership in the process and results. MAJCOMs should not be brought in late in the process for coordination.
  - Senior leadership should create incentives for career development for personnel in AFWIC and those seconded to AFWIC by MAJCOMs. This would encourage the best talent in the Air Force to work on AFWIC problems and would persuade MAJCOMs to contribute to that talent.
- AFWIC should develop and follow a rigorous process for analysis, interfacing with external organizations, quality assurance, and product production. We describe a template for such a process in the following sections and in Figure S.1.
- AFWIC should develop more-sophisticated means of communication to establish connections and credibility with key audiences. Deliverables for top-level decisionmakers in the Air Force—and those subsequently transmitted by Air Force leadership to the Office of the Secretary of Defense, Office of Management and Budget, and Congress—should be short and visually attractive, with a clear bottom line, and they should clearly indicate the existence of rigorous, transparent, and authoritative analysis to support conclusions and recommendations.

AFWIC Must Reduce Barriers to Innovation

Large institutions, such as the Air Force, must break down barriers between organizational units and cultures to achieve agreement on innovative, enterprisewide solutions to future problems. AFWIC can take the following steps to reduce these barriers:

- AFWIC should be populated by staff with a wide variety of skills representing all disciplines in the Air Force who are selected with an emphasis on independence, innovation, and critical thinking. To produce truly integrated analyses, the Air Force will need to support AFWIC in finding talent with deep functional expertise paired with a commitment to embracing an enterprisewide, systems view.
- AFWIC should avoid any internal organizational structure that follows functional or mission boundaries.
- AFWIC should avoid physically seating personnel by functional or mission specialties. This would help discourage a culture of functional or mission association and would foster interdisciplinary interactions.
- The Air Force should encourage MAJCOM participation in AFWIC analysis.
- AFWIC should be selective in its choice of problems. Topics should force enterprisewide thinking by crossing missions and functional disciplines and should be responsive to both near-term and longer-term decisionmaking needs.

AFWIC Should Stay Above the Fray of Current Operations

To successfully address future challenges, CONOPS, and force structure options, AFWIC needs to stay above the fray of current operations and work in a time frame beyond the Future Years Defense Program (FYDP). However, any solutions identified by AFWIC will need to eventually shape the Program Objective Memorandum (POM) and be plausible enough to gain stakeholder buy-in. These considerations are somewhat in tension with one another. To partially mitigate these tensions, we recommend the following:

- The Air Force should avoid placing AFWIC on a battle rhythm synchronous with the POM cycle, but AFWIC needs to maintain situational awareness of POM issues. Analysis of problems should be set by the changing military, technological, and political environments that the Air Force must respond to and shape. AFWIC's work tempo should follow those driving factors and should be conducive to consistent, high-quality analysis.
- AFWIC should provide concrete options for the POM, and all options offered by AFWIC should include assessments of feasibility (e.g., cost, logistics support, sustainment considerations), and especially potential offsets.

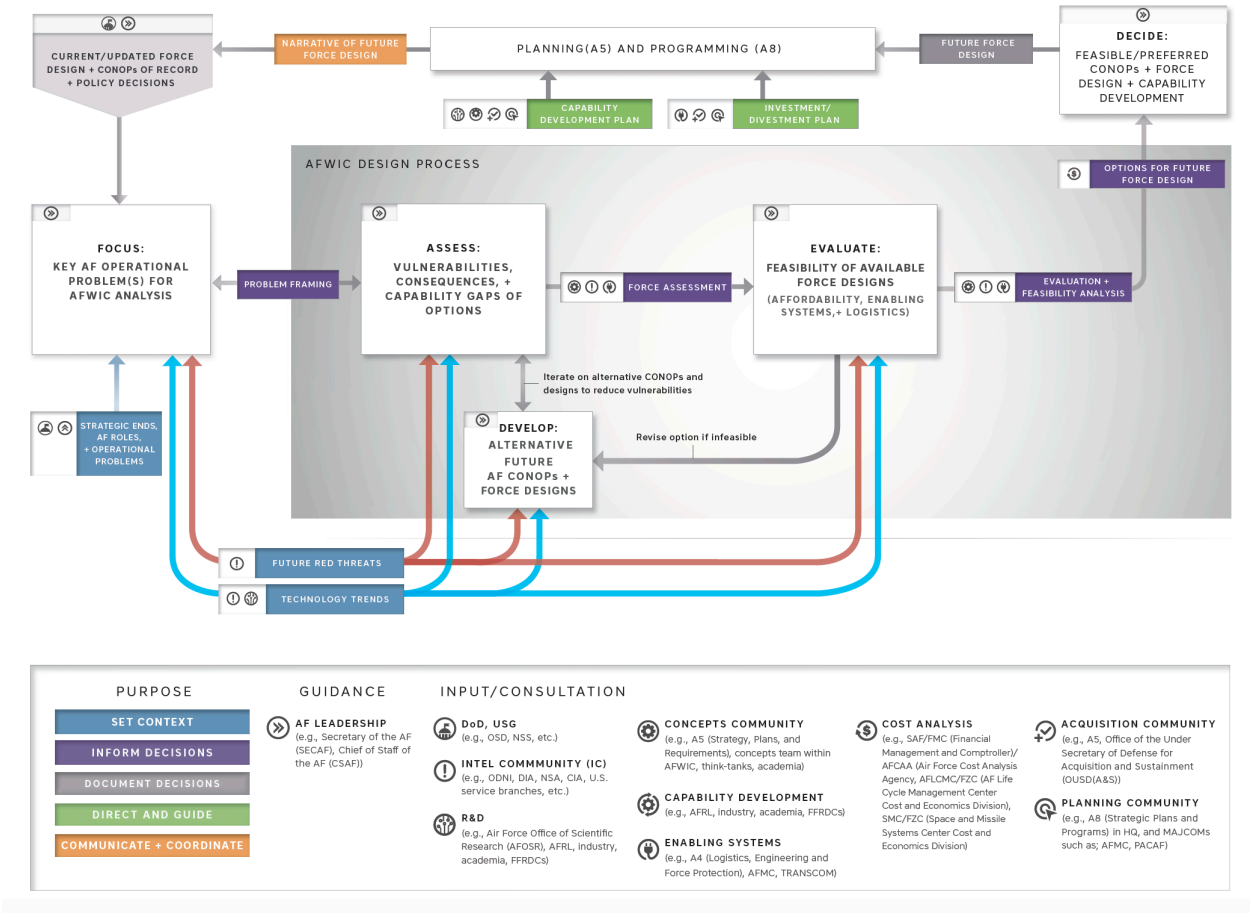
A Vision for AFWIC's Analytical Process and Products

Consistent with our earlier findings and recommendations, we propose a structure for AFWIC's activities and analytical products. Figure S.1 shows our proposal for how AFWIC activities and product elements could fit within the larger force development process. The key decisions with respect to force design, planning, and programming are made outside AFWIC and are depicted in the top row. However, AFWIC's analytic activity (depicted in the center grey box) is a critical part of this process, and AFWIC or AFWIC-enabled product elements (depicted in colored boxes and further detailed in Table S.1) provide crucial information and guidance at virtually every step.[1] Similarly, other organizations provide inputs to key AFWIC actions and product elements (as represented by the icons in Figure S.1). The process is a continuous, iterative cycle, with information flowing in various directions to inform multiple steps. Figure S.1 and Figure S.2 also appear in a larger format in Appendix E of this report.

Any given iteration would begin with the current or planned force, CONOPS of record, and policy decisions, as indicated by the upper-left arrow in the figure. Next, multiple individuals and organizations, including the Office of the Secretary of Defense (OSD), Joint Chiefs of Staff, SECAF, CSAF, and AFWIC, would focus their attention on problems that require analysis (see the "Focus" box on the left of the middle row). This process would be informed by awareness of future threats, technology trends that could help address those threats, and Air Force warfighting capabilities and strategic ends. These inputs are the result of the work of many organizations. However, as suggested by the blue boxes on the bottom row, AFWIC is well positioned to synthesize these insights from industry, academia, the Air Force Research Laboratory (AFRL), non–U.S. Department of Defense (DoD) research organizations, and other experts and to communicate them to senior leadership. Given the mix of consultations and timelines for updating, these deliverables are best produced as stand-alone documents rather than packaged together. However, AFWIC staff will be responsible for reconciling the content across the three context-setting documents (i.e., *Future Threats*; *Technology Trends*; and *Strategic Ends, Air Force Roles, and Operational Problems*) to ensure consistency and timeliness.

[1] A *product element* could be a stand-alone deliverable or part of a larger deliverable. Each product element would include sufficient information on problem framing, assumptions, methods of analysis, results, and conclusions at a level of detail and reproducibility appropriate for its intended audience.

Figure S.1. Relationship of Product Elements to Analytical Steps



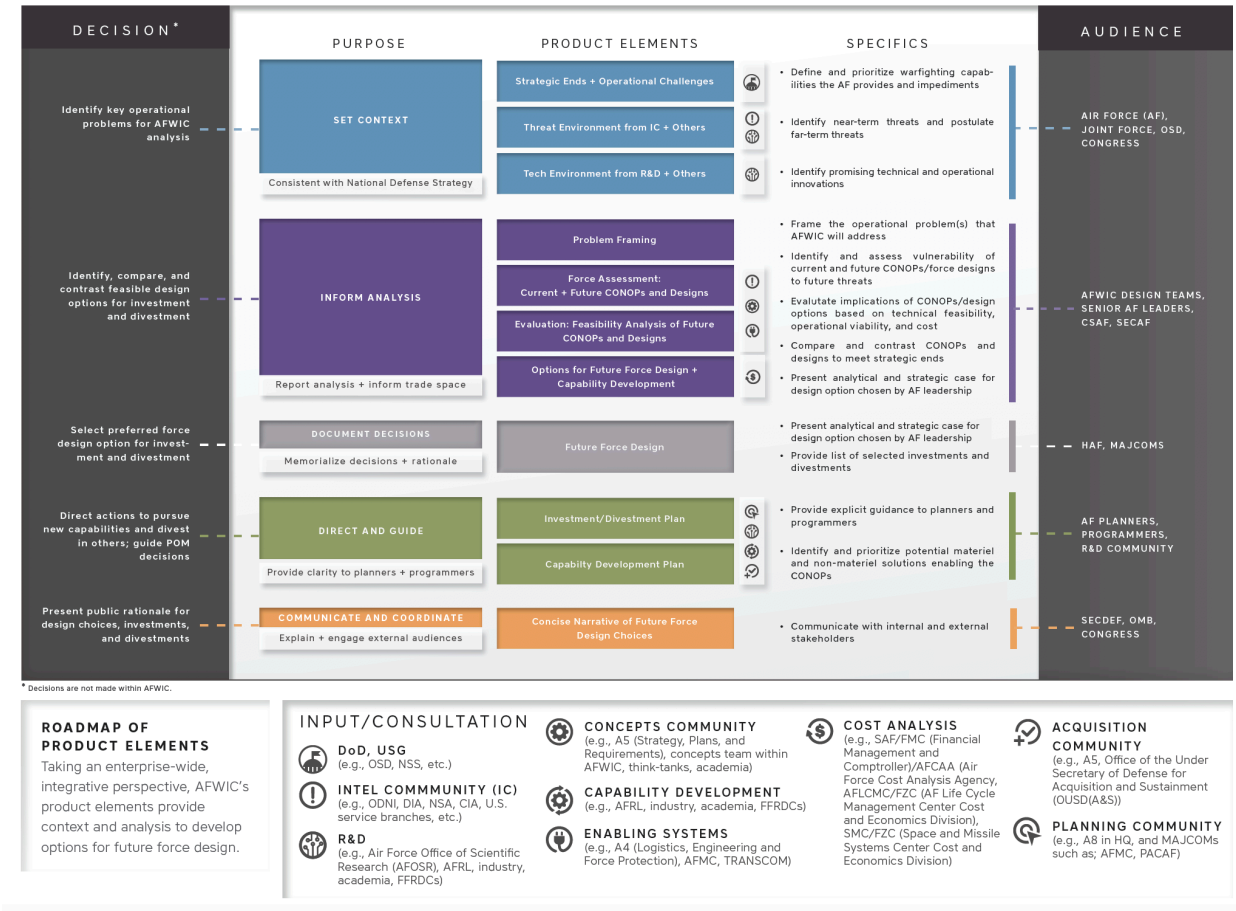
NOTES: AF = U.S. Air Force. AF/A8 = Air Force Plans and Programs. AFLCMC/FZC = Air Force Life Cycle Management Center Cost and Economics Division. AFMC = Air Force Materiel Command. CIA = Central Intelligence Agency. DIA = Defense Intelligence Agency. FFRDC = federally funded research and development center. HQ = headquarters. NSA = National Security Agency. NSS = National Security Strategy. ODNI = Office of the Director of National Intelligence. PACAF = Pacific Air Forces. SAF/FMC = Secretary of the Air Force for Financial Management and Comptroller. TRANSCOM = U.S. Transportation Command. USG = U.S. government.

The "focus" step would result in a documented framing of the problem: a clear statement of the operational problem in the context of the strategic direction set by DoD leadership and the roles that the Air Force will play. Problem framing includes assumptions and premises, some of which might come from senior leadership or from the AFWIC team, and a roadmap for analysis. Each element of the problem framing should be justified, documented, and revisited over the course of the analysis. AFWIC will be a key contributor to this product because it will be the point of departure for AFWIC's analysis.

Next, AFWIC will begin its primary task—to design future force options to address the identified problems. This task involves three main activities, which are shown in the middle grey box of Figure S.1: (1) assess vulnerabilities and gaps in current or potential force designs, (2) develop potential CONOPS and force designs to fill those gaps, and (3) evaluate the cost and feasibility of solutions. Each of these activities is informed by AFWIC's synthesis of future threats and technology trends. As indicated by the arrows, these steps are iterative and mutually informative. They incorporate inputs from other communities, as represented by the icons in Figure S.1. The assessment and evaluation steps each result in a product element, which are shown in purple. Each step of the analytic process should be thoroughly documented, with a clear audit trail that will enable internal review and validation and outside scrutiny. This would include documentation of the results and implications of wargames. The result of AFWIC's analysis is a set of force-design options that will be presented to senior leadership. The strength and quality of this analysis of options and trades will be the most visible sign of AFWIC's impact on decisionmaking.

AFWIC's role does not end there. AFWIC's expertise and enterprisewide perspective make it uniquely suited to help document decisions, provide guidance for planning and programming, and communicate future force designs at a high level. These inputs are represented by the colored boxes on the top row of Figure S.1. For example, AFWIC will lead in the development of "plan-to-program" guidance to A5, A8, and other components and create capability development guidance for the AFRL, AFMC, and others. These guidance documents should be developed in close consultation with the receiving components, particularly A8, which will be playing a key role in connecting AFWIC's work to the POM. Ultimately, this process results in a new status quo force, which is the point of departure for continued thought about emerging problems.

Figure S.2. Summary of AFWIC-Related Product Elements



NOTES: HAF = Headquarters Air Force. IC = Intelligence Community. OMB = Office of Management and Budget. R&D = research and development. SECDEF = Secretary of Defense.

Conclusions

In sum, AFWIC's most important task is to define and evaluate operational concepts that can allow the Joint Force to accomplish important missions that currently are at risk of failure. This will entail, among other things, efforts to facilitate a coherent linkage among Joint Force operational concepts for future warfighting, the Air Force's roles in those concepts, and the resulting implications for design of the future Air Force. Alternative CONOPS need to be connected to plausible, cost-informed force-design options. Different combat design choices could have dramatically different implications for enabling capabilities and institutional elements of the Air Force, such as communications, installations, flying test ranges, recruiting, and combat support. This sequencing of analysis is the primary reason for AFWIC's creation: to support Air

Force leaders in making decisions with an integrated view from the outset, carry that analysis into planning and programming guidance, and further direct Air Force components to take actions consistent with the decisions.

AFWIC's success also will be measured by its effectiveness at clarifying trade-offs among design options across operational objectives. To be effective, AFWIC's products will need to communicate a coherent line of reasoning, from threats and vulnerabilities in the current force to new operational concepts for the Air Force, that is consistent with the Joint Force concept and has the potential to exploit adversary weaknesses and Joint Force strengths.

Acknowledgments

The authors would like to thank Lt Gen Jerry Harris (AF/A8), Maj Gen Clint Crosier (AF/A5), and Maj Gen Michael Fantini (AF/A5R) for the opportunity to provide assistance to the AFWIC team as they embarked on their ambitious journey to stand up the organization. We benefited from the expertise of many AFWIC team members who generously set aside time to meet with us for extended conversations and information sharing. These team members include Brig Gen Clint Hinote (AF/A5R), Col Bryan Cannaday (AF/A5), Col (ret) Tyler Gabriel, Col Pete Santa Ana (AF/A5), Lt Col Ian Chambers (AF/A5), Lt Col Troy Chevalier (AF/A5), Lt Col Douglas Kuhn (AF/A4), Lt Col Kevin Treat (AF/A5), Maj Koewler (AF/A5), Mark Gallagher (AF/A9), Doug Fullingim (AF/A9), Don Forrer (AF/A5), Chris Collins (AF/A5), Rich Hencke (AFRL), and Nicole Misita (AF/A5). Special thanks are due to Maj Craig Svanberg (AF/A5) for enabling smooth communications and scheduling between the AFWIC and PAF teams.

We also were the beneficiaries of the expertise of many other officials in the Air Force and other services who made themselves available for discussions about AFWIC's present and future roles. In the Air Force, these included Maj Gen Killough (PACAF Chief of Staff), Tony Reardon (AF/A5), Mike Trumpfheller (AF/A8X), Jerry Lautenschlager (SAF/AQ), and Amy Graveley (AF/A4).

Retired and former officials provided us with much needed perspective on past integration efforts. We were grateful to have had the opportunity for extended discussions with Lt Gen (ret) Robert (Bob) Elder, Jr., whose perspective on Air Force integrated planning was valuable to us as we sought to better understand the breadth and depth of AFWIC's challenges. Don Tison, former Assistant Deputy Chief of Staff (G-8), provided us with valuable insights about the Army integration process now underway. Thanks also are due to Mike Novak, Deputy Director of Warfighter Integration (N9I) and James McCarthy, former Assistant Deputy Chief of Naval Operations for Integration of Capabilities and Resources. RAND Corporation colleagues Brian Persons and John Yurchak also helped us better understand Navy processes.

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Gen Robert Elder (U.S. Air Force, Ret.); and our RAND colleague, Jordan Bresnahan, for her excellent administrative support throughout the project.

Abbreviations

9/11	terrorist attacks of September 11, 2001
AC	atomic clock
ACC	Air Combat Command
AF/A2	Air Force Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations
AF/A4	Air Force Logistics, Engineering, and Force Protection
AF/A5	Air Force Strategy, Integration and Requirements
AF/A6	Air Force Information Dominance
AF/A8	Air Force Plans and Programs
AF/A8X	Air Force Directorate of Strategic Planning
AF/A9	Air Force Studies, Analysis and Assessments
AF/LR	Air Force Long Range Planning
AF/XO	Air Force Directorate of Operations
AF/XP	Air Force Directorate for Plans and Programs
AF/XPX	Air Force Directorate of Strategic Plans
AFC	Army Futures Command
AFCAA	Air Force Cost Analysis Agency
AFFOC	Air Force Future Operating Concept
AFGM	Air Force Guidance Memorandum
AFGSC	Air Force Global Strike Command
AFLCMC	Air Force Life Cycle Management Center
AFLCMC/FZC	Air Force Life Cycle Management Center Cost and Economics Division
AFMC	Air Force Materiel Command
AFOSR	Air Force Office of Scientific Research
AFOTEC	Air Force Operational Test and Evaluation Center

AFRL	Air Force Research Laboratory
AFSC	Air Force Systems Command
AFSEA	Air Force Strategic Environment Assessment
AFSPC	Air Force Space Command
AFWIC	Air Force Warfighting Integration Capability
AMC	Air Mobility Command
AOC	Air Operations Center
AWACS	Airborne Early Warning and Control System
BMC2	battle management command and control
BoD	board of directors
C2	command and control
C4I	command, control, communications, computers, and intelligence
CAG	conceiver action group (or concept action group)
CBA	Capabilities Based Assessment
CDC	Capability Development Council
CDD	Capability Development Directorate
CFL	core function lead
CIA	Central Intelligence Agency
CIP	CORONA Issue Paper
CNOG	Chief of Naval Operations guidance
COCOM	combatant command
COG	concept options group
CONOPS	concept of operations
CSAF	Chief of Staff of the Air Force
DARPA	Defense Advanced Research Projects Agency
DCNO	Deputy Chief of Naval Operations
DIA	Defense Intelligence Agency
DIU	Defense Innovation Unit
DoD	U.S. Department of Defense

FFRDC	federally funded research and development center
FID	Functional Integration Directorate
FY	fiscal year
FYDP	Future Years Defense Program
GAO	U.S. Government Accountability Office (formerly: U.S. General Accounting Office)
GPS	Global Positioning System
HAF	Headquarters Air Force
HQ	headquarters
IADS	integrated air defense system
IC	Intelligence Community
IFDL	in-flight data link
INS	inertial navigation system
MAJCOM	major command
MAP	mission area plan
MIDS-JTRS	Multifunctional Information Distribution System Joint Tactical Radio Systems
N8	U.S. Navy Integration of Capabilities and Resources
N81	Office of the Chief of Naval Operations Assessment Division
N9	U.S. Navy Warfare Systems
N9I	Office of the Chief of Naval Operations Warfighter Integration Division
NASIC	National Air and Space Intelligence Center
NMS	National Military Strategy
NSA	National Security Agency
NSS	National Security Strategy
ODNI	Office of the Director of National Intelligence
OMB	Office of Management and Budget
OPNAV	Office of the Chief of Naval Operations

OPR	office of primary responsibility
OSD	Office of the Secretary of Defense
PACAF	Pacific Air Forces
PAF	Project AIR FORCE
PED	processing, exploitation, and dissemination
PGM	Program Guidance Memorandum
PNT	positioning, navigation, and timing
POM	Program Objective Memorandum
PPBE	Planning, Programing, Budgeting and Execution
PPG	Plan to Program Guidance
QDR	Quadrennial Defense Review
R&D	research and development
RAP	Resource Allocation Plan
S&T	science and technology
SAF/AQ	Secretary of the Air Force for Acquisitions
SAF/FMC	Secretary of the Air Force for Financial Management and Comptroller
SDPE	Strategic Development Planning and Experimentation Office
SEAD	suppression of enemy air defenses
SECAF	Secretary of the Air Force
SECDEF	Secretary of Defense
SMC	Space and Missile Systems Center
SMC/FZC	Space and Missile Systems Center Cost and Economics Division
SME	subject-matter expert
SMP	Strategic Master Plan
SP3	Strategy, Planning, and Programming Process
SPG	Strategic Planning Guidance
TATP	Thrust Area Transformation Plans
TOA	total obligation authority
TRANSCOM	U.S. Transportation Command

TTPs	tactics, techniques, and procedures
UARC	university-affiliated research center
UAV	unmanned aerial vehicle
USAF	U.S. Air Force
USAFE	U.S. Air Forces in Europe
USG	U.S. government
VCSAF	Vice Chief of Staff of the Air Force

1. Introduction

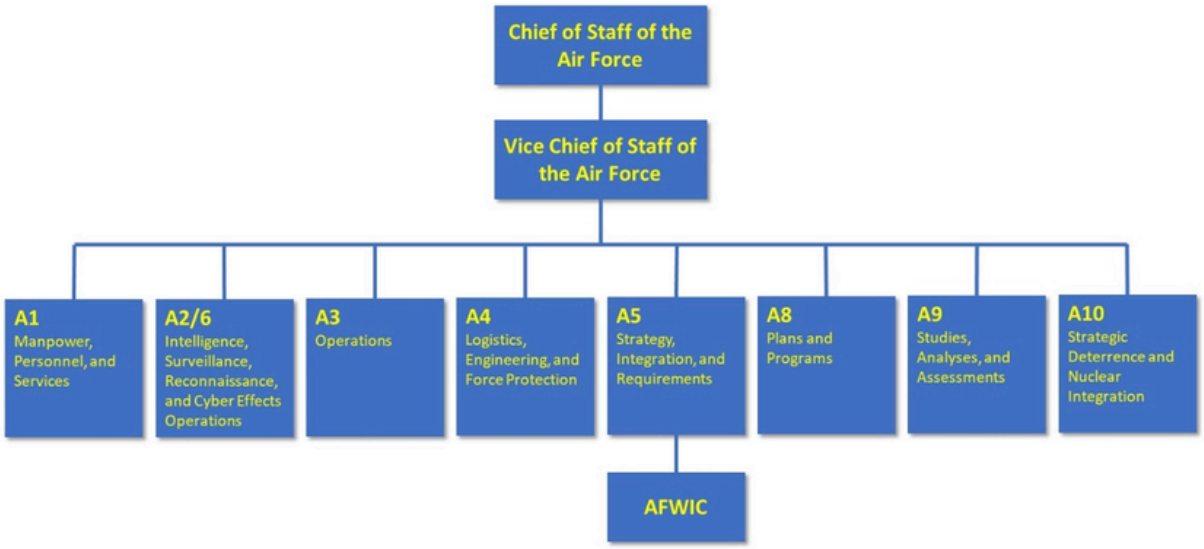
"Air Force personnel should apply the same rigid discipline to analysis that they do to flying an airplane. The accident rate for analysis is quite high. However, these accidents are, for the most part, not as dramatic and personal as aircraft accidents, and consequently, there is no concerted campaign to reduce the rate." —Kent et al., 2008, p. 99.

The force design of the U.S. Air Force (USAF) is defined by the numbers, locations, and configurations of uniformed military and civilian personnel; the inventory of weapons systems, munitions, and installations; and the many critical logistics, communications, and other enabling systems accumulated over decades of investment. Each year, the existing force design is shaped by many incremental decisions made in the process of assembling the Program Objective Memorandum (POM) and the budget. Annual negotiations over the POM provide a venue for balancing demands for readiness with demands for resources to modernize the force. To meet present and future threats, the many incremental investment and divestment decisions that occur in the POM process should be pointed toward a coherent future force design, but that is difficult to do in the absence of a clear vision and roadmap. Near-peer adversaries have increased their capabilities substantially and legacy concepts of operations (CONOPS) and capabilities are, in some cases, unequal to the demands being placed on them. To face off against emergent threats and capitalize on technological and other advantages, the Air Force, in support of Joint Forces, will need to chart a path toward an adaptable future force design that is grounded in solid analysis, operationally feasible, and realistic in its cost.

Over the past several years, the USAF has made a series of organizational changes to strengthen its capacity at the enterprise level to conceptualize and shape future force design and capability development over the longer term. Following a recommendation of the Air Force Studies Board (National Research Council, 2014), the first notable step was the formation of the Capability Development Council (CDC) in October 2016. The CDC was tasked to convene senior Air Force leaders regularly to discuss top priorities for research, development, and experimentation that will enable the Air Force to contribute to Joint Force warfighting objectives. A second step came in October 2017, when the Secretary of the Air Force (SECAF) and the Chief of Staff of the Air Force (CSAF) announced the formation of the Air Force

Warfighting Integration Capability (AFWIC), which would report through the Chief of Headquarters Air Force (HAF) Strategic Plans and Programs (then AF/A5/8, now AF/A8). AFWIC's purpose is to bring focus, resources, and accountability to centralized, enterprisewide future force design and capability development planning. A third step came in October 2018, when HAF A5/8 was split (again) into Strategy, Integration and Requirements (AF/A5) and Plans and Programs (AF/A8), with AFWIC placed within AF/A5. Figure 1.1 reflects the current placement of AFWIC in the Air Force's organizational structure.

Figure 1.1. AFWIC's Place Within the Air Staff



In February 2018, the Vice Chief of Staff of the Air Force (VCSAF) and Deputy Chief of Staff, AF/A5, asked RAND Project AIR FORCE (PAF) to assist AFWIC in developing analytical and other products in support of future concepts, future force design, and capability development planning.[2] They also asked PAF to consider whether organizations or procedures used in the Army, Navy, and Marine Corps might have relevance to—and therefore benefit—AFWIC.

In this report, we propose (1) a roadmap for AFWIC's approach to analysis in support of concept development and force design and (2) an accompanying slate of product elements to

[2] The project was initiated under the Deputy Chief of Staff for Plans and Programs (A5/8) prior to the splitting of A5 and A8. Sponsorship transitioned to AF/A5 after the split.

document and communicate AFWIC's analyses and findings. AFWIC will create some of these product elements, which could be stand-alone deliverables or parts of a larger deliverable. For other product elements, AFWIC will be a contributor or the synthesizer. For example, AFWIC will lead in documenting analyses, wargames, and force design decisions and in creating visualizations of vulnerabilities, capability gaps, and trade-offs. These are separate product elements that most likely would be bundled into a single deliverable. In this deliverable, AFWIC would be responsible for capturing and preserving analyses supporting alternative CONOPS, the development of force design options (both investments and divestments) to execute the CONOPS, and capability development portfolios. Products that AFWIC will support would be guidance documents for AF/A5 and AF/A8 planners and programmers who are responsible for developing the POM each fiscal year. Finally, AFWIC's analyses will be the basis for a concise and compelling graphic-rich document for communicating Air Force force design priorities and their rationale to senior leaders in the U.S. Department of Defense (DoD), Office of Management and Budget (OMB), and the Congress. (Henceforth, we use the term *Air Force senior leaders* to mean the SECAF, CSAF, and VCSAF.)

The deliverables that AFWIC is capable of producing will be shaped by who works for AFWIC and how AFWIC works. Our project scope did not call for undertaking an organizational design or business process improvement exercise. However, in focusing on analyses and products, the PAF team considered ways in which AFWIC could function most effectively to fulfill its mission. We therefore discuss accepted principles of organizational design and culture that could help AFWIC achieve its mission.

Rationale for AFWIC's Establishment

Prior to the establishment of AFWIC, the Air Force had been operating since 2010 within a decentralized structure in which design and planning choices came to senior leadership from a bottom-up process driven by major commands (MAJCOMs) in their designated roles as core function leads (CFLs) (National Research Council, 2014, p. 24). A bottom-up process had the advantage of placing decisionmaking close to operators and their deep knowledge of the needs of missions. But this approach came with a cost; specifically, the relatively few degrees of freedom left to the SECAF and CSAF in their decisionmaking and a focus on readiness to the exclusion of a more strategic view of concept development and force planning. The disconnection from

analysis of longer-term force planning became apparent in planning choices events, where important decisions on force restructuring are made (Leftwich et al., 2019). Over the past several years, senior Air Force leaders came to grips with the seriousness of this limitation and recognized the need to improve both the quantity and quality of the Air Force's enterprise-level analysis and decisionmaking on future force design and capability development planning.

An October 3, 2017, memorandum signed by the SECAF and CSAF announced the establishment of AFWIC to "orchestrate future force design" and "deliver the integration, understanding and consistency required to guide and direct future AF force transformation" (USAF, 2017). AFWIC was envisioned to work effectively within "a new and more centralized and integrated set of planning, programming, budgeting, execution and capability development processes." AFWIC thus is intended to fill a void in Air Force–wide planning: how to tackle major operational challenges that transcend single functions in the Air Force, but even more importantly, depend on how the Air Force effectively supports Joint Force operational objectives.

AFWIC's vision is to "drive enterprise-wide integration and future force design enabling the Air Force to rapidly transition into a networked multi-domain 21st century force" (USAF, 2018; see Appendix A). *Integration* is the operative word: It is easy to say, but as our historical review of Air Force planning over the past several decades in Chapter 2 shows, it is extremely difficult to implement and sustain in a large, complicated, and geographically dispersed organization.

AFWIC's stated mission is to "develop total force, multi-domain operating concepts to implement the National Defense Strategy and drive integration through centralized enterprise design and capability planning. AFWIC identifies prioritized ways and means to guide resourcing priorities improving Air Force lethality and enhancing the joint and coalition fight" (USAF, 2018; see Appendix A). For the purposes of this study, the PAF team reframed AFWIC's mission in terms of its intended outputs: *provide senior leadership with actionable options for designing an adaptable force structure over the next ten to 15 years that supports national strategy across the full spectrum of Air Force roles*.

An adaptable force structure will be shaped by technology and geopolitical trends and their influence on allies' (Blue) and adversaries' (Red) offensive and defensive warfighting CONOPS. Air Force leaders expect AFWIC to generate and analyze options for new CONOPS that are

consistent with national-level objectives, such as those found in the National Military Strategy (NMS) and Joint Force operational challenges; analyze options for future force designs to execute the alternative CONOPS; and present leadership with (1) viable, cost-informed force design and force-enabling options and (2) coherent supporting strategies for investments and divestments.

AFWIC initially was established with a staff of 45 people, most of whom were detailed from other HAF Air Staff directorates. Later, manpower billets were drawn from the Air Staff directorates and MAJCOMs. The MAJCOM billets are aligned with activities related to their CFL responsibilities, which were eliminated with the creation of AFWIC. Guidance from the Under Secretary of the Air Force and VCSAF is to move toward the initial operating capacity targeted manpower strength of 261 for two years and hold there until the leadership can evaluate AFWIC's effectiveness (USAF, 2017). Current staffing, as of June 2019, is approximately 75, with an additional 45 to 50 expected to be added before the end of fiscal year (FY) 2019.

AFWIC's organization and functioning, as it was initially conceived in June 2018, is described in the AFWIC CONOPS found in Appendix A and discussed further in Chapter 3. However, AFWIC's organization has been evolving since that time and will continue to change as it matures and grows. For this reason, and given our focus on AFWIC's future analytical products, we chose not to dwell on details of its initial organization.

AFWIC as an integrating organization will need to function within existing organizational structures and processes whose boundaries relative to AFWIC are as yet unclear. Addressing enterprisewide operational challenges requires a joint and coalition perspective, given that effects can be achieved through multiple means, not all of which are in the control of the Air Force. In addition, gaining strategic advantage for Blue depends on understanding Red's strengths, weaknesses, vulnerabilities, strategies, and its likely—yet uncertain—changes over time. It also depends on Blue's understanding of its own position and uncertainties over time. In this complex and dynamic threat environment, Blue needs to take an adaptive approach to design, planning, and programming. Near-term readiness and warfighting priorities need to be balanced against longer-term modernization, transformation, and capability development. Finally, options not only need to demonstrate warfighting superiority; they also need to be cost-informed and logistically feasible. Such trade-offs require the full engagement of senior leaders who are

willing to accept risk and thus divest in some assets while seeking to buy down risk through investment in others.

Identifying divestment options is a critical element of AFWIC's remit, but these options are typically unpopular with Congress (and, at times, within the Air Force). In short, true integrated planning requires senior leaders who are willing to make hard choices. Defending hard choices and assessing the consequences of those choices requires technically credible and transparent analysis. Existing analytical tools are not wholly adequate for analyzing force design options under a wide variety of technology, operational, and budgetary uncertainties. Generating and evaluating analytically defensible choices is perhaps AFWIC's greatest challenge. This challenge has persisted throughout the Air Force's history, and RAND Corporation researchers and others have produced an extensive body of work to help the Air Force frame and analyze force structure choices, as we note in relevant sections of this report.

In sum, AFWIC's mission is not a new one for the Air Force. Rather, it represents another opportunity for the Air Force to learn from its similar efforts in the past and address the known issues that led those past to fall short and ultimately fail. An aspiration of this report is to capture lessons learned from the Air Force's past and from other services and propose a path forward on integrated planning that proves credible, adaptable, and sustainable over time and across the tenures of Air Force leaders.

Research Approach

The AFWIC initiative was just beginning when this project began, and, as of February 2019, when we completed our study, it had yet to reach full staffing. Because the AFWIC organization was evolving throughout our analysis, our research approach was broad, seeking general principles that likely would remain robust to modest changes to AFWIC direction. We approached the problem from several angles, using various lines of research to discover potential pitfalls the organization might face and to offer promising paths for its analysis and analytical products. The three main lines of research were:

- **Lessons from history:** We gained the most-directly applicable insights from studying the Air Force's previous attempts to stand up organizations to perform activities similar to those of AFWIC. This historical analysis spans from the 1970s to the present. We noticed some common themes for both success and failure and drew from these generalizations to

make recommendations for AFWIC today. This line of inquiry is documented in Chapter 2 and Appendix B.

- **An examination of parallel efforts:** As this research was being conducted, the other services were, to some extent, changing and/or altering the way that they conduct longer-term capabilities analysis. Our sponsor asked what might be learned from these initiatives. We followed these efforts and interviewed senior leaders, some repeatedly, throughout the work. To a certain extent, studying the other services corroborated insights, but for the most part, ongoing efforts in the other services are too immature at this juncture to know how well they might or might not be fit for their intended purpose. The results of this research are summarized in Chapter 3 and described in more detail in Appendix D.
- **Case studies:** Our third approach was to work through two case studies. These cases provided specific, concrete examples for exploring the real challenges that AFWIC will have to overcome to be successful and the processes it will need in place to generate consistent, high-quality products. The case studies chosen were future options for positioning, navigation, and timing (PNT) and future options for command, control, communications, computers, and intelligence (C4I). These cases were selected because they were candidate prototype analysis areas for AFWIC, the issues span the enterprise (and beyond the Air Force), and they illustrate contrasting challenges to problem framing. We performed an abbreviated in-house examination of these cases: The goal was not to replicate the full analysis that AFWIC would do but rather reveal the process and products that AFWIC will need to accommodate. We refer to these case studies throughout the report and use them to discuss problem framing issues in Chapter 6.

Our findings and recommendations result from a synthesis of the insights from these lines of research, particularly the historical record of previous Air Force efforts and the examination of current case studies. All findings and recommendations were further guided by, and are consistent with, the general principles of organizational design and management from the social sciences, specifically Mintzberg, 1979; Rumelt, 2011; Burton, Obel, and Håkonsson, 2015; and Schein and Schein, 2017.

How This Report Is Organized

In the next chapter, we summarize lessons drawn from a review of previous efforts by the Air Force dating back to the 1970s to wrestle with the challenges of top-down force planning in a geographically and functionally diverse organization. In Chapter 3, we describe AFWIC's configuration as of February 2019 and summarize comparable integration efforts among the other military services. In Chapter 4, we lay out a proposed framework for AFWIC's approach to analysis, and in Chapter 5, we describe the slate of analytical product elements that are needed to meet AFWIC's multiple objectives and that could be used to communicate with different

audiences both within and beyond the Air Force. In Chapter 6, we consider the challenges of the first step in analysis—problem framing—for two critical enabling functions of PNT and C4I systems. The report concludes in Chapter 7 with a summary of findings and recommendations to help guide the development and maturation of AFWIC's analytical tasks. The appendixes contain a reproduction of AFWIC's CONOPS (Appendix A); a detailed history of the Air Force's previous experience with integrated, enterprisewide, long-term planning (Appendix B); an initial mapping of earlier Air Force documents to those proposed for AFWIC (Appendix C); a summary of observations and findings from our examination of recent (and ongoing) integration efforts by the other services (Appendix D); and large-format versions of the flow chart of analyses and the table of proposed product elements (Appendix E).

2. Lessons Learned from Past Air Force Approaches to Integrated Planning

AFWIC is not the first attempt by Air Force leaders to improve decision support pertaining to the future of the service through new organizational structures and processes. Drawing on published materials and internal Air Force documents, we undertook a detailed examination of the major centralized integration efforts the Air Force has sought to institutionalize in the past. In Appendix B, we describe their scope, implementation, and key products or documents and offer insight into their eventual demise.[3] Drawing on the detailed material and citations presented in Appendix B, this chapter focuses on the key themes and lessons learned that emerged from our historical analysis.

AFWIC and many of its antecedents were intended to replace decentralized planning models with a strategy-based, centralized process generating options across multiple domains. However, then (as now), a key impediment to top-down planning in the Air Force was the ". . . significant degree of distributed authority, with [MAJCOMs] headed by four-star leaders possessing significant independent authority for the design and execution of the Air Force program" (Mazarr et al., 2017, p. 61).

Overview

The story begins with initiatives in the late 1970s.[4] Since then, some Air Force integration initiatives have focused on capability development to formulate innovative concepts of operations and develop and acquire closely associated systems, while others have sought to determine not only what capabilities might be needed in the long term but also how these new

[3] For a discussion of strategic planning capstone documents and initiatives since the end of World War II, see Cohen, 2017.

[4] It should be noted that there were related efforts predating those in the 1970s. One, termed "Project Forecast," began in 1964 as a means of surveying future technology and assessing its feasibility in future weapon systems. It ultimately failed because the effort was disconnected from any formal force planning process. Other initiatives in the early and mid-1970s were short-lived and did not have much influence on the future force. See Weishoff, 1990, and Whiting and Dale, 1996, for more on those initiatives.

capabilities might influence future force structure, including manning, training, and infrastructure. The initiatives share a vision of providing Air Force leadership—especially the CSAF and SECAF—with "decision space" that enables them to determine the direction of the Air Force.

The process created under Gen Ronald R. Fogleman (CSAF, 1994–1997) came closest to putting forward an integrated Air Force vision and plan for the future that had the potential to translate into programmatic decisions, based on our review of Air Force planning history as summarized in Appendix B. Fogleman determined that the Air Force needed to strengthen its ability to conduct centralized, long-range planning in order to tie the vision of the future Air Force to new concepts, capabilities, and programs.[5] At the time, strategic planning was a decentralized activity that resided in the MAJCOMs, precluded cross-function or enterprisewide decisionmaking, and favored MAJCOM-prioritized programs.[6] In addition to several organizational changes, Fogleman directed the development of a Long-Range Plan, an unclassified summary version of which was released to encourage dialogue with industry, think tanks, and other external stakeholders. The plan identified specific areas in which the Air Force would invest and included directive statements with end states, tasks for achieving the end state, and assumptions and constraints in strategic issue areas. The aim of the plan was to provide guidance to planners and concept developers in the Air Staff and the MAJCOMs to exploit or generate innovative concepts, and—through the Annual Planning and Programming Guidance—encourage programmers to establish initial wedges and offsets to build toward the new capabilities. The process Fogleman initiated was carried through into Gen Michael Ryan's tenure (CSAF, 1997–2001), owing to the former's efforts to carefully incorporate consensus-building among USAF leaders across the enterprise.

Were it not for outside influences and pressures on the Air Force during this time—and some overly ambitious implementation efforts internally—centralized long-range planning might

[5] A 1999 RAND report for the Air Force concluded that "current Air Force planning is a highly decentralized process that is conducted within the major commands (MAJCOMs) away from the Air Staff," allowing "no vantage point from which to make Air Force–wide strategic decisions" (Lewis et al., 1999, p. 2). In related, unpublished RAND research conducted in 1996, Leslie Lewis came to similar conclusions. For an in-depth treatment of *Global Reach—Global Power* and other Air Force vision statements, see Cohen, 2017.

[6] See Lewis et al., 1999, pp. 1–5. Gen Merrill McPeak (CSAF, 1990–1994) established a Modernization Planning Process that, although dedicated to long-range planning, "at the direction of the [Directorate of Operations] . . . evolved into a MAJCOM-led process" (Whiting and Dale, 1996, p. 44).

have become more-strongly institutionalized. The Air Force has faced frequent tension between current and long-range planning on one hand, and between centralized (HQ) and decentralized (MAJCOM) planning on the other—the former because of overriding security needs (e.g., wars) and the latter often because of changes in leadership.

In general, the Air Force has demonstrated some historical ambivalence to integrated, centralized strategic planning linked to programming. This is, in part, because of the very nature and culture of the Air Force: The Air Force leadership sets the tone and guides the overall direction of the service, but the MAJCOMs have considerable latitude in their own planning and implementation of that direction. This has made it a supreme challenge to centralize long-range planning and concept development. External influences and pressures on the Air Force and internal dynamics that undermine implementation placed insurmountable obstacles in the way of deeply embedding centralized long-range planning at headquarters.

Lessons for AFWIC

There is extensive scholarly literature on managing successful organizational change in the public sector over several decades. Fernandez and Rainey, 2006, synthesize much of this literature and identify a consensus in the research around eight factors, or "determinants of effective implementation of organizational change" (p. 169). These factors are to (1) ensure the need, (2) provide a plan, (3) build internal support for change and overcome resistance, (4) ensure top-management support and commitment, (5) build external support, (6) provide resources, (7) institutionalize change, and (8) pursue comprehensive change.

Using these factors and the details of the Air Force history provided in our review in Appendix B, we derived several lessons that could help Air Force leadership set the context for AFWIC and improve its chances of success and institutionalization.[7] These lessons are presented in the positive but trace their origins to both successes and failures in efforts to develop integrated planning and capability development processes. We will elaborate on these points with respect to their applicability to AFWIC in Chapters 4 through 7. We derived the following lessons for Air Force leadership:

[7] Similar lessons from Air Force experience, from the experiences of other military and corporate organizations, and from the academic literature also can be found in Gandy, 2012, p. 16, and Mazarr et al., 2017.

- **Senior leadership must be intimately and directly involved in the development of the vision and strategy and in deciding on trade-offs to implement the strategy.** During the Fogleman process and during Gen Ryan's tenure, the CSAF met with other Air Force leaders on the topic of the Air Force plan more frequently than the three CORONA meetings during the year. Similarly, the CSAF and SECAF met with the Air Staff's long-range planners monthly to discuss candidate strategies for implementing plans. For AFWIC's analysis to carry the requisite authority in planning, programming, and budgeting, as it did during the Fogleman-Ryan eras, senior leaders' involvement should occur on a relatively regular basis. (This applies to factor four from Fernandez and Rainey, 2006.)
- **Consensus among the key Air Force stakeholders about the fairness and transparency of the process is critical.** The importance of building confidence in the analytical process across the enterprise, the conceptualization of future CONOPS and needed capabilities, and the path to get there (in terms of both investments and divestments) cannot be overstated. This is why the early and frequent engagement of senior leaders above the director of AFWIC is so critical. Confidence in the process enables a robust discussion about the merits of alternatives, reduces the likelihood that the process is linked to individual leaders, and increases the chance that it will survive beyond the leader who established it. There is only one instance where a long-range planning effort persisted after a change in leadership (Fogleman to Ryan); the rest of the efforts disintegrated after the original leader left his position. For AFWIC, the process must involve the entire Air Force leadership, including potential successors to the current CSAF who would be in a position to provide continuity. CORONAs can be used as culminating events that cement a consensus around the process and analysis, but they should be preceded by considerable preparation and interaction. Furthermore, documents bearing on the topics under discussion should be accessible to all stakeholders in the process. (This applies to factors three and four from Fernandez and Rainey, 2006.)
- **Consensus on the analytical process should facilitate strong links among the strategic vision, long-range planning, and concept development on one hand and between programming and budgeting on the other.** Long-range planning efforts that have been disconnected from resource allocation have failed. Fogleman, a former programmer, knew that the plan had to be implemented through the POM. Therefore, programmers had to be given guidance based on the plan that would define trade-offs to be reflected in the POM over time. However, it was critical that these trade-offs be both feasible and affordable—specifying investments in new capabilities and identifying offsetting divestments from legacy capabilities. Without this specific guidance, Air Staff programmers would be left to decide on the trade-offs, which they would be forced to do when fed by a decentralized planning process. Similarly, AFWIC will need to establish strong links to AF/A5 and AF/A8 to ensure that its analysis will be translated into feasible and practical guidance. (This applies to factors one, two, six, and seven from Fernandez and Rainey, 2006.)
- **Innovative concept development efforts that provide the building blocks for the implementation of the strategic vision and long-range plan should be interdisciplinary and focused on future operational challenges.** Efforts in the early days of Air Force Studies and Analyses and to support planning in the 1990s emphasized cross-disciplinary innovation under the organizing principle of operational challenges

that USAF leaders defined. Although operators are central to the process of concept development, the formulation of new concepts that are operationally viable and effective, technically feasible, and affordable requires the involvement of a wide array of functional expertise. This includes operators and also those with relevant expertise in emerging technologies, intelligence, enabling capabilities, acquisition, and cost analysis. Fundamentally, the motivator of concept development must be future operational-level challenges in the form of joint objectives and tasks. AFWIC should be a primary organizer and proponent of such efforts. (This applies to factor eight from Fernandez and Rainey, 2006.)

- **Planners must look at future challenges and opportunities well beyond the Future Years Defense Program (FYDP), but not so far that the view of the future is perceived to be unrealistic and the process loses buy-in.** The 30-year planning horizon that Fogleman set was eventually viewed as too far in the future, as noted in Appendix B, and was scaled back to 25 years; even 20 years might be more accessible to most participants. Allowing for the current FYDP plus three or four more would provide time for new systems to be developed and procured (and for legacy systems to sunset gradually). Wargames can be invaluable tools for AFWIC to draw on in identifying future challenges and for developing and assessing concepts to meet those challenges. (This applies to factor eight from Fernandez and Rainey, 2006.)
- **The focus on future operational challenges requires distinct organizations from those focused on current operations.** One of the initial actions Fogleman took in his initiative to institutionalize long-range planning was to create a special assistant dedicated to this activity and then establish an entire Air Staff Directorate for Plans and Programs (AF/XP) separate from the Directorate of Operations (AF/XO). Fogleman's actions are rooted in basic organizational design principles. These principles emphasize that individual organizational units work best when given a consistent set of tasks and goals (Mintzberg, 1979, pp. 384–387). When working toward multiple, competing goals, organizational units struggle to perform well and need additional coping mechanisms to resolve the competing demands (Gaim et al., 2018). Fogleman recognized that current operations and long-range planning processes differ significantly in objectives. Indeed, any organizational boundary has the potential to introduce the need for additional coordination within the organization, which then adds to the organization's workload. This must be taken into account when deciding whether to split or merge tasks among units (Scott, 1992, p. 232). In the context of AFWIC, the burden of any needed coordination between planning and operations appears low. Basic principles of organizational design suggest that separating these activities would spare future planners the distractions of current operational requirements without undue coordination burden. The planners will, however, need relevant operational experience to be effective in their coordination activities.

These findings, grounded in decades of Air Force experience and the organizational design literature, offer a useful lens through which to consider AFWIC's prospective approach to long-term, integrated planning and the recent efforts of the Army, Navy, and Marine Corps to address similar challenges.

3. AFWIC's Initial Model for Integrated Planning and Comparison with the Other Military Services

With the backdrop of the Air Force's history of attempts to improve its long-term planning, this chapter addresses AFWIC's mission, objectives, and structure as they were initially conceived in spring 2018 and how AFWIC was viewed as fitting within the Air Force's Strategy, Planning, and Programming Process (SP3). This chapter concludes with an examination of how the other services are tackling integrated long-term planning in the context of their own organizational structures and cultures. We also include a summary of findings relevant to AFWIC. Further details of the other services' experiences are provided in Appendix D.

AFWIC's Place in Existing Air Force Processes

As we noted in Chapter 1, AFWIC was created to fill a gap in the process the Air Force uses to deliberate on decisions related to its future force structure. That gap, communicated by the CSAF and SECAF in their October 2017 memo announcing the creation of AFWIC, was that "our ability to fully integrate across core functions and take advantage of cross functional capabilities and efficiencies is not meeting the challenges of a rapidly evolving operational environment. We must establish better unity of effort across diverse portfolios to better understand and prioritize resources" (USAF, 2017). Air Force leadership is looking to AFWIC to guide the development of the future force with an integrated—as opposed to functionally demarcated—view.

Although the October 2017 memo clearly delineates the challenge, it leaves the meaning of "integration across functions" open to interpretation. For the purposes of this report, the term is grounded in the need of warfighting to be mission-focused, with the Air Force playing roles that draw on multiple capabilities. For example, such functions as air power, logistics, training, and reconnaissance all contribute to the execution of a warfighting concept, strategy, and mission, and typically are brought together under the rubric of a combatant commander's operational plan. CONOPS, strategies, and missions drive integration across functions. The point of AFWIC is to avoid confining solutions to functional silos.

In the context of concept development and future force design, integration across functions requires Air Force leaders to think about the Air Force's roles in joint warfighting from an enterprise perspective (e.g., how to counter anti-aircraft defenses) rather than from a narrower single-function perspective (e.g., how to use jet fighters to solve the problem). Putting some context around AFWIC's role in integration is fundamental to defining the analyses and product elements that AFWIC needs to generate or coordinate.

Overview of the Legacy Strategy, Planning, and Programming Process

Planning and development of the future force is accomplished under the purview of the SP3 and governed by Air Force Guidance Memorandum (AFGM) 2016-90-1101, the *Air Force Strategic Planning Process.* The guidance memorandum describes an elaborate and sophisticated process that is designed to "create Air Force forces able to provide responsive and effective Global Vigilance—Global Reach—Global Power to support the national strategy now and in the future environment" (USAF, 2016, p. 1). It goes on to define the SP3 as a

> [p]rocess to integrate strategy, concepts, and capability development to identify force objectives and programming to support practical organization, training, equipping and posture across the Total Force. Comprised of distinct, interrelated elements set in the context of Presidential and DoD guidance. The elements are categorized as Strategic Planning, Program Planning and Development, and Program Defense (USAF, 2016, p. 31).

The AFGM describes SP3 as consisting of a series of activities and associated products that are designed to link budgets submitted by various mission area and functional areas to the Air Force's long-range strategy. The SECAF and CSAF, guided by national-level direction from the Secretary of Defense (SECDEF) and Chairman of the Joint Chiefs of Staff, produce a vision for the future of the Air Force. The Air Force organization responsible for strategic planning (AF/A5) identifies challenges in the future national security environment and develops concepts (consistent with the vision of the SECAF and CSAF) to address those challenges. AF/A5 subsequently establishes strategic vectors and provides guidance to the rest of the Air Force (mission area functional leads) on priority areas of investment. Using leadership priorities, the mission area functional leads develop their plans, which are compiled into a document called the *Ten-Year Integrated Plan*, which projects two FYDPs forward and provides a gauge of the Air Force's progress toward the future vision. Finally, a 30-year Resource Allocation Plan (RAP) is intended to be an investment plan that will result in the future force needed to fulfill the Air

Force's mission responsibilities consistent with the SECAF and CSAF vision and the future security environment (USAF, 2016, p. 3).

Each year, the investment plan is reviewed through the planning choices process. The Air Force's most-senior leaders review the plan and assess the disconnects between the plan and the expected available investment budget. Leaders then consider shifts in investments across the portfolio to best manage risk in acquiring the components of the future force that are needed. The final investment decisions are made during the planning choices event. Those decisions are then conveyed to the mission area functional leads through a document, the Plan to Program Guidance (PPG), which subsequently informs their POM submissions. As a final step, gaps between the programmed and required forces feed the capability development planning process, which drives analysis by capability collaboration teams to examine how to fill those gaps.

The Air Force has produced various documents over the years in executing the SP3. Table C.1 in Appendix C briefly summarizes the key SP3 products preceding the establishment of AFWIC, their purposes, and their current statuses.

Gaps in Integration

The memo from the SECAF and CSAF establishing AFWIC suggested that disconnects exist between the part of the SP3 process that is focused on strategic planning and those parts focused on program planning, capability development, and subsequent defense of the program (USAF, 2017). These same disconnects were noted and addressed by Fogleman 25 years ago in a strategy-driven process, as noted in the previous chapter and in Appendix B. As an alternative, the memo stated that AFWIC would address these disconnects:

> The AFWIC will operate within a new, more centralized and integrated set of planning, programming, budgeting, execution and capability development processes that will replace Core Function Leads. The AFWIC will deliver the integration, understanding and consistency required to guide and direct future [Air Force] force transformation. The AFWIC will explore innovative solutions, develop capstone, operational and functional concepts, and prioritize these efforts across the Air Force, spanning doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy (USAF, 2017).

Discussions in 2018 with Air Force leadership involved in the SP3, as it had been functioning prior to AFWIC's establishment, provided insights into the integration challenge (personal communication with Lt Gen Jerry D. Harris, then A5/8, September 5, 2017). Typically, the strategy and planning process would start with a top-down approach, while the programming

process would follow a bottom-up approach. For strategy and planning, leadership and staff at HAF would produce resource-informed and resource-constrained views of the future Air Force. High-level risk analysis of how that force might perform in the future security environment would set the stage for trade-off discussions across such broad capability areas as fighter aircraft versus bomber aircraft and fighter and bomber aircraft versus strategic lift or aerial refueling. While those discussions would be taking place, the Air Force functional communities that represent specific capability areas would be developing and defending their inputs to the POM in the setting of the Air Force corporate board structure.

This approach presented several challenges. The POM inputs from the functional areas did not always reflect the strategic decisions being made through the strategy and planning steps in the process. If strategic decisions were made to divest of a particular weapon system or capability, the other functional communities that supported that capability would need to make divestments in their activities and resources that supported those weapon systems. Similarly, the long-term investment decisions for new capabilities made in the strategy and planning activities would not always consider the broader implications of those decisions on other parts of the Air Force that would be responsible for enabling the operation of the new weapon system platforms. AFWIC was created to address these challenges.

Planning Choices

The legacy SP3 process had activities that provided Air Force senior leadership with the opportunity to debate high-level, high-impact decisions about the future structure of the Air Force. These activities concluded with the planning choices event, at which trade-offs among force structure components were discussed and decided. These choices were all tied to the 30-year RAP, which is shown with other legacy SP3 products in Table C.1 in Appendix C. This process had several weaknesses. First, links were lacking between planning choices for combat forces and their impact on enabling and infrastructure choices. Second, the process was not properly timed to inform the bottom-up budget planning activities of the various functional communities. Finally, planning choices events lacked a structured analysis of how future force structure decisions would enable, or create vulnerabilities in, plausible futures other than those highlighted in the Air Force Strategic Environment Assessment (AFSEA), which is now a discontinued product.

AFWIC's Business Model as Specified in its Concept of Operations

The approved AFWIC CONOPS (reproduced in Appendix A) highlights AFWIC's primary outputs and their purposes as they were viewed in June 2018:

> AFWIC key outputs, approved by SECAF and CSAF, include an authoritative Family of Concepts, Capability Development Guidance, and a Design Blueprint. The Concepts capture the Air Force's vision for future warfighting within the joint, interagency, and coalition contexts. The Capability Development Guidance is implemented within the requirements, acquisition, and technology processes to drive the development of the capabilities and systems the future force needs to fulfill the Family of Concepts and meet the Design Blueprint. The Blueprint describes the future force we need to fight as an integrated family of systems. It is the direct output of the future force design process and becomes the primary input into the planning and programming processes (USAF, 2018).

The particular characteristics of these proposed products had not been developed at the time of this project, and indeed, this report (Chapter 5 in particular) is intended to inform AFWIC's convergence on a set of product elements that will serve purposes beyond those noted in the AFWIC CONOPS. Products aside, AFWIC did need to establish an organizational design to launch its operations and build staff.

AFWIC's Initial Organizational Design and Staffing

AFWIC's CONOPS outlines an initial organizational structure of six directorates intended to foster integration (see Appendix A). One of the six, the Functional Integration Directorate (FID), was charged with accomplishing the core integration function for which AFWIC was created. Constituted of subject-matter experts (SMEs) representing the cross-functional Air Force, this directorate was tasked with ensuring that everything AFWIC touches (e.g., concept development, future force design, capability development, programming guidance to MAJCOMs and functional leads) addresses the integration and interdependencies of Air Force functional communities.

The AFWIC CONOPS highlighted the role of the FID as a departure from the legacy SP3 by stating, "[w]hereas previously, integration occurred at the four-star level, and after independent plans, concepts, and budgets were already built, the Functional Integration Directorate integrates at the earliest and lowest possible levels, driving integration at the very

beginning of concept development and future force design" (USAF, 2018, p. 5).[8] AFWIC's initial organizational design also included a Joint and Coalition liaison element to serve as the primary interface with Joint and Coalition partners, ensuring tight links with those communities of interest throughout the entire force design process. As AFWIC has evolved since inception, its actual work has been organized through a less rigid and more-organic structure of design teams for developing future concepts and force design options. Design teams draw staff from the various directorates (which are more useful for staff management and administrative purposes) and other components of the Air Force.

AFWIC's staffing model has relied to date on drawing people and billets from the MAJCOMs. Although it creates immediate benefits for AFWIC, the draw from the MAJCOMs has limited their capacity to perform near-term work or further support AFWIC with subject-matter expertise.

Summary Assessment

Our review of AFWIC's responsibilities, as embodied in its June 2018 CONOPS, the products to be generated, and the legacy SP3 products they are supposed to replace, is summarized in Table 3.1.[9] The table does not reflect AFWIC's activities as they have evolved as of February 2019. However, Table 3.1 is useful in revealing several areas where product gaps might exist that AFWIC will need to fill if it is to achieve the vision set forth by the SECAF and CSAF in October 2017. First, CONOPS will need to be analyzed against a broad variety of plausible futures, vulnerabilities of current and new operating concepts will need to be identified, and these insights will need to be preserved for future analysis. Second, guided by its own analysis in support of concept development and identification of needs for new capabilities, AFWIC will need to communicate the viability of emerging technologies, their potential applications, and the status of such capability development initiatives as experimentation campaigns. Third, analysis will be needed to demonstrate the connections between desired future capabilities and the decision pathways to generate those capabilities through a portfolio of

[8] If the internal structure of AFWIC defaults over time to mimicking the functional boundaries of the previous CFLs, it would be a sign that AFWIC will have difficulty delivering on its promise of integration.

[9] Table 3.1 was presented as a briefing titled "AFWIC: Corona South '18" by AFWIC's leadership to CORONA South in February 2018 to demonstrate how AFWIC's products, as initially conceived, would replace products developed and used in the legacy SP3 (AFWIC, 2018).

investment and divestment choices across all Air Force functions. Fourth, specific work plans will be needed to guide analysis of design choices. Design elements and attributes will need to address combat force structure options and the enabling and institutional changes needed to support future combat forces. Fifth, AFWIC will need to produce PPGs for the planning community to capture and preserve documentation of the interdependencies of force structure among functional areas. Finally, AFWIC will need to communicate critical integration concepts internally and externally. Addressing these information needs and other needs is the focus of Chapters 4 and 5.

Table 3.1. Comparison of Legacy SP3 Products and AFWIC's June 2018 Thinking About Process and Products

Phase	Legacy SP3 Milestones and Work Products	Milestones and Work Products as Represented in AFWIC's June 2018 CONOPS
Capability development	1. HAF Enterprise Capability Collaboration Teams (ECCTs) (flight plans) 2. Capability Collaboration Teams (solution paths)	AFWIC will scope and direct enterprise capability development activities. 1. Will be led by AFWIC's FID 2. Must align with Family of Concepts
Strategy	1. Air Force Strategic Master Plan (SMP) 2. Air Force Strategy or Strategic Guidance or Vision 3. AFSEA 4. Air Force Future Operating Concept (AFFOC)	1. Replaced by AFWIC Capability Development Guidance and Design Blueprint 2. Concise translation and articulation of Air Force end states from such documents as the National Security Strategy (NSS) and NMS 3. Air Force Future Operational Assessment (AFWIC) 4. Replaced by Family of Concepts: Capstone, Operational, Functional (AFWIC)
Planning	1. Core Function Support Plans (CFSPs) 2. Strategic Planning Guidance (SPG) 3. 30-year RAP 4. PPG	1. During transition, MAJCOMs will still provide content as required; product will be replaced by AFWIC's Capability Development Guidance and Blueprint 2. Leads will supply data and proposals to support, concepts, capability development, and strategy, planning, programming, budgeting, and execution (SPPBE) process as determined by SPG; includes risk assessments and gaps 3. No change to process 4. No change to process
Programming	1. POM Preparation Instruction (PPI) 2. Program Guidance Memorandum (PGM) 3. POM 4. Programmatic Issue Paper responses	HAF collects and integrates lead command and agent data and product inputs to execute Planning, Programming, Budgeting and Execution (PPBE) in accordance with AFWIC Design Blueprint, Air Force Plan, and Office of the Secretary of Defense (OSD) guidance; collaborates with lead command and agent and AFWIC across capability programs for PPBE tasks
Budgeting	1. Budget Estimate Submission (BES) 2. Budget Issue Paper responses 3. President's Budget (PB) 4. Unfunded Priority List (UPL)	No significant changes to these processes. HAF integrates and finalizes PB; lead command and AFWIC support as required
Execution	1. MAJCOM Execution Plan 2. Initial distribution 3. Spring Program Review (SPR) and Fall Program Review (FPR) 4. Reprogramming requests	No significant changes to these processes. HAF provides resources and execution guidance; lead command and AFWIC adjust as required across capability programs

Overview of Approaches to Integration by the Other Services

To inform our recommendations to AFWIC, we drew on published reports and conducted interviews with current and former officials to shape an overview assessment of recent efforts by the Navy, Marine Corps, and Army to improve their own forcewide integration. The full review, including citations, can be found in Appendix D.

Informed by our overview of past Air Force efforts in Chapter 2 and the more-detailed history in Appendix B, we identified several desirable attributes of integration, such as a process

driven by clear and consistent guidance reflecting military and civilian leaders' strategy-based priorities; an independent, objective analytic culture that is able to envision alternative CONOPS and translate cross-domain, joint CONOPS risks and capability shortfalls into investment and divestment options; and a programming culture that is able to convert analytically derived options into a variety of resourcing trades (including major trades) that can be presented to leaders with nonadvocacy-based logic and explicit implications. These were the attributes we used to evaluate the ongoing force design integration efforts of the other services.

Although the Navy, Marine Corps, and Army have indicated a strong desire to achieve integration, their approaches differ, and the extent to which they achieve the attributes described above also differs. For example, the Navy planning process features strategic leadership direction on investment priorities up front via the Chief of Naval Operations guidance (CNOG), followed by a programming phase that is dominated by two-star resource sponsors and organized by platform. A potential integrating feature is the Navy's "kill chain/kill web" analysis, which aims to identify gaps in end-to-end CONOPS execution, including such enablers as communications and electronic warfare (Lawrence, 2018). Beyond a gap analysis, the process aims to analyze, generate, and approve major resourcing trade options to support the capabilities highlighted in the CNOG and the integration shortfalls identified in the kill chains and kill webs. In practice, success in bringing about an unbiased assessment of trade-offs among options is difficult, in part because of the outsized influence of the platform-organized resource sponsors relative to enabler, integration, and Congressional advocates. Navy integration also has suffered from contradictory visions of resource priorities between the Navy Secretary and the Chief of Naval Operations, including major differences in emphasis on shipbuilding versus current readiness or shipbuilding versus nonplatform capability modernization.

The Marine Corps places high importance on concept development—i.e., how they will fight in the future—as a driver of integration under the three-star direction of both Concept Development and Integration and Marine Corps Combat Development Command at Quantico, Virginia (U.S. Marine Corps, 2018a). The Marine Corps has a highly structured planning and resourcing process and an inherently integrated warfighting ethos (such as combined air and ground operations). This said, one key challenge the Marine Corps faces with its ground forces is determining an effective warfighting CONOPS for countering anti-access pacing threats after years of close combat in Iraq and Afghanistan and decades of emphasis on amphibious landings

in a relatively uncontested environment. In terms of resourcing, major integration trades in support of future capabilities might be difficult to effect within the Marine Corps' "green" budget,[10] given that roughly 50 percent of its total obligation authority (TOA) is allocated to military pay (compared with about 20 percent for the more–platform-centric Air Force and Navy). Note that direct, service-to-service comparisons are not possible because the procurement of Marine Corps aircraft and ships comes from Navy appropriations rather than Marine Corps funds. Also, the Marine Corps has been heavily emphasizing current readiness of ground forces for years.

The Army is trying to achieve more-integrated capabilities through the creation of a four-star modernization advocate leading the new Army Futures Command, headquartered in the technology-focused environment of Austin, Texas (U.S. Army, undated). This approach is attempting to tie together requirements, science and technology (S&T), and acquisition. Like the Marine Corps, the Army is engaged in transitioning from legacy CONOPS focused on close combat and uncontested airspace to warfighting approaches that will be effective against a pacing threat potentially capable of denying access to key battlespace areas. The Army Futures Command effort is too young to assess in terms of its accomplishments, but any effort to modernize and integrate the Army's capital stock has to contend with a long history of cultural and programmatic dominance of manpower (military pay constitutes about 35 percent of Army TOA), and more recently, current readiness.

Summary Assessment

The most-relevant products of other services' integration efforts appear to be the Navy's up-front guidance on strategy-based leadership priorities in the form of the CNOG, and, conceptually at least, the Navy's analytically derived "kill webs," which show a CONOPS-based, cross-domain view of capability shortfalls. It is possible that the Air Force would benefit from adapting and improving on some form of these products, especially the kill chains and kill webs. Although Army efforts in the form of a Futures Command are nascent, the focus on

[10] *Green* means the Marine Corps appropriations, as opposed to the Navy's *blue* appropriations. The nuance is that ships and aircraft are bought with blue—not green—dollars and appear in the Navy POM rather than the Marine Corps POM. This is sometimes referred to as "Blue in support of Green," in that the ships or aircraft are bought to support the sister service.

multidomain, joint command and control (C2) could be an important step toward better integration and more-effective CONOPS against a pacing threat. Although the Army, Navy, and Marine Corps processes have unique strengths and weaknesses, they share several impediments to achieving integration. These impediments include difficulties in devising and programmatically implementing a variety of cross-domain, joint capability–informed resource trades supported by logic that will be compelling to DoD leaders and legislators. Integration efforts also are affected by the services' resourcing cultures and their favored funding priorities. This manifests itself in a struggle to balance manpower and current readiness against modernization, and within modernization, to balance platform-centric and enabler capabilities.

4. Proposed AFWIC Analyses

To fulfill its mission, AFWIC will need to produce transparent and credible analyses of feasible and effective force design options. Effectiveness in this context means demonstrating convincingly that these options hold the potential to mitigate or otherwise overcome key operational problems that Joint Forces will confront, both now and ten to 20 years in the future. By considering different ways to accomplish tasks that might otherwise emerge from a stovepiped functional orientation, AFWIC can help the Air Force better shape its roles in joint warfighting strategies. AFWIC also needs to carry its analysis of integrated force design into the plan-to-program process to ensure that subsequent programming actions made by the broader Air Force functional communities are consistent with the larger design choices coming from AFWIC's analysis.

In this chapter, we draw from our review of the Air Force's experience with long-term planning (Chapter 2), a diagnosis of gaps in AFWIC's proposed approach (first half of Chapter 3), and the recent experiences of the other services (second half of Chapter 3). We begin with a definition of force structure and then present a roadmap to guide AFWIC's iterative flow of consultations, analyses, and touch points with senior leaders as it takes on a variety of operational problems. We use PNT and C4I as examples. Proposed product elements are then overlaid on the analytical steps in Chapter 5, each with a prescribed purpose of informing a decision and meeting the needs of intended audiences through technically sound and well-presented deliverables.

Defining the Concept of Force Structure

The force structure of the Air Force is made up of various parts, all working together to enable the Air Force to deliver air, space, and cyberspace capabilities in support of the joint fight. For illustrative purposes, we parse force structure into three categories—combat, enabling, and institutional—but we recognize that the categorization could be done in different ways and that not all of the missions assigned to the U.S. armed forces involve combat. For example, U.S. forces frequently are tasked with conducting humanitarian relief, partner training, strategic

reconnaissance, and a host of other activities in support of U.S. national security. In these cases, forces classified here as *enabling* and *institutional* often directly perform the assigned mission. The point is to emphasize that integration in AFWIC will need to account for the interdependencies among the various parts of the force structure in the course of force design, strategic planning, and capability development—before moving into the programming phase.

Combat Force Structure

Some of the force structure is built to perform a specific combat mission and deliver an effect (i.e., an intended outcome) required of the Air Force by combatant commanders. Examples of these missions could include suppressing enemy air defenses or providing close air support for ground forces. This part of the force structure could be called the *combat force*, and includes the weapon systems the Air Force uses to deliver combat effects (i.e., to destroy targets) in support of the combatant commander's war plan. Current force employment concepts, fighter and bomber aircraft, and remotely piloted aircraft armed with missiles are thought of as the primary elements of the combat force structure. Other parts of the combat force structure include the nuclear missile fleet, special operations forces aircraft and personnel, and some elements of the cyberspace force.[11]

Enabling Force Structure

Other parts of the force structure largely exist for the purpose of enabling the combat force structure to execute its mission. Examples of this part of the force might include C2 resources; airlift and aerial refueling forces needed to deploy the combat forces to forward locations; and intelligence, surveillance, and reconnaissance forces needed to identify targets and monitor the battlespace. Some of the enabling force components also are required by other services and their capacity is sized to support not just the USAF forces but also the level of capability the Air Force is expected to provide to the other services to enable execution of their missions (e.g., the Army requires strategic airlift to move forces to forward operating locations). These could be referred to as *enabling systems*. The following are examples of enabling systems:

- strategic and tactical airlift

[11] When the Air Force considers the cost of combat force structure, it includes the cost of the maintenance personnel and equipment, training systems, and other costs that are necessary for day-to-day operations.

- intelligence, surveillance, and reconnaissance (e.g., remotely piloted aircraft, satellite constellations)
- C2 (at the strategic, operational, and tactical levels)
- communications
- deployable base operating support systems (e.g., housekeeping sets, base buildup equipment, runway repair systems, air traffic control systems, base protection resources, fire and crash rescue systems)
- logistics and sustainment
- space satellite constellations (e.g., Global Positioning System [GPS], weather satellites).

Institutional Force Structure

Beyond combat force and enabling force components, there is a part of the force structure that is required to support the existence of the Air Force. Some of these components can be deployed to provide needed support to joint combat and enabling forces during contingencies (for example, finance, personnel, and contracting). This part of the force structure might be referred to as the *foundational* or *institutional component*. For example, personnel and equipment must operate from some location, hence the need for installations and all elements of installation support.

Some institutional parts of the force structure are associated with managing the business of the Air Force. Such parts could include acquisition management, research and development, accounting and financial management, information technology and business management systems, and headquarters functions. Other parts of the institutional component are tied to human capital, such as personnel, manpower, training, and education. Finally, there are several institutional functions associated with managing base installations and infrastructure, such as force protection, medical, fire protection, engineering, and facilities management.

A Proposed Analytical Roadmap for AFWIC

At any one time, AFWIC likely will be engaged in tackling several different operational problems with enterprisewide implications, some of which might take months or even years to grasp. Therefore, AFWIC will need to operate on its own "battle rhythm" apart from the POM process while seeking opportunities to advance the future force design through the POM process. Its analytical products will provide essential guidance to the myriad near-term POM decisions that will influence investments, modifications, and divestments in future weapons, enabling systems, and institutional practices for years to come.

To add value to long-term Air Force planning, AFWIC's leaders will need to be selective in their choice of problems, focusing on enterprisewide operational problems that would not or should not be addressed by individual MAJCOMs. Operational problems whose scopes are largely confined in a single MAJCOM can and should be dealt with at the MAJCOM level, Air Force planning guidance, and future CONOPS developed within AFWIC. In the longer term, as the debate on operational challenges stabilizes, AFWIC could engage in broader Air Force challenges that are faced by the institutional and enabling elements of the force structure.

AFWIC's focus is on developing future force design options to enable the Air Force to execute new CONOPS to meet national objectives. Unbound by a single or dominant functional orientation, as had been the case under the CFL approach to force design, design options could include some combination of new weapons platforms, modification of existing weapons platforms, changes in enabling systems (e.g., PNT and C4I), and changes in institutional policies. For example, if the Air Force considers options that rely more heavily on cyber and space capabilities to perform some combat missions, it might choose to reduce or eliminate some manned aircraft systems. Such reductions would have implications for basing strategies; more-robust and -resilient C4I; tankers, maintainers, and other enabling elements; and training priorities and other institutional elements of the force structure. Design choices could affect all aspects of the force structure. For example,

- for combat forces, design options could include stand-in or stand-off;[12] degree of autonomy; degree of network integration; position of person-in-the-loop (e.g., cockpit or ground flight control station); mix of kinetic and nonkinetic attack modes; and more low-cost, rapidly fieldable platforms versus fewer high-end platforms
- for enabling forces, design options could include organic versus commercial providers (e.g., GPS alternatives, strategic lift and aerial refueling alternatives), networked versus distributed systems, and artificial intelligence versus person-in-the-loop
- for institutional forces, design options might include the role of human performance or job aids, robotics, organic capability versus outsourcing for training and education or installation management, and environmental considerations.

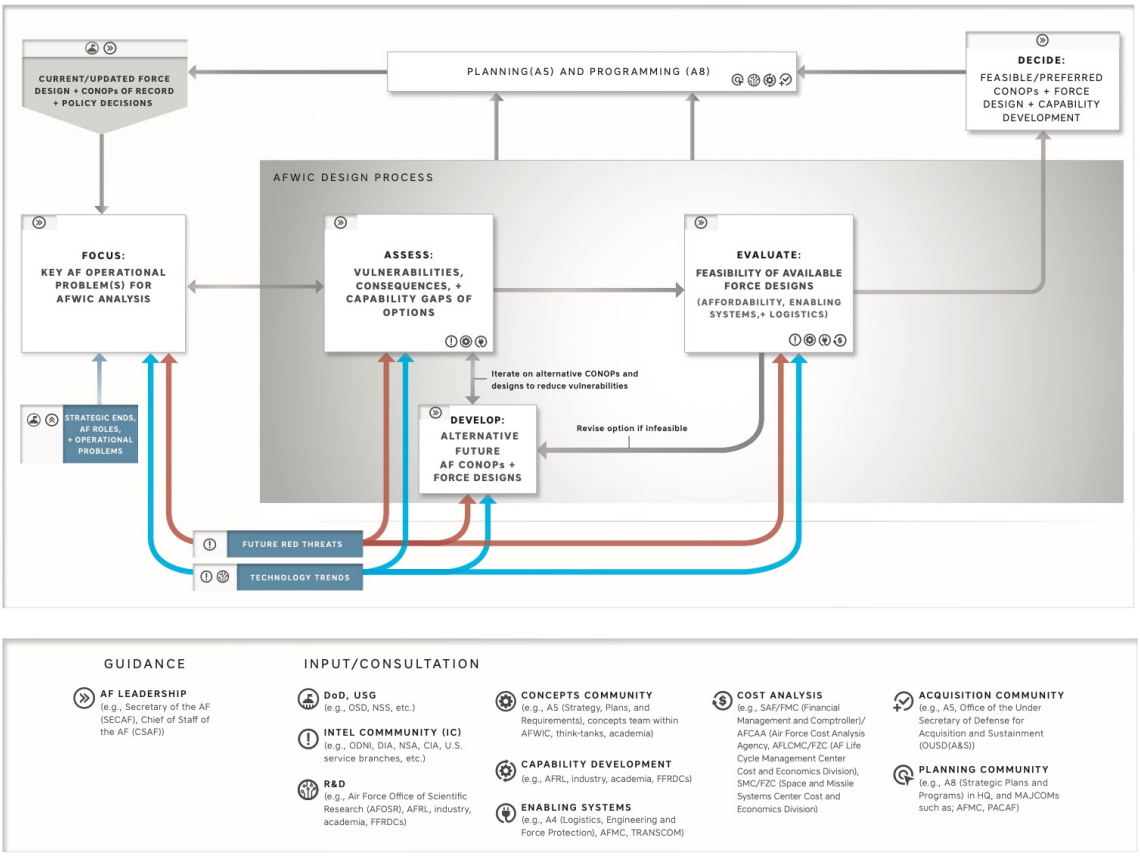
In practical terms, force design options will take the form of a portfolio of incremental changes from the status quo aimed at solving an operational problem or improving the efficiency or effectiveness of operations. (Even transformational change will need to be executed

[12] In a *stand-in CONOPS*, Blue forces engage using manned aircraft intended to penetrate an adversary's air defenses. In a *stand-off CONOPS*, Blue forces will maintain their assets outside the range of adversary fire and instead fight from a distance.

incrementally in the annual POM, budgeting, and appropriations processes.) Some of the changes can be executed immediately in programs of record. Other changes will require further research, development, testing, and prototyping. This could be the case even when the future CONOPS and accompanying preferred future force design represent a substantially new and different approach to warfare. Therefore, AFWIC will need to consider the temporal component of its option set and the budgetary and programmatic practicalities of moving the Air Force from its current force design to a substantially different design over time.

For both transparency and credibility, AFWIC's approach to analysis and its associated slate of products will need to extend beyond those outlined in its December 2018 briefing to CORONA (Design Concepts, Design Blueprint, and Capability Development Guidance), as summarized in Table 3.1 in Chapter 3. To motivate the need for this expansion in the context of the larger force development process, the PAF team developed a set of iterative—and, where necessary, recursive—steps in AFWIC's analyses of design options. These steps are summarized in Figure 4.1 and are provided in more detail and in a larger format as Figure E.1. Depending on the particular operational problem at hand, some of the steps might be skipped or results can be drawn from previous work.

Figure 4.1. Flow of AFWIC's Analyses to Guide Force Design



NOTES: AF = U.S. Air Force. AFMC = Air Force Materiel Command. AFRL = Air Force Research Laboratory. CIA = Central Intelligence Agency. DIA = Defense Intelligence Agency. FFRDC = federally funded research and development center. HQ = headquarters. NSA = National Security Agency. ODNI = Office of the Director of National Intelligence. PACAF = Pacific Air Forces. R&D = research and development. SAF/FMC = Secretary of the Air Force for Financial Management and Comptroller. TRANSCOM = U.S. Transportation Command. USG = U.S. government.

The process begins in the upper-left corner of Figure 4.1. Rectangular boxes represent analytical steps. The gray shaded area represents the core of the AFWIC design process. Boxes and arrows outside the gray area represent processes external to AFWIC, some of which constitute inputs to AFWIC and others represent target decisions that AFWIC's analysis will inform. Double-headed arrows represent an iterative process of consultation until the relevant parties are satisfied with the product at that particular step and are ready to move on. The red, blue, and gray arrows represent, respectively, vital inputs on future Red threats, technology trends, and national strategic guidance from sources outside AFWIC that are shaped to meet AFWIC's own need to set the context of its analysis of alternative CONOPS and force designs.

The key decisions with respect to force design, planning, and programming are made outside AFWIC and are depicted in the top row of Figure 4.1. However, AFWIC's analytic activity (depicted in the center gray box of Figure 4.1) is a critical part of this process, and AFWIC or AFWIC-enabled product elements will provide crucial information and guidance at every step. A product element could be a stand-alone deliverable or part of a larger deliverable, as we describe in Chapter 5. In that chapter, we provide details about the other organizations that will need to provide inputs to key AFWIC actions and product elements. The AFWIC analytic process is a continuous, iterative cycle, with information flowing in various directions to inform multiple steps.

Any iteration would begin with the current or planned force, CONOPS of record, and policy decisions, as indicated by the upper-left box. Next, multiple individuals and organizations, including the OSD, Joint Chiefs of Staff, SECAF, CSAF, and AFWIC would focus their attention on problems that require analysis (see the box titled "Focus" on the left of the middle row in Figure 4.1). This process would be informed by awareness of future threats, technology trends that could help address those threats, and Air Force warfighting capabilities and strategic ends. These inputs are the result of the work of many organizations. However, as suggested by the blue boxes on the bottom row, AFWIC is well positioned to synthesize these insights from industry, academia, AFRL, non-DoD research organizations, and other experts and communicate them to senior leadership.

The Focus step would result in a documented framing of the problem: a clear statement of the operational problem in the context of the strategic direction set by DoD leadership and the roles that the Air Force will play. Problem framing includes assumptions and premises, some of which could come from senior leadership or from the AFWIC team, and a roadmap for analysis. Each element of the problem framing should be justified, documented, and revisited over the course of the analysis. AFWIC will be a key contributor to this product because it will be the point of departure for AFWIC's analysis.

Next, AFWIC would begin its primary task—to design future force options to address the identified problems. This task involves three main activities, shown in the middle grey box: (1) assess vulnerabilities under various scenarios and identify gaps in current or potential force designs, (2) develop potential CONOPS and force designs to fill those gaps, and (3) evaluate the cost and feasibility of those solutions. Each of these activities is informed by AFWIC's synthesis

of future threats and technology trends. As indicated by the arrows, these steps are iterative and mutually informative and incorporate inputs from other communities, which we describe further in Chapter 5. The result of AFWIC's analysis is a set of force design options to be presented to senior leadership. The strength and quality of this analysis of options and trades will be the most-visible sign of AFWIC's impact on decisionmaking.

AFWIC's role does not end there: AFWIC's expertise and enterprisewide perspective make it uniquely suited to help document decisions, provide guidance for planning and programming, and communicate future force designs at a high level, as represented by the boxes in the top row of Figure 4.1. For example, AFWIC will lend support to the development of PPG by A5, A8, and other components and to the creation of capability development guidance led by the CDC. Ultimately, this process would result in a new status quo force, which is the point of departure for continued thought about emerging problems.

MAJCOMs will continue to manage requirements specific to their remit. The role of AFWIC is to consider CONOPS and future requirements that cut across MAJCOM functions. AFWIC also should seek solutions to future problems that might be addressed in one way by one MAJCOM, but in the future might need to be done in a very different way that requires participation outside that MAJCOM. We describe Air Force CONOPS in Chapters 4 and 5 as wholly within the context of joint CONOPS. That is, the Air Force roles derive from joint warfighting strategies.

In the following sections, we explain the steps, inputs, and processes in more detail, using PNT and C4I as examples to further illustrate the analysis. In Chapter 5, we describe the product elements in more detail.

Foundational Inputs to the AFWIC Design Process

An AFWIC team will need to first establish a strong base of strategic guidance, threat assessments, and technology assessments before it can launch into its problem framing and analytical processes. AFWIC team members will need to seek and synthesize this information from others.

Strategic Ends, Challenges, and Air Force Roles

The future force design process needs to be grounded in national-level strategic guidance, and a consensus between Joint Force and Air Force leadership on the roles of the Air Force in the context of a particular operational problem. Clarity of Air Force roles is foundational to all that follows in AFWIC's analysis. By *roles*, we mean the full variety of Air Force activities that support national and combatant commander needs. Reaching agreement on Air Force roles is a nontrivial exercise and will require considerable deliberation among leadership to achieve. It is not our aim in this report to define these roles, but examples might include supporting global and regional stability, empowering indigenous forces, empowering nonmilitary instruments of power, cooperating with allies, communicating with competitors, and preparing for joint operations.

As examples of the kinds of challenges the design process will face, consider contingencies involving Russia and China, which are two different challenges requiring different approaches because of U.S. force posture, distinct alliance structures (with attendant variations in allied capabilities and interoperability), and varying levels of effort in the physical domains. The CONOPS for defeating aggression by each of these powers in a major conflict could have similarities, but also will have important distinguishing characteristics.

Potential contingencies with China will see a predominance of operations in the air and maritime domains, combined with space and cyberspace. The distances to be spanned in the conduct of operations are large and success would rely on the ability to project power from bases in allied territory in addition to U.S. territory and from such platforms as carrier strike groups. The United States has several important bilateral relationships, but there is no superstructure to integrate the efforts of multiple allies. As a growing economic, military, and political power, China has made significant advances in operational capability and increased its influence with countries in the region.

Potential Russia contingencies likely will focus more on land-centric operations integrated with air, space, and cyberspace. A significant difference from the Indo-Pacific theater is that the NATO alliance brings together not only the military capacity of 29 members but also a mature C2 structure, advanced interoperability (including in platforms and communications), and methods for sharing intelligence. The European theater provides broader options for basing and

supporting operations.[13] The United States and its NATO allies also have experience from Iraq, Afghanistan, and other operations in integrating non-NATO partner countries.

Future Red Threats

AFWIC will need to make specific requests to representatives of the intelligence and operational communities to build its own situational awareness of the variety of future Red threats and their relevance to the operational problem at hand. Compartmentalized information across the intelligence agencies and the services will make this front-end piece challenging for the AFWIC team, but the relevance of AFWIC's design options will hinge on its success in grasping the trends and nuances in the character of the threat environment across a variety of adversaries.

Authoritative intelligence, however, is restricted to what the Intelligence Community (IC) can observe and assess with some confidence at any juncture in time. This characteristic of authoritative intelligence restricts the assessments of intelligence products to a certain time horizon. That horizon is generally much shorter than the life span of a weapon system. To augment authoritative intelligence, AFWIC will need to reach out to organizations that can provide information on technological trends to anticipate threats that are not yet observed by intelligence collection.[14]

Taking this deeper view of threat assessments will require AFWIC to both seek assessments of authoritative intelligence from the IC and solicit assessments of emerging threats based on technology trends. These types of analysis can be provided by such organizations as the AFRL and by reaching out to FFRDCs and university-affiliated research centers (UARCs). By augmenting assessments from the IC, AFWIC can make more-informed decisions relating to the ability of technologies to meet threats in the future, particularly in areas that evolve rapidly, such as cyber operations.

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[13] For illustrative alternative basing options, see Lostumbo et al., 2013, Chapter 9.

[14] Sometimes called *physics-based threat assessments*, these assessments should extend beyond physics to include technology-based threat assessments, which would include threats from such vectors as cyberspace operations.

Technology Trends

AFWIC's Innovative Solutions Directorate, which is described in the AFWIC CONOPS in Appendix A, is leading in gathering information from industry, academia, research organizations, and other organizations on existing, emergent, and prospective technologies with a focus on the particular operational problem at hand. AFWIC will need to be adept and efficient in identifying knowledgeable and forthcoming sources and discerning and critical in its assessment of the potential viability of newly emerging technologies from both Red and Blue perspectives. The AFWIC team will need considerable help from others at this stage. A well-designed consultation process will be critical.

Again, using PNT and C4I as examples, AFWIC will need to interface with the acquisition community, industry, and the S&T community to assess these future technology trends. The acquisition community (e.g., Secretary of the Air Force for Acquisitions [SAF/AQ], Space and Missiles Systems Center [SMC], Air Force Life Cycle Management Center [AFLCMC]) and industry (the traditional defense industrial base and other potential industry partners) will need to provide AFWIC with information about the current state of technology, acquisition and modernization programs, and capability development. The S&T community will need to provide information about the state and potential of future technologies in both prototyping and experimentation and R&D. Organizations involved in prototyping and experimentation (e.g., Rapid Capabilities Offices, Defense Innovation Units [DIUs], AFWERX [see USAF, undated], Strategic Development Planning and Experimentation [SDPE], Air Force Operational Test and Evaluation Center [AFOTEC]) can provide assessments of the most-promising technologies in the near-to-medium term. The R&D organizations (e.g., AFRL, Air Force Office of Scientific Research [AFOSR], Defense Advanced Research Projects Agency [DARPA], FFRDCs, academia) can provide a broader assessment of potential technologies in the medium-to-long term.

The Role of Air Force Leadership

Our review of past efforts by the Air Force to institute a durable top-down future force design process, which we summarize in Chapter 2 and detail in Appendix B, clearly shows the critical role that Air Force senior leadership plays. This role takes several forms. First, the planning organization—in this case, AFWIC—needs to know that senior leaders are behind the

AFWIC team's approach to problem framing and analysis and that the team's efforts could lead to unpopular choices regarding new approaches to warfighting, along with a corresponding divestment in legacy programs. "Top cover" is essential to AFWIC's effectiveness. This comes in the form of support from the CSAF and SECAF and also from the relationship between AFWIC's leadership and three- and four-star leaders throughout the Air Force. To this point, as of this writing, AFWIC is led by a two-star general, which could prove insufficient when major changes in priorities are in play. Second, having the current CSAF behind AFWIC is necessary but not sufficient for AFWIC's success. Air Force components would benefit from some assurance that the next CSAF likely would be supportive of AFWIC's mission and role in shaping Air Force options for investment and divestment. Finally, AFWIC's leader needs to carry sufficient authority among their peers to gain buy-in to AFWIC's approach to options analysis and support for the choice set that emerges from the design process. Anything less will undermine AFWIC's value and the ability of the Air Force to make a convincing case for change to DoD leadership and key leaders in Congress.

The actual frequency of meetings between AFWIC's leadership and the CSAF, whether at CORONAs or other senior leadership events, is less important than the understanding across the Air Force enterprise that the roles of senior leadership noted above are securely in place and fully functional. In the following sections, we note where specific "touches" might be most helpful in conferring authority to AFWIC on its path toward the development of effective and feasible options for future force design.

The Role of AFWIC's Consultation Processes

Acquiring the foundational inputs described earlier will require that AFWIC be staffed appropriately and be committed to establishing strong working relationships with a wide variety of organizations and individuals who possess information vital to AFWIC's pursuit of viable future force design options and capability development priorities. We do not mean to suggest that AFWIC should be doing all of this outreach to different sources of information and analysis and integrating it in a sequential manner. The "concept action group" idea (Kent and Thaler, 1993) suggests an interdisciplinary group centered on an operational problem that brings these sources (e.g., operators, intel analysts, technologists) together to provide information in an

interactive way. AFWIC could pull such a group together from sources within its own ranks and from elsewhere in the Air Force, DoD, and other organizations.

Other consultations will be needed throughout the analytical process for AFWIC to properly execute its integrative functions, as summarized in Table 4.1. For any given tasking, AFWIC likely will need to consult with only a subset of those mentioned in the table. Consultations will be needed with cost analysts who will help the AFWIC team in its consideration of the full costs of operating an alternative force structure with its attendant enabling systems and institutional requirements and constraints. Consultations with the planners in AF/A5 and the programmers in AF/A8 also will be essential in helping the AFWIC team ground its comparative analysis in the realities of the existing force structure and the feasibility of transitioning production lines and supporting systems over time.

Perhaps most important to its sustainability, AFWIC should use the consultation process to cultivate a larger sense of ownership for its work within the Air Force. The failure to seek such buy-in was frequently cited as a reason for the failure of past integrated planning efforts, as we discuss in Chapter 2 and Appendix B. Consultations will need to be an ongoing element of AFWIC's operations, as opposed to an episodic or one-off approach that would make relationship building among critical partners difficult. Establishing these interactions will prevent AFWIC from becoming too insular and Air Force–centric in its thinking about Air Force roles and added value to joint operations.

Using C4I as an example, each of the MAJCOMs in the Air Force will have perspectives that should inform the analysis. Air Force Global Strike Command (AFGSC), for example, will take a global perspective on the needs in both its nuclear and conventional missions to draw on effective C2, communications, and intelligence support. Air Combat Command also has global responsibilities across all operational theaters, whereas PACAF and U.S. Air Forces in Europe (USAFE) and Africa will bring the regional perspective, which is an important point of comparison on the relative demands of different theaters of operation. However, the scope of stakeholders in C4I also needs to include those who understand threats to C4I (e.g., National Air and Space Intelligence Center [NASIC] and other parts of the IC), emerging technology and research needs (AFRL and other parts of the S&T community), and representatives from the other services to ensure a joint perspective. The Air Force also will need to account for the potential impact of its analysis and decisions on allies, given that programs, standards, and

technology are shared to improve interoperability, such as the Multifunctional Information Distribution System Joint Tactical Radio System (MIDS-JTRS) used by NATO.

Table 4.1. AFWIC's Key Partners for Consultations

Community	Examples of Representative Organizations
DoD, USG	OSD
Intelligence	ODNI, CIA, DIA, NSA, NASIC, U.S. service branches
R&D	AFRL, AFOSR, DARPA, FFRDCs, UARCs, academia, industry
Concepts	AF/A5, JS/J5, JS/J7, COCOMs, C-MAJCOMs, concept teams within AFWIC, think tanks
Capability development	AFRL, SDPE, AFOTEC, AFWERX, DIUs, FFRDCs, industry
Net assessment	AF/A5SW, AF/A9, OSD/ONA, OSD Policy, N-81, CAA, JS/J8, FFRDCs, COCOMs, think tanks
Enabling systems	AF/A2, AF/A4, SAF/CIO, AFMC, AMC, AFSPC
Cost analysis	SAF/FMC, AFCAA, AFLCMC/FZC, SMC/FZC, CAPE
Acquisition	SAF/AQ, AFLCMC, SMC
Planning	AF/A5; MAJCOMs such as ACC, AFGSC, AMC, AFSPC, PACAF, and USAFE; JS/J5, COCOMs

NOTES: ACC = Air Combat Command. AF/A2 = Air Force Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations. AF/A4 = Air Force Logistics, Engineering, and Force Protection. AF/A9 = Air Force Studies, Analysis and Assessments. AFCAA = Air Force Cost Analysis Agency. AFLCMC/FZC = Air Force Life Cycle Management Center Cost and Economics Division. AFSPC = Air Force Space Command. AMC = Air Mobility Command. CAA = combat aviation advisor. CAPE = Cost Assessment and Program Evaluation. C-MAJCOM = component major command. COCOM = combatant command. JS/J5 = Joint Staff Director for Strategy, Plans, and Policy. JS/J7 = Joint Staff Director for Joint Force Development. JS/J8 = Joint Staff Director for Force Structure, Resources, and Assessment. N81 = Office of the Chief of Naval Operations Assessment Division. ONA = Office of Net Assessment. SAF/CIO = Assistant Secretary of the Air Force for Information Dominance and Chief Information Officer. SMC/FZC = Space and Missile Systems Center Cost and Economics Division.

In sum, AFWIC's job is to be an integrator. It cannot do that job without actively engaging with the relevant units where specific expertise resides. AFWIC is not replacing these other organizations but instead is complementing them by bringing an enterprisewide perspective through consultation. AFWIC will be ineffective if it attempts to operate in a bubble.

Analytical Steps to Support the Development of Future Force Design Options

For each operational problem AFWIC tackles, it will need to refine and frame the problem statement itself, map out a series of consultations with experts outside AFWIC to acquire information essential to its task, and devise a studies and analysis plan that will lead to a presentation of options to put before the CSAF and other senior leaders. In this section, we

describe each of these steps in general terms to provide the flavor of AFWIC's analytical tasks, the value of an interdisciplinary concept action group (Kent and Thaler, 1993) and the consultations required along the way, and the necessarily iterative and recursive nature of the process of developing and analyzing options for their effectiveness and feasibility. AFWIC also can draw on the experience of such organizations as Bell Labs (Gertner, 2013) and RAND (Light, 2005), which emphasize the importance of cultivating organizational cultures that thrive on interdisciplinarity and the free flow of ideas and critique.

Starting Point of Current CONOPS and Force Design of Record

AFWIC's design process begins with the force as it is: combat, enabling, and institutional systems that constitute the programs of record and that both operationalize and constrain the current CONOPS. In addition to the hardware and prevailing CONOPS, AFWIC will conduct its work in the context of DoD and Air Force institutional priorities, policies, and statutory requirements. AFWIC should make these factors explicit in the course of its analysis of options. Ultimately, some of these factors might be binding constraints that would require significant effort to change (e.g., treaty requirements) or have external dependencies that the Air Force can influence but not overcome easily (e.g., industrial base issues). To the extent that a change in those policies and practices could lead to more-effective or less costly options, AFWIC's analysis should address those issues explicitly.

Selection of Key Operational Problems and Problem Framing

The CSAF and other senior leaders might direct a specific problem to AFWIC for its attention. A specific problem also might be defined in key documents or come from an Air Force–sponsored wargame or an expression of interest from Congress. Either way, AFWIC's team will need to take what is likely to be a somewhat general directive and frame a more-precise problem statement that will be amenable to analysis. As described in Leftwich et al., 2019, one of the most-critical steps in problem framing is to create a clear statement of objectives and a discrete set of performance metrics that capture the most-important dimensions of each objective. These objectives are informed by the threat and technology assessments described previously.

An example of a strategic objective for PNT capability development in the context of a stand-in CONOPS is "The Air Force will maintain robust and resilient PNT capabilities in contested, degraded, and operationally limited environments." For attack, that might mean the ability to find, fix, track, and target without the use of GPS. For air refueling, that might mean the ability to navigate and rendezvous when the electromagnetic spectrum is contested. Robustness and resiliency are operational performance metrics and should be defined explicitly. In this case, *robustness* could be defined as "the ability to maintain PNT capabilities with integrity adequate for the mission (i.e., accuracy and precision) and with sufficiently continuous availability (i.e., geographic and temporal) while under adverse conditions." *Resiliency* could be defined as "the ability to recover PNT capabilities during or after adverse conditions through adaptability (e.g., flexible, self-healing, or redundant/complimentary PNT systems)." The operational performance metrics also incorporate the technical performance metrics: accuracy and precision, geographic and temporal availability, and adaptability, each of which must include minimum requirements for acceptable performance.

The example of C4I illustrates the pitfall of defining a solution instead of framing a problem. Measuring the performance of C4I needs to be tied to the operational outcomes it is intended to support. For example, communication networks should be evaluated on resiliency and *survivability*, the ability to continue operating through an attack. However, federated network and information ecosystems identify potential ways to achieve resiliency and survivability but are not performance metrics themselves. Instead, communications performance metrics could include the rate and volume of data exchange among tactical platforms based on the assessed requirements, the distance and latency of communications in a denied or semipermissive environment, and error rates. The minimum and desired requirements for these performance metrics might vary depending on the mission, context, and criticality of accomplishing a task. For C2, performance metrics could include the quality of data provided for decisionmaking, number of nodes required to support decisionmaking, and desired span of control.

Another critical step is the identification of elements of the problem that are uncertain, which, in the context of force design, is a very large set. Uncertainties relate to adversaries, theaters of operations, Red and Blue capabilities, rates of technological progress, acquisition process timelines, and a host of other factors that can influence the effectiveness of the current or

future force. Essential to AFWIC's problem framing will be its skill in enumerating uncertainties and distinguishing between those outside the control of the Air Force and those in the control of the Air Force. This step also will help AFWIC identify key design attributes that will vary across options and that can be analyzed for their effectiveness and feasibility.

Finally, this is the stage in the process where AFWIC's conceptualizers and analysts should develop their roadmap for analysis, including the type of wargaming that might inform the development of options, mathematical modeling tools, experimentation campaigns, and other processes for acquiring data and insights into the relative performance and feasibility of alternative force designs.

Examples from Prior RAND Work

Ochmanek et al., 2017, provides a good example of the level of analysis envisioned for framing as we describe in this section. Also, for an example of an application of Kent's strategies-to-tasks framework (Thaler, 1993; Kent et al., 2008), see Snyder et al., 2019. Ochmanek (2018) offers additional insights into force design issues for DoD more broadly.

Alternative Future Air Force CONOPS and Associated Force Designs

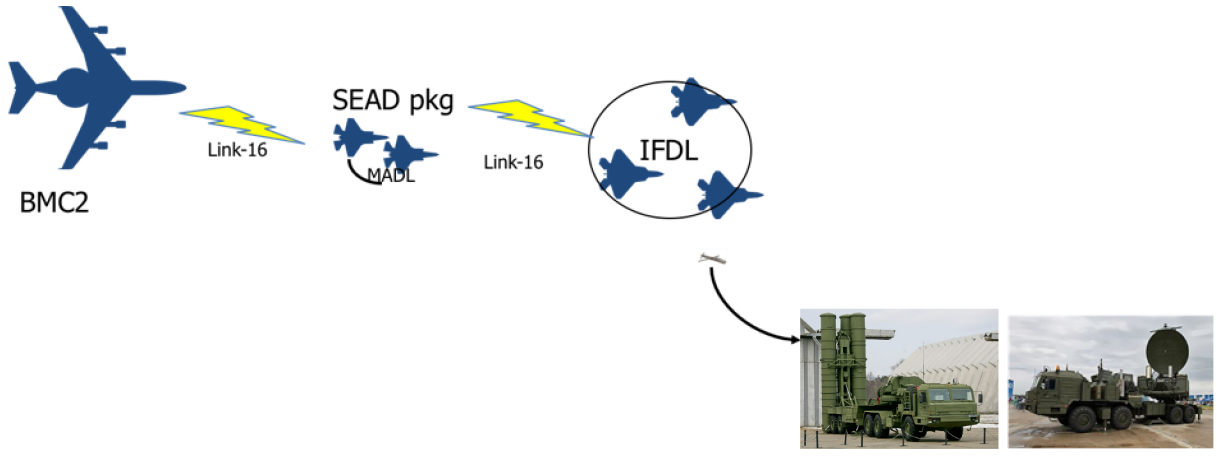
Existing Joint Force operational plans embody roles of the Air Force and assumptions about the ability of the Air Force to deliver effects to combatant commanders. The adequacy of the Air Force's contributions is contingent on its current force design and strength levels but also is critically dependent on the viability of the CONOPS by which the Air Force functions as part of the Joint Force. It is worth noting that the Air Force operates not only with other services but also in unified actions with multinational organizations (e.g., NATO) and with indigenous forces. As the threat environment and technology landscape change for both Red and Blue forces, improved or new CONOPS must be developed to ensure that Blue's objectives can be achieved in the future.

The process of conceptualizing new and innovative CONOPS is a vital function of AFWIC and should be a magnet for independent and creative thinkers in the Air Force to come together without prejudice toward any weapon system, component of the organization, or functional area. As we emphasize throughout this report, this conceptualizing should not be done in a vacuum only to be thrust upon Air Force senior leadership, but rather should be done with the continuous interaction of senior leaders with AFWIC. Making use of the Kent and Thaler, 1993, concept

action group idea, concept development should be undertaken with an open mind toward tackling operational problems in ways that take full account of Blue's competitive technological and other advantages and exploit Red's weaknesses in both technology and CONOPS. Drawing from the different elements of the force structure described earlier in this chapter, alternative force designs arise in the course of developing and refining alternative CONOPS. This process could occur in the context of wargaming or mathematical modeling and simulations.

Using C4I as an example, we consider a mission-level analysis for the suppression of enemy air defenses (SEAD). Figure 4.2 shows a simple illustration of a SEAD CONOPS against advanced Russian integrated air defense systems (IADS). The sophistication of the IADS calls for the use of advanced 5th-generation aircraft. This CONOPS relies on a relatively self-contained package in which advanced aircraft, such as the F-35, can serve as both sensor and shooter or communicate to the F-22 to drop a small-diameter bomb on the targeted Russian IADS. The aircraft also might need to communicate with a battle management platform for additional fires or to confirm that it has engaged the target. The F-22s are able to communicate in a closed loop through the in-flight data link (IFDL) but would need to use Link-16 to receive data from the F-35s. From 2020 on, the F-22s will have to use MIDS-JTRS terminals to transmit and receive those data (see Zazulia, 2018).

Figure 4.2. Notional SEAD CONOPS



SOURCE: The first photo is from Wikimedia Commons. The second photo is of the Russian Krasukha-2 electronic warfare system and is from Wikimedia Commons/Vitaly V. Kuzmin.
NOTES: BMC2 = battle management command and control. MADL = multifunction advanced data link.

An alternative CONOPS that relies on air-ground integration—with the F-35 serving as the sensor and communicating targeting data through a BMC2 platform to ground fires units—will need to use Link-16 to communicate to ground units for the foreseeable future. Evaluating this CONOPS must account for distance; adversary jamming capabilities; and the timelines required to identify, track, and target the IADS. This is just one mission in one operational context. A thorough analysis of C4I would require the examination of multiple missions in various operational contexts to understand the ramifications of various force design choices and the implications of making changes to the current approach.

C4I system options will both shape and be driven by the overall design choices that the Air Force develops. The current Air Force infrastructure relies on relatively short-distance, relayed communications; integrated and centralized planning of operations in an Air Operations Center (AOC); and large-scale collection, processing, exploitation, and dissemination (PED) of intelligence. Alternative force design options could have broad and large-scale implications for Air Force C4I systems. The attributes of C4I that likely will drive alternative designs and options are

- **the degree of centralization in C2:** The AOC construct has served the Air Force well in multiple conflicts over the past three decades, providing the backbone for planning and overseeing the execution of large-scale air operations and more-recent integration of space and cyberspace operations.
- **the deployment of autonomous systems:** The development of more-autonomous or semiautonomous systems[15] will drive potentially greater needs for data exchange at the tactical edge, where multiple platforms will need to share data and analysis in real time while communicating to rear-echelon planning cells. More-autonomous systems might be able to process more data at higher rates than when humans are in the loop, but also might have to coordinate their maneuvers more tightly in complex environments.
- **data transmission requirements:** The amount and type of data[16] that need to be communicated, including between which platforms and at what rate, maximum latency, and distance.

Table 4.2 represents a notional menu of options for modified or new approaches to C4I that is not mutually exclusive in every case. Although the options are organized by communications, C2, and intelligence, they could be combined and integrated to achieve varying degrees of control, autonomy, and bandwidth. Options across the three columns could contribute

[15] We use the definitions for *autonomous* and *semiautonomous weapon systems* in DoD Directive 3000.09, 2017.

[16] We include voice and video in a broad definition of data.

to addressing operational and tactical challenges, such as creating multidomain effects in communications-degraded environments, but also could introduce new challenges. Each of the options in the table would need to be analyzed for its implications on existing and proposed new systems. For example, increasing air-to-ground communications links and bandwidth could have implications for C2 and battle management, e.g., whether the air component has operational or tactical control of the ground units or vice versa or whether PED is carried out from a centralized or a more decentralized point.

Table 4.2. Notional C4I Options

Communications	C2	Intelligence
4th- and 5th-generation communications compatibility	Centralized C2 (multidomain AOC)	Centralized PED
Air-to-ground communications	Multinodal, decentralized C2	Decentralized PED
AEHF SATCOM	Multidomain planning tools	Hybrid PED
Deployable mesh networks	Autonomous targeting system	

NOTES: This table is for illustrative purposes only; it is not exhaustive. AEHF SATCOM = Advanced Extremely High-Frequency Satellite Communications.

Examples from Prior RAND Work

Kent and Ochmanek, 2003, and Lingel et al., 2008, present good examples of this type of analysis.

Scenario Analysis, Force Assessment, and Identification of Gaps

A challenge of developing and exploring the consequences of new CONOPS and the force designs that would be required to operationalize them is that Blue is likely to face more than one adversary. Blue forces will need to be more robust and resilient to changing conditions in the threat environment than they appear to be at present. This step of AFWIC's analysis thus requires careful thinking about the scenarios in which to assess the vulnerabilities of current and potential future forces operating under current and future CONOPS (Davis, 2012; Lempert et al., 2016). It is not enough to restrict analysis to a small number of defense planning scenarios that might not stress alternative designs to reveal fundamental weaknesses. In fact, the most-stressing scenarios might not be the most likely. AFWIC should assess whether potential future force

designs and CONOPS leave the Air Force vulnerable to failure in any scenario spanning the full variety of roles and plausible contingencies.

Once an approach to scenarios is established, AFWIC will need to employ simulation methods to conduct a progression of force planning assessments. It most likely would do so by collaborating with AFRL and other organizations with relevant expertise and through mathematical models, wargaming, experiments, or some combination of those elements. The usual approach to force planning is to compare the implications of new CONOPS and capabilities with the programmed force at the end of the FYDP. In some cases, AFWIC might need to extend its analysis to the next FYDP. This analysis should reveal the consequences of not making changes—whether incremental or more fundamental—in the current force structure and ensure a common understanding and diagnosis within AFWIC and the Air Force of the sources and factors contributing to current vulnerabilities. This analysis also could include an exercise where existing capabilities are taken away and operational planners are asked what they would need to work around the loss. From this point forward, AFWIC's design process becomes iterative in shaping alternative concepts, refining the elements of a future force that would be required to actualize the CONOPS, and assessing their effectiveness against a variety of adversary CONOPS. After each round of analysis, the AFWIC team would adjust concepts or force designs to improve performance. This "learning loop" process would continue until several future CONOPS and force design options emerged that passed some threshold measures of effectiveness. In sum, AFWIC should be considering viable and promising CONOPS and then, through the scenario analysis and force assessment process, connecting the dots to the broad features of force structures that are necessary to execute those CONOPS successfully. AFWIC's analytic goal is a set of feasible force structure options that will enable execution of new CONOPS.

C4I Example

Using the example of C4I, vulnerabilities in communications manifest themselves at all levels of warfare. At the tactical level, challenges include the ability to communicate in jammed environments securely and reliably. These challenges entail the ability to share data between aircraft or among units across multiple domains and the ability to find ways to reduce the

adversary's ability to accurately target U.S. forces.[17] Adversary jamming systems are increasing in power, field of view, and the ability to jam in multiple frequencies. The United States has used various techniques to overcome these effects, such as increasing transmission power, which is limited for aircraft and other platforms; developing new waveforms; using frequency hopping; and employing directional antennas. However, each of these approaches provides a limited window of advantage as adversaries develop and field new systems.

The current C4I systems design serves the Air Force well in most operational contexts, but the high-end fight presents significant challenges. The AOC construct and the AOC Weapon System provide the platform for planning and conducting integrated air, space, and cyberspace operations in preplanned and dynamic operations (DoD, Director, Operational Test and Evaluation, 2018). The AOC Weapon System is scalable but has not been used in a high-velocity fight against a near-peer. Add to that emerging demands for integrating more multidomain effects and the sense is that the Air Force will need to develop more-adaptable, resilient systems to provide the necessary C2 (Clark, 2017). The Air Force has explored multiple options for distributed operational C2, integrating such new technologies as artificial intelligence–assisted planning and execution and developing new career paths for multidomain operational planners (USAF, 2017).

PNT Example

A comparison of design options could take various forms but fundamentally depends on a strong analytical foundation. Table 4.3 illustrates a notional scoring of exemplar design options for PNT based on the performance metrics defined in the section on problem framing and the strategic objective for PNT earlier in this chapter. Example PNT design options include new tactics, techniques, and procedures (TTPs) for GPS-denied environments; a modernized GPS enterprise; theater airborne GPS networks; weapon system–level precision inertial navigation systems (INSs) and atomic clocks (ACs); and standardized weapon system–level PNT interfaces. A qualitative assessment of these PNT design options illustrates the extent to which each design option could add to the robustness and resiliency of PNT capabilities under both stand-in and stand-off CONOPS. The design options are scored according to whether they partially (◑) or

[17] Link-16, for example, has a radio-frequency signature that makes it susceptible to adversary targeting (Keller, 2016).

completely (●) fulfill the minimum requirements for the performance metrics and enable operations at stand-in and stand-off.

Table 4.3. Notional Performance of PNT Design Options

	Stand-In CONOPS			Stand-Off CONOPS		
Design Option	**Integrity**	**Availability**	**Adaptability**	**Integrity**	**Availability**	**Adaptability**
New TTPs		◑	◑		◑	◑
Modernized GPS enterprise	◑	◑		●	●	
Airborne GPS networks	●	●				
			◑			
Precision INSs and ACs	●	●		●	●	
			◑			◑
Standardized interfaces	●	●	●	●	●	●

NOTES: This table is for illustrative purposes only. ◑ = partially enables CONOPS. ● = completely enables CONOPS.

Examples from Prior RAND Work

Gentile et al., 2019; Boston et al., 2018; Martin et al., 2019; Heginbotham et al., 2015; and Hagen, 2010, offer examples of analyses envisioned in this section. Demonstrating effectiveness will be necessary—but not sufficient—for AFWIC to fulfill its mission. It also must establish with some degree of credibility, if not detail, that these effective options also are feasible. That is the next step of the analytical process.

Feasibility Analysis: Affordability, Flexibility, Adaptability, Robustness, and Other Implications

As shown in our summary of the Air Force's history of long-term planning efforts in Appendix B, the credibility of new CONOPS and visionary ideas about the future of warfighting can be damaged irreparably by inadequate attention to the feasibility of those ideas and their cost implications. Hence, the aim of this step is to identify potential solutions that are affordable and implementable at different points in the future, and which could fill a capability gap pending the

development of more-innovative approaches. The choices might be separated at the highest level as either investments or divestments. Investments in new capabilities would be justified because of new technological opportunities for Blue that exploit Blue's strengths and/or Red's weaknesses; force Red to reallocate resources (e.g., from offense to defense); or counter Red's technologies, CONOPS, or intent. Divestment in legacy capabilities could be justified on several grounds; for example, when technological obsolescence renders the weapon system sufficiently unfit for the purpose, higher priorities prevail (e.g., shift from nuclear to conventional forces after the Cold War), or when the sustainment costs of legacy systems are higher relative to comparable new capabilities.

What we call *feasibility analysis* can be viewed as a bundle of analyses that AFWIC will need to conduct on each potential option that emerges from its evaluation of effectiveness under a variety of possible warfighting scenarios. These analyses include affordability, the practicalities of the logistics required to execute the alternative CONOPS, and other implications that might relate to Air Force or DoD policies with the potential to constrain or prohibit execution of the CONOPS or implementation of the force design. These are discussed in more detail in the next sections.

Affordability of Future Force Structure Options

When thinking about force structure trade-offs and cost implications, the calculus must consider the cost of the combat system and the associated costs of enabling and institutional capabilities that are necessary to use the combat system. Decisions based on costs are not always straightforward. For example, weapon systems exist to provide the Air Force with the capability to perform a mission or deliver a combat effect on the adversary. Most cost analyses of weapon systems are based on total life-cycle costs or total costs of ownership, but, in some cases, these methods might miss the full costs of using the weapon systems to deliver a desired effect. The difference between the two cost structures is tied to the cost of the associated resources needed to enable the weapon system to deliver its intended effect in a warfighting environment. The former is generally referred to as *total ownership costs* or *life-cycle cost*. The latter could be referred to as *mission-effect costs*.

As an example, to use a fighter aircraft for a strike mission, the Air Force must deploy the aircraft to the theater, bed down the support forces, refuel the aircraft, and provide other

maintenance services. This is in addition to the other platforms and personnel that support the strike mission, from reconnaissance to battle management and battle damage assessment. Life-cycle cost analysis might consider the costs of buying the weapon system, training aircrew to fly it, and training maintainers to repair it; the costs of repair and depot maintenance; and the cost of providing the infrastructure at a base to host squadrons of the weapon system. However, such an analysis does not account for the cost of tankers and airlift to deploy the squadron to a contingency operation, nor does it account for the increased costs associated with maintaining home station weapon systems when the economies of scale are lost when part of the unit is deployed. Although AFWIC's estimates of these costs would need to be refined, some understanding of their approximate bounds would be useful in the earlier stages of assessing their relative viability. For example, senior leaders might want to know how the cost of using a fighter aircraft for a strike mission compares with the cost of destroying the target using a team of cyber warriors that can operate from the confines of their offices in the continental United States, assuming the same approximate level of lethality.

To illustrate the difference between the cost of ownership and the cost of operating and capture the interdependencies of the three core components of the force structure, we offer in Table 4.4 a notional (albeit extreme) example of operations in a contested environment. In this scenario, we present two alternatives for operating against a near-peer enemy with a capable quiver of cruise and ballistic missiles. As Table 4.4 indicates, the stand-off concept in a contested environment presumably will rely heavily on long-range weapons, such as cruise missiles, while the stand-in concept with 5th-generation fighters could deliver less expensive direct attack or glide weapons. Another factor, and one that would tilt in the other direction, is that the stand-in force would need more-robust (and costly) active mission defenses than the long-range force. These costs also could be added to the chart.

Table 4.4. Notional Example of a Cost Assessment of Force Options

Capability and Design Factors	Concept 1: Stand-In	Concept 2: Stand-Off
Employment concept	Forward-deploy highly capable 5th-generation combat aircraft to ten forward operating locations (three MOB and seven austere) inside the enemy's threat ring	Employ deep strike weapons from a bomber force based in a secure environment
Force structure	188 5th-generation fighters	20 strategic bombers
Development and procurement costs ($ billions)	77.40[1]	44.75[2]
Total ownership cost per year[3]	$2.42 billion	$885 million
Employment factors		
Initial strategic lift requirements (number of C-17s)	609	30
C-17s after WRM buy down	161	8
Combat force requirements (STONS)	1,518	835
Base operating support requirements (STONS)	15,412	1[4]
Airfield damage repair capability at locations within threat range (STONS)	3,551	0
Total cost to employ		
Cost of WRM to buy down strategic lift requirement ($ millions)	458.8	5.3
Cost of munitions for 14-day employment ($ billions)	7.21[5]	1.43[7]

NOTES: MOB = main operating base. WRM = war reserve materiel. STONS = short tons.
[1] U.S. Government Accountability Office (GAO), 2011, p. 140.
[2] GAO, 1997, p. 14.
[3] Costs are from the Air Force Total Ownership Cost decision support system.
[4] This assumes that bombers would deploy to established USAF locations with significant infrastructure in place to support the additional crews.
[5] GAO, 2015, pp. 61, 123; USAF, 2003.
[7] GAO, 2015, p. 95.

Using PNT as another example, equipping aircraft and munitions with precision INSs could be fairly inexpensive. However, developing and deploying a theater airborne GPS network might be relatively expensive and potentially cost prohibitive. The acquisition community, SAF/FMC, AFCAA, and industry should help AFWIC determine the costs for each design option. A feasibility analysis for design options also should include the time frame for implementation and any implementation-related challenges. The S&T, acquisition, and operational communities should help AFWIC determine the feasibility of design options. For example, equipping aircraft and munitions with precision INSs or standardizing PNT interfaces

would require coordination among a substantial number of program offices and could make such capability developments more difficult to implement.

AFWIC could provide senior leadership with an overview of the design choice analysis, including the operational capabilities and gaps across a variety of scenarios; CONOPS-enabled force structure; affordability, risks, and implications on other parts of the force structure; and other important issues germane to decisionmaking. Table 4.5 illustrates a notional comparison of PNT design options and the information necessary for decisionmaking. The same notation is used as in Table 4.3, in which design options are scored according to whether or not they partially (◑) or completely (●) fulfill the minimum requirements for the performance metrics and enable operations for stand-in and stand-off CONOPS.

Table 4.5. Notional Performance, Affordability, Risk, and Key Issues of PNT Design Options

	CONOPS-Enabled				
Design Option	**Stand-In**	**Stand-Off**	**Affordability**	**Risk**	**Key Issues**
New TTPs	◑	◑	$	High	Limited PNT capabilities only
Modernized GPS enterprise	◑	●	$$$$	Medium	More robust and resilient, but adversaries might develop new counters
Airborne GPS networks	●		$$$$	Medium	Short-duration PNT capabilities only
Precision INSs and ACs	●	●	$$$	Low	More robust, but limited flexibility
Standardized interfaces	●	●	$$	Low	Interchange one PNT system at a time

NOTES: ◑ = partially enables CONOPS. ● = completely enables CONOPS.

Flexibility, Adaptability, and Robustness of Force Structure Alternatives

Because of the wide array of uncertainties about future threats, technology readiness rates, budgets, and adversary intentions, the feasibility assessment needs to include a broader set of military objectives than affordability alone. In considering trade-offs across future force design options, AFWIC would do well to think about the *flexibility* that each option affords. Using the example of munitions, options that would enable the Air Force to operate in a variety of different warfighting conditions might be more desirable than an option with more-limited applications, although there also are cases in which only one system can serve a particular purpose. The

concept of *adaptability* is similarly attractive in enabling the Air Force to adjust more rapidly to changes in the threat environment; for example, the emergence of a new strategy and the deployment of space-based capabilities. *Robustness*—good performance of a plan or strategy under a wide variety of possible future conditions—is another desirable property when designing a future force structure that is intended to address an uncertain future threat environment. Davis, 2014, refers to flexibility, adaptability, and robustness as "FARness" properties. Measures that capture these properties would become performance metrics in the feasibility analysis of the force design options (Leftwich et al., 2019).

Examples from Prior RAND Work

Davis, 2014, and Lempert et al., 2016, provide examples of analyses envisioned in this section.

Temporal Aspects of Force Design

National, strategic-level direction for the armed forces varies according to the priorities and perspectives of presidential administrations. These priorities sometimes change within administrations in response to geopolitical events and intelligence assessments of the threat environment. Thus, the timescale of fluctuating demands on the desired—and assessed—force structure is on the order of years. In contrast, most weapon systems take years to develop and they remain in service for decades. The desired force, therefore, changes with considerably higher frequency than the actual force (the supply side of the equation). The result is a frequent, if not permanent, structural disconnect between desired and actual forces.

This phenomenon has important implications for the operation of AFWIC. If we define risk in this context as correlated with the difference between the actual force and the assessed force desired to meet national objectives, not all risks are equivalent for AFWIC. Risks associated with driving force development that are likely to endure generally would present higher priorities for action than risks that are more ephemeral. The existence of nuclear-capable adversaries is an example of an enduring driving force. Although the details of the nuclear threat have evolved over time, the general need for nuclear deterrence has persisted since the dawn of the nuclear age, and so, for example, has the perceived need for nuclear-capable bombers. However, the perceived need for a supersonic bomber was a more ephemeral need based on

rapidly evolving threats; changing technologies favored stand-off weapons and low-observable aircraft.

Chasing high-frequency changes in demand with long-wavelength changes in supply is inefficient and leads to persistent risks. Ephemeral driving forces might go away before a weapon system even sees duty or could lead to the retirement of a weapon system well before the end of its natural life span. This observation suggests a need for AFWIC to consider how to bring these temporal factors into its presentation of force structure options to decisionmakers.

The temporal disconnect that leads to fluctuations in risk arises from two sources: (1) how fast demand changes and (2) how fast the force structure can change in response. Whether the demand side of the risk fluctuations will persist is a matter of military and strategic judgment. That the nuclear threat is not likely to go away in the foreseeable future is fairly certain. But after the terrorist attacks of September 11, 2001 (9/11), it was unclear for how long the United States would need substantial counterinsurgency capabilities and therefore how much of the force structure needed to shift from a focus on the high-end threat to capabilities needed for counterinsurgency operations.

What is easier to assess accurately is how long it will take to effect changes to force structure. On the quickest (high-frequency) end of the spectrum are nonmateriel solutions (e.g., changes to CONOPS). Modifications to existing weapon systems will be slower, followed by the introduction of new weapon systems, and finally, at the longer end of the spectrum, research and development into new technologies.

Information of this kind is valuable to decisionmakers. Are driving forces assessed to be enduring and can they be addressed with rapid force structure changes? These probably will be high priorities for decisionmakers. Are the driving forces potentially ephemeral and the assessed means to address them available only through research and development? Decisionmakers likely will decide to accept many risks of this type. Including these assessed timescales in AFWIC products would be useful to decisionmakers.

Another consequence of fluctuating demands is that perceived needs for new capabilities carry greater weight than the perceived excess of legacy ones. National-level priorities provide a guide that, after analysis, can lead to clear disconnects between the desired and actual forces. But because these priorities can and do shift, existing capabilities often are retained as a hedge

against these shifts. They also are retained because there is often a considerable time (and cost) to reconstitute them. These factors lead to a natural disinclination to divest in legacy capabilities.

The more AFWIC can assess these temporal dimensions, estimate their uncertainties, and express them as part of force structure options to senior leaders, the better equipped senior leaders will be to make sound and stable decisions.

Capability Development Planning

The operations of the CDC, which was established in 2017, were brought into the AFWIC organization because of the deep connections between future force design and the identification of enhanced and new capabilities, many of which will require further R&D, experimentation campaigns, and prototyping before they are ready to be deployed in the field. The relationship between the CDC and AFWIC's Capability Development Directorate (CDD) is explained in the text of AFWIC's CONOPS, which we have reproduced in Appendix A, but is not explicitly shown in the organizational chart (described as an "organizational construct") in Figure A.2. The analytic steps to support capability development planning are discussed in some detail in Leftwich et al., 2019.

AFWIC's role will be to identify the specific capabilities that would be required to execute a new CONOPS and determine whether that capability already exists in a deployable form and, if not, at what point in the future it could reach a readiness level that would enable its production and deployment. Each capability will have its own timeline of development steps, in some cases including basic research and further lab or bench-scale testing, experimentation campaigns to further explore barriers to development, prototyping at a field scale, and production issues. With development timelines likely varying by years, not months, AFWIC will be challenged both to set priorities among capability development options based on their criticality to the functionality of the future CONOPS and to consider nearer-term measures that would help close critical gaps in capability and enable an overall transition to a new force structure to proceed.

Because of the many uncertainties that pervade capability development, AFWIC will need to devise a hedging strategy for developing new capabilities that will be adaptable as threats evolve. As part of the feasibility assessment, AFWIC should take a portfolio approach and evaluate several alternative capability development strategies that provide varying degrees of robustness at different costs (personal communication with Richard Silberglitt, 2019). The

overall aim is to identify S&T investments that need to be made in the near term that will raise the odds of a robust set of capability options in the future.

Examples from Prior RAND Work

Martin et al., 2019; Thirtle et al., 2008; and Leftwich et al., 2019, provide examples of analyses envisioned in this section.

In the next chapter, we overlay a suggested slate of product elements onto the analytical roadmap shown in Figure 4.1.

5. Overview of Proposed AFWIC-Related Product Elements

Analysis is at the core of AFWIC's mission. Just as important to AFWIC's mission will be its skill and effectiveness in documenting its work and communicating the essential content to a variety of audiences. In this chapter, we discuss the different purposes and audiences of product elements associated with AFWIC's integrating role and its role in decision support and propose a format that best suits decisionmaker or audience needs. As noted in Chapter 4, a product element could be a stand-alone deliverable or part of a larger deliverable.

AFWIC will not be the sole author or producer of every product element. This reflects the fact that AFWIC's staff will be constrained by their numbers and expertise, but it also reflects the nature of the integration processes that AFWIC will need to orchestrate to be effective and sustainable over the longer term. To this end, AFWIC will play a key coordinating role in ensuring that analyses are documented properly, including assumptions and supporting information, and that planning and program guidance flowing from key decisions appropriately reflects investment, divestment, and sustainment decisions. For product elements related to threats, technology, and planning and programming guidance, AFWIC will need to be closely involved to ensure relevance and consistency with its role in integration.

Figure 5.1 shows the product elements overlaid on the flow of analysis. (The information in Figure 5.1 is provided in a larger format as Figure E.2 in Appendix E.) Each element has a purpose, an audience, and a role in decisionmaking, as summarized in Figure 5.2, which also is provided in a larger format as Figure E.1 in Appendix E. Product elements could be packaged by purpose (see the second column in Figure 5.2), thus keeping the number of total deliverables to as few as four or five, depending on whether the "document decision" element is merged with the "direct and guide" elements.

Figure 5.1. Relationship of Product Elements to Analytical Steps

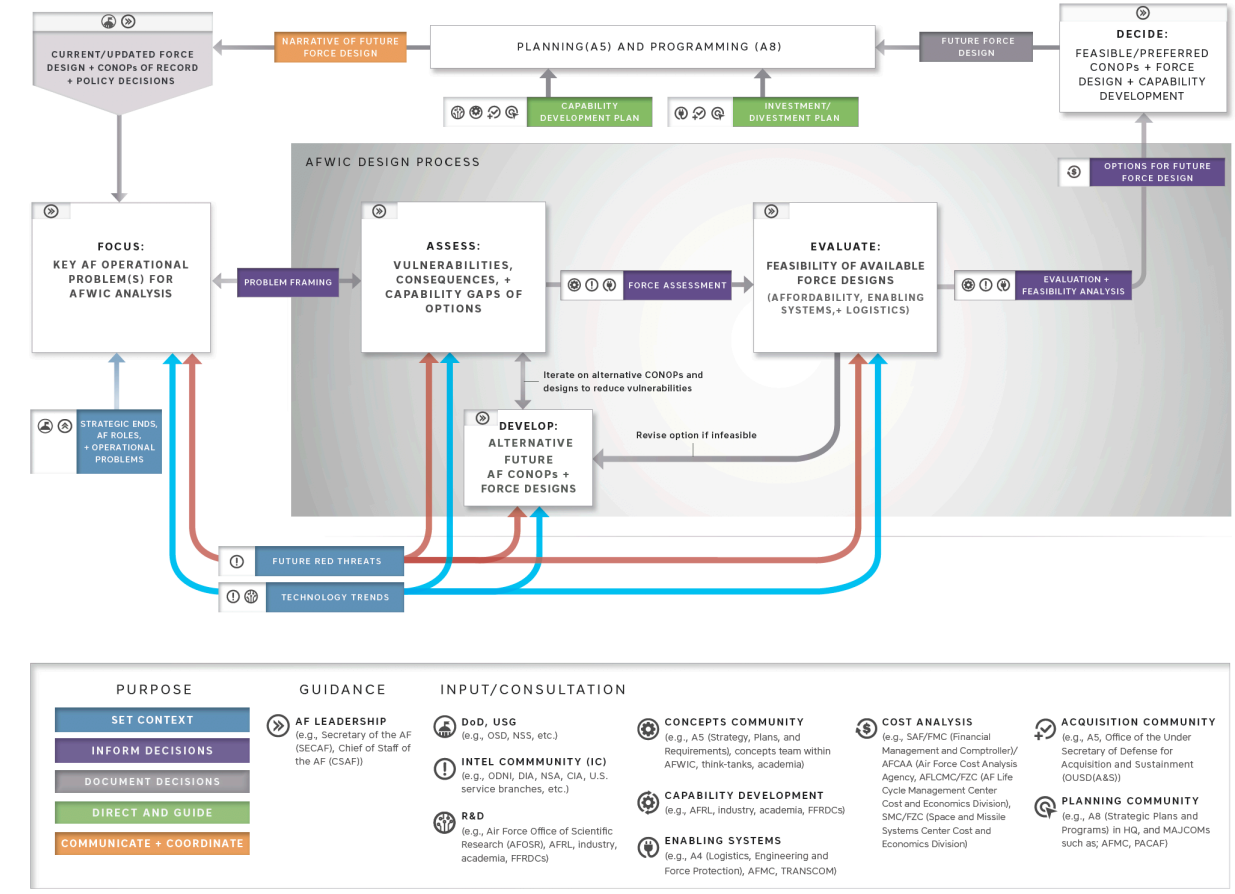
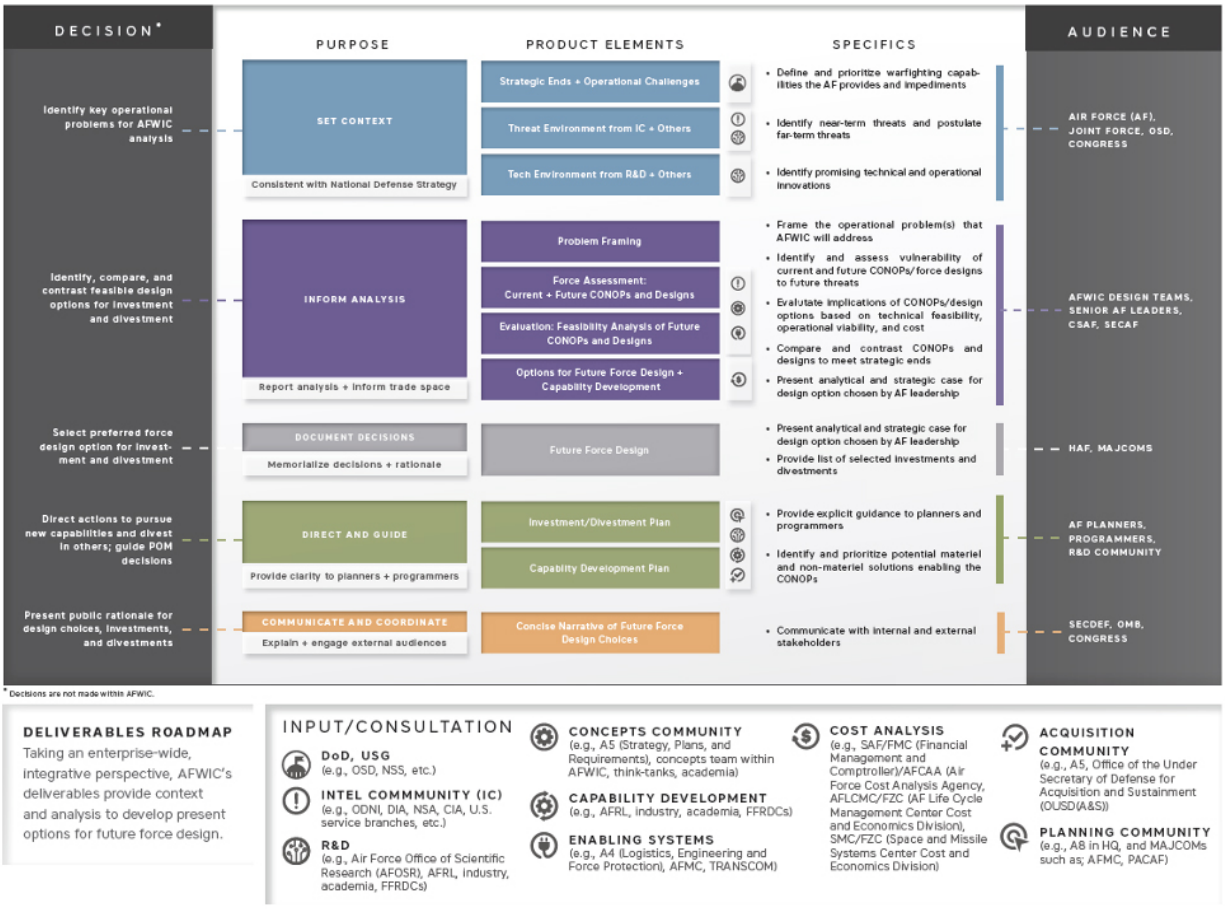


Figure 5.2. Summary of AFWIC-Related Product Elements



In this chapter, we propose a form and structure for each element identified in Figure 5.2 that AFWIC alone, AFWIC with support from partners, or partners with AFWIC's support will produce. Some of these elements could be bundled together; others would be more effective as stand-alone products. For each element, we specify the purpose, decisionmaking context, and audience; recommend consultations that AFWIC should seek as it pursues vital information and gains buy-in from other Air Force and DoD components; and recommended touch points with leadership to confirm key assumptions and methods for conducting analysis. Suggested product formats are intended to serve the needs of decisionmakers or others. These could include, for example, formal reports for archival and communications purposes; briefings in standard formats to ease search and retrieval; and online tools and visuals to support individual and group interactions, wider dissemination, and outside vetting.

Some of the product elements will require review and updating at least annually to reflect the realities of decisionmaking, particularly budgeting and appropriations, that will have

occurred subsequent to their initial development. Feedback to AFWIC and the ability to process such feedback systematically will be essential to AFWIC's sustainability and long-term effectiveness.

For all types of deliverables, all supporting analyses, reports, transcripts, and other reference materials should be maintained by a knowledge science specialist (e.g., a librarian) and stored electronically by AFWIC in a central repository.

Set the Context

From AFWIC's perspective, the first top-level decision relates to which priorities senior leaders will direct AFWIC to address, recognizing that AFWIC's value added will come by taking on enterprisewide issues that could not be handled comprehensively by a single MAJCOM or other component. AFWIC will draw on the three foundational lines of information that will direct its problem framing and path of analysis. The foundational lines are a clear statement of strategic ends, the operational problem to be tackled, and the role of the Air Force (see Table 5.1). Second, a context-setting document will need a classified annex that characterizes the threat environment, drawn from its consultations with the IC and other experts (see Table 5.2). Third, AFWIC will need to synthesize the key messages on technology trends gleaned from its consultations with industry, academia, AFRL, non-DoD research organizations, and other experts on existing, emergent, and prospective technologies with bearing on the operational problem (see Table 5.3).

Because these three lines of information come largely from outside AFWIC, AFWIC's role should be to serve as the editor, reconciling the content across the three product elements to ensure consistency, timeliness, and suitability for AFWIC's subsequent analytical tasks. Given the different mix of consultations and timelines required for each of these product elements, they might be most efficiently produced as stand-alone documents and then packaged together as a deliverable.

Strategic Direction

This product element, summarized in Table 5.1, will require updating whenever national strategic policy shifts, typically after a change of presidential administration or in response to significant geopolitical events, such as a major conflict. AFWIC will not be the source of

strategic direction, but will be one of several sources providing senior decisionmakers with the information necessary to interpret the impact of strategic policy changes on strategic direction. AFWIC, however, will be responsible for interpreting the application of the strategic direction to the operational problem at hand. Its focus will be on strategic directions for the Air Force but should reflect the Air Force role within Joint Forces and national defense strategy.

Table 5.1. Product Element on Strategic Direction

Features	Specifications
Owner	AFWIC
AFWIC role	Editor of material coming from A5 and other sources
Purpose	Connect generally stated strategic objectives to the particular operational problem before AFWIC, including clarification of Air Force roles in joint acquisitions and operations
Audience	MAJCOM senior staff and commanders; HAF/SAF senior staffs; AFWIC design team members; other DoD partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Authors and owners of national-level strategic guidance; other strategists in DoD, the Air Force, and elsewhere in the USG; strategic thinkers outside government
Touch points with Air Force leadership	Before deliverable is finalized, senior leaders should review and provide feedback on key assumptions and findings
Decisionmaking needs	Ensure that analyses of design options are consistent and focused on U.S. strategic objectives when shaping future CONOPS and design options and making decisions on preferred future force structure and design
Options for formats	Narrative-form classified white paper (several pages)

NOTE: SAF = Secretary of the Air Force.

Future Threats

AFWIC will need to be proactive in seeking information from a wide variety of sources, including from those knowledgeable in the other services and DoD about Blue developmental efforts. Sorting out the differences between assumptions and evidence in the projection of future threats should be a key element of this deliverable. Situational awareness is fundamental to AFWIC's integration function. This element will emerge from extended and probing discussions between AFWIC and partners about their characterization of future threats and the uncertainties inherent in those assessments.

Table 5.2. Product Element on Future Threats

Features	Specifications
Owner	AFWIC
AFWIC role	Editor of material coming from AF/A2 and others in the IC
Purpose	Consolidate multiple lines of evidence from multiple sources on status and trends of the threat environment; make distinctions between evidence and assumptions explicit
Audience	Air Force and AFWIC leadership; AFWIC design team members; partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Members of the IC, including ODNI, DIA, NSA, CIA, and the services
Touch points with leadership	Before deliverable is finalized, senior leaders should review and provide feedback on key assumptions and findings
Decisionmaking needs	Ensure that analyses of design options are consistent and focused on a common base of interpreted intelligence when shaping future CONOPS and design options and making decisions on preferred future force structure and design
Options for formats	Narrative-form classified white paper (several pages)

Technology Trends

As with the future threats document, AFWIC will need to initiate consultations to build a coherent understanding of multiple lines of technological development. This element should have a succinct main body and be accompanied by technical appendixes. Furthermore, AFWIC will need to revisit this material at least annually to ensure that it embodies the most-current information and experimental results.

Table 5.3. Product Element on Technology Trends

Features	Specifications
Owner	AFWIC
AFWIC's role	Editor of material coming from AFRL and others in the R&D community, including industry
Purpose	Consolidate multiple lines of evidence from multiple sources on status and trends in technologies relevant to the operational problem at hand
Audience	AFWIC leadership; AFWIC design team members; partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Air Force Office of Scientific Research, AFRL, industry, academia, FFRDCs
Touch points with leadership	Before deliverable is finalized, senior leaders should review and provide feedback on key assumptions and findings
Decisionmaking needs	Ensure that analyses of design options are consistent and focused on a common base of understanding about technology readiness levels and emergent trends when shaping future CONOPS and design options and making decisions on preferred future force structure and design
Options for formats	Narrative-form classified white paper (several pages) with technical appendixes as necessary to document multiple lines of evidence appropriately

Inform the Analysis

This category of product elements encompasses problem framing, data gathering, analysis, modeling, gaming, and decision analytics in support of an interactive presentation of options and trade-offs to decisionmakers. These four analytical product elements should include sufficient information on problem framing, assumptions, methods of analysis, results, and conclusions at a level of detail and reproducibility that is appropriate for its intended audience.

Product elements could be produced sequentially and then later packaged together, with each one providing a logical connection to the next. The sequence would begin with problem framing: a clear statement of the operational problem in the context of the strategic direction set by DoD leadership and the roles that the Air Force will play (see Table 5.4). Problem framing includes assumptions and premises, some of which could come from senior leadership or from the AFWIC team, and a roadmap for analysis. Each step of the problem framing should be justified, documented, and revisited over the course of the analysis.

Each subsequent step of the analytic process (Tables 5.5, 5.6, and 5.7) also should be thoroughly documented, with a clear audit trail that will enable internal review and validation and outside scrutiny. This would include documentation of the results and implications of wargames. Although PowerPoint slides might be useful to facilitate internal discussions, the format is unsuitable for documenting analytical methods and preserving a record of assumptions, source materials, and reasoning that will underpin key findings.

As an example, a briefing and accompanying narrative document on meeting the military challenges posed by China (classified; internal to DoD) might include

- scenario and Red force laydown, circa 2038 (Table 5.5)
- a description of warfighting dynamics and outcomes when Blue fights with the program-of-record force (extended) and legacy CONOPS (Table 5.6)
- capability and posture options for redressing gaps and shortfalls in capabilities (Table 5.6)
- an analysis of these options to include effectiveness, cost, and robustness in the face of enemy countermeasures (Table 5.7).

From a leadership perspective, the single most important contribution to the entire analytic process is the level of agreement among senior Air Force leaders achieved through in-depth discussions about the problem framing, assumptions, and approach to analysis. Product elements follow from that explicit agreement. The final element of the AFWIC design process is the presentation to senior leadership of options and trade-offs across attributes of alternative force designs and their implications for investment and divestment in combat, enabling, and institutional systems (Table 5.8). The strength and quality of this analysis of options and trades will be the most visible signs of AFWIC's contributions to decisionmaking.

Problem Framing to Shape AFWIC's Analyses

This element, which is summarized in Table 5.4, might be the most intellectually challenging for AFWIC because it requires complex problems to be scoped and framed into forms that are amenable to analysis and, ultimately, action. In Chapter 6, we provide an elaboration of this step using the examples of PNT and C4I. Getting this part of the analysis wrong will negate subsequent work. This also is a step in which AFWIC would greatly benefit from rigorous and critical external review before proceeding. The text will need to be clear, concise, and actionable in terms of setting the course of subsequent analyses.

Table 5.4. Product Element on Problem Framing

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author
Purpose	State the operational problem to be solved in terms of key objectives and associated performance metrics; major uncertainties and assumptions; design attributes of interest; and approach to analysis
Audience	AFWIC leadership; AFWIC design team members; internal Air Force partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Air Force partners (A4, A8, MAJCOMs) with whom AFWIC will collaborate in developing design options
Review process	Formal and informal internal and external reviewer process to ensure rigor and technical credibility
Touch points with leadership	Front-end discussion and feedback on problem framing, key assumptions, and general analytical approach; before deliverable is finalized, senior leaders should review document and ensure that they and the AFWIC team have reached a common understanding of the operational problem to be solved
Decisionmaking needs	Ensure that the problem is appropriately framed when shaping future CONOPS and design options and making decisions on preferred future force structure and design
Options for formats	Narrative-form classified white paper (several pages)

The Development of Future CONOPS and Force Designs

AFWIC will draw on the results of wargames, other analyses, and expert judgment to formulate a starting set of future CONOPS and associated force designs aimed at addressing the problem as framed in the earlier step. AFWIC should plan to carry at least two—and preferably three or four—alternative CONOPS through each step of the analysis. To set the stage for the vulnerability analysis, this element, as noted in Table 5.5, also should address the variety of scenarios that these CONOPS are intended to address.

Table 5.5. Product Element on Future CONOPS and Force Designs

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author
Purpose	Document methods and analysis in support of the development of future CONOPS and associated future force structures
Audience	Air Force and AFWIC leadership; AFWIC design team members; internal Air Force partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Conceptual thinkers from inside and outside DoD, including FFRDCs and academics; Air Force partners (A4, A8, MAJCOMs) with whom AFWIC will collaborate in developing design options; internal and external reviewers to ensure rigor and technical credibility
Review process	Formal and informal internal and external reviewer process to ensure rigor and technical credibility
Touch points with leadership	Front-end discussion on analytical approach; participation in wargaming; before deliverable is finalized, senior leaders should review and "own" key findings and implications
Decisionmaking needs	Generate a set of future force design options whose effectiveness can be defended with analysis; these options will move forward to the feasibility assessment
Options for formats	High-quality graphics showing CONOPS and force structures (e.g., Overmatch and Korea reports); an accompanying white paper of key graphs and a narrative (several pages) providing an overview of key findings

Scenario Analysis and Force Assessment

The results of the scenario analysis and force assessment will provide the rationale for future force design and capability development planning guidance. The assessment will include a thorough role-based evaluation of current force capabilities and future force performance under current and possible future CONOPS. AFWIC will need to fully document the audit trail of evidence supporting each of the alternative CONOPS and associated designs. At the same time, AFWIC will need a clear and compelling presentation of these results for high-level briefings internal and external to the Air Force.

Table 5.6. Product Element on Scenario Analysis and Force Assessment of Future Force Design Options

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author
Purpose	Identify sources of vulnerabilities to Blue forces under a variety of scenarios and assumptions about future CONOPS
Audience	Air Force and AFWIC leadership; AFWIC design team members; internal Air Force partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Experts on specific platforms and systems from inside and outside DoD, including FFRDCs and academics; Air Force partners (A4, A8, MAJCOMs) with whom AFWIC will collaborate in developing design options
Review process	Formal and informal internal and external reviewer process to ensure rigor and technical credibility
Touch points with leadership	Front-end discussion on analytical approach; participation in wargaming; before deliverable is finalized, senior leaders should review key findings and implications
Decisionmaking needs	Pinpoint capability gaps and needs for investments in new capabilities, enhancements in existing capabilities, and changes in CONOPS
Options for formats	High-quality graphics showing CONOPS and force structures (e.g., Overmatch and Korea reports); accompanying white paper of key graphs and narrative (several pages) providing an overview of key findings; technical appendixes describing methods and analyses.

Feasibility Assessment

This assessment will include the implications of the design problem at hand on other parts of the Air Force. Different design choices could have dramatically different implications for combat, enabling, and institutional force components. This analysis will be essential to the design-to-planning guidance and PPG and is the primary reason that AFWIC was created: to make decisions with an integrated view from the outset and then carry that analysis into planning and programming guidance. That guidance would direct the actions that each of the Air Force functions would need to take to implement the decisions. As with other product elements, this analysis should be subjected to rigorous internal and external review to expose a variety of perspectives.

Table 5.7. Product Element on Feasibility Assessment

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author with assistance from A5, A8, and MAJCOMs as needed
Purpose	Screen the set of effective options for their feasibility in terms of affordability, flexibility, adaptability, and robustness
Audience	Air Force and AFWIC leadership; AFWIC design team members; internal Air Force partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Cost analysts, logisticians, and other experts inside and outside DoD, including FFRDCs and academics; Air Force partners (A4, A8, MAJCOMs) with whom AFWIC will collaborate in developing design options
Review process	Formal and informal internal and external reviewer process to ensure rigor and technical credibility
Touch points with leadership	Front-end discussion on analytical approach; direct interaction between analysts and leaders in defining trade space and displaying trades dynamically
Decisionmaking needs	Identify key trade-offs and potential modifications in CONOPS and force structure options to enhance effectiveness and feasibility
Options for formats	High-quality graphics comparing options across the variety of feasibility performance metrics (e.g., Overmatch and Korea reports); an accompanying white paper of key graphs and a narrative (several pages) providing an overview of key findings

Trade-Off Analysis

This element will shape critical deliberations among Air Force senior leadership on which force design option to pursue. It not only will need to be concise and visually compelling but also will need to convey the fact that each figure and table has a body of analysis behind it that can withstand close scrutiny. As an example, this content might take the form of a briefing and an accompanying narrative on programmatic recommendations derived from the analysis of the China scenario (classified; internal to USAF) and include

- adjustments to acquisition programs inside the FYDP (e.g., additional munitions)
- new capabilities to pursue on an accelerated basis; recommended priorities for experimentation
- new or expanded R&D initiatives
- suggested divestitures and programmatic reductions if future USAF TOA is not sufficient to support recommended additions.

Force design and capability development planning are multiple-objective problems, meaning that there are no optimal solutions as would be the case with a constrained single-

objective problem. Trade-space will have multiple different dimensions: effectiveness, cost, and timeliness will likely be at the top of the list. However, the very nature of integration demands that AFWIC consider the implications that a major change in warfighting (e.g., stand-off versus stand-in) could have on enabling and institutional force design. This element is where these kinds of issues need to be raised, analyzed, and interpreted.

Table 5.8. Product Element on Trade-off Analysis

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author
Purpose	Illuminate trade-offs between effectiveness and feasibility
Audience	Air Force and AFWIC leadership; AFWIC design team members; internal Air Force partners with whom AFWIC will consult and collaborate in developing design options
Consultations	Cost analysts, logisticians, and other experts inside and outside DoD, including FFRDCs and academics; Air Force partners (AF/A4, AF/A6, AF/A8, MAJCOMs) with whom AFWIC will collaborate in developing design options
Review process	Formal and informal internal and external reviewer process to ensure rigor and technical credibility
Touch points with leadership	Front-end discussion on analytical approach; direct interaction between analysts and leaders in defining trade space and displaying trades dynamically
Decisionmaking needs	Identify key trade-offs and potential modifications in CONOPS and force structure options to enhance effectiveness and/or feasibility
Options for formats	High-quality graphics comparing options across effectiveness and feasibility metrics; accompanying white paper of key graphs and a narrative (several pages) providing an overview of key findings

Document Decisions

Senior leaders will consider AFWIC's presentation of options and trades. They could ask for additional analysis of hybrid options or further evidence to back up claims of effectiveness or cost. In the end, the CSAF will make a decision about a preferred option. The particulars and the reasoning behind the preferred option will need to be documented because it will become the foundation for guidance documents and serve as an archive of the factors that drove the preferences of senior leaders. When these choices are challenged, as they inevitably will be in

DoD and by Congress, the Air Force will need a clear and compelling technical story to tell that is grounded in credible analysis.

Future Force Decision Document

This product element will be derivative of the trade-off element outlined in Table 5.8, but instead of laying out each of the CONOPS and design alternatives with equal weight, this deliverable will memorialize the actual choice made by senior leadership and their rationale for doing so (Table 5.9). This element also will provide the factual underpinning for the guidance to programmers (Table 5.10) and guidance for capability development planning (Table 5.11).

Table 5.9. Product Element on Future Force Decision

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author
Purpose	Memorialize the future force design decision made as a consequence of options analysis and provide a clear and consistent message to planners and programmers
Audience	All Air Force components, OSD, Joint Chiefs of Staff
Consultations	Consultations leading to the decision will have been completed, but the draft document should be shared with all key audiences for review and comment
Touch points with leadership	Before the deliverable is finalized, senior Air Force leaders should review for consistency with the decision process
Decisionmaking needs	The deliverable will provide the basis for design-to-planning and capability development planning guidance
Options for formats	Unclassified decision memorandum with classified technical appendixes

Direct and Guide

After the CSAF has made their decision on a preferred option to address the particular operational problem at hand, AFWIC will support the development of PPG to A5, A8, and other components as well as capability development guidance to AFRL, AFMC, and others. A8 will play a critical role in connecting AFWIC's work to the POM. The consultations with A8 will have been going on well before the final design choices are made; therefore, the actual writing and issuing of guidance should be a collaborative and relatively smooth process.

Design-to-Planning Guidance

The effectiveness of this deliverable will determine the Air Force's success in translating the results of the deliberative design process into programming choices at the headquarters and component levels of the Air Force. The quality of earlier consultations with A8 in particular should help shape the content of this guidance and enable the direction for future force design—which is set at the top—to ripple through the many thousands of individual choices that make up the POM.

Table 5.10. Product Element on Design-to-Planning Guidance

Features	Specifications
Owner	A8
AFWIC's role	Support to ensure consistency with force design analysis
Purpose	Translate future force design decision into specific guidance to planners (A5) and programmers (A8)
Audience	All Air Force components, OSD, Joint Chiefs of Staff
Consultations	Draft document should be shared with all key audiences for review and comment
Touch points with leadership	Before the deliverable is finalized, senior Air Force leaders should review for consistency with the decision process
Decisionmaking needs	The deliverable will provide the basis for POM and budgeting decisions in current and out years
Options for formats	Unclassified guidance memorandum with classified technical appendixes

Capability Development Guidance

As with the design-to-programming guidance summarized in Table 5.10, early and frequent consultations with AFRL and others in the R&D community will help determine the effectiveness and coherence of the capability development guidance arising from the design choice process. A8 also should play a supporting role. Ownership of this product will reside with the CDC Working Group, which was brought into the AFWIC organization at the time of AFWIC's establishment (Leftwich et al., 2019).

Table 5.11. Product Element on Capability Development Guidance

Features	Specifications
Owner	AFWIC/CDC Working Group
AFWIC's role	Support to ensure consistency with force design analysis
Purpose	Translate future force design decision into specific guidance to planners (A5) and programmers (A8)
Audience	CDC Working Group, all Air Force components, OSD
Consultations	The draft document should be shared with all key audiences for review and comment
Touch points with leadership	Before the deliverable is finalized, senior Air Force leaders should review for consistency with the decision process
Decisionmaking needs	The deliverable will provide the basis for POM and budgeting decisions in current and out years related to S&T investments and divestments and experimentation campaigns
Options for formats	Unclassified guidance memorandum with classified technical appendixes

Communicate and Coordinate

Finally, AFWIC's deliverables will serve a critical function in communicating the nature of the choices faced in future force design and the arguments for a preferred option that will drive investments and divestments for the foreseeable future. A product intended for external communications should crystalize the Air Force's case statement for investments and divestments and provide a clear and compelling vision of a future force structure that is consistent with national strategic documents. This kind of product also will be valuable as a tool for communicating and coordinating follow-on decisions made by OSD, the Joint Chiefs of Staff, and COCOMs (see Table 5.12).

Rationale for Future Force Design

The Air Force, like all the services, needs to be able to tell its story to various different audiences. However, some audiences are more important than others: At the top of the list are OSD, OMB, and Congress. Lengthy technical documents are unsuitable for this purpose. At the same time, concise and visually attractive deliverables are ineffective if their content is not derived from solid, well-documented analysis. This product element is thus a distillation of the preceding analyses and deliverables. There is no shortcut to its production.

Table 5.12. Product Element on Rationale for Future Force Design

Features	Specifications
Owner	AFWIC
AFWIC's role	Lead author
Purpose	Present a clear and compelling rationale for Air Force decisions on future force design, including investments and divestments
Audience	Congress, OMB, OSD, COCOMs, and Air Force and other service leaders
Consultations	Selected members of intended audience to preview deliverable and provide feedback
Review process	Internal and external reviewers in the Air Force, DoD, and—to the extent possible—congressional staff to ensure its effectiveness in communicating key messages
Touch points with leadership	Preview deliverable and receive feedback prior to publication
Decisionmaking needs	Support OSD, OMB, and congressional decisionmaking on Air Force budget and appropriations
Options for formats	Classified and unclassified versions of high-quality graphics-based storyboard providing rationale for Air Force investment and divestment positions (e.g., Overmatch and Korea reports)

Using the previous example of the China scenario, the deliverable summarized in Table 5.12 would be a concise overview, conveyed via infographics and narrative, of the rationale behind the planned evolution of USAF capabilities, CONOPS, and posture (classified; primarily for external audiences, e.g., Congress). Its content would include concise summaries and accompanying graphics of

- the operational challenges posed by China in the warfighting scenario
- how the old program-of-record force and CONOPS fall short
- how recommended new capabilities and CONOPS address key operational shortfalls.

If we carry the example further, in 2020, AFWIC would turn to addressing the military challenges posed by Russia in the 2030 time frame and would prepare the same set of briefings and documents noted for the China example in the discussions accompanying Tables 5.5 through 5.8 and Table 5.11. With that work completed, AFWIC could then publish a future force design document synthesizing work on both China and Russia that spells out the force structure, key modernization initiatives, and other features of the Air Force of 2030. Subsequent analyses of key operational problems would use this document as a starting point.

Summary

AFWIC's business is the production of technically credible, integrated analyses to support Air Force future force design and capability development planning. If it stays focused on this mission, it will be fulfilling a function that previously has not endured within the Air Force. The product elements outlined in this chapter are intended to serve different purposes and audiences. The elements in Tables 5.4 (problem framing) through 5.8 (trade-off analysis) could be packaged together at the culmination of the design choice problem or produced sequentially as each phase of analysis is completed.

In the next chapter, we offer two examples to demonstrate the critical nature of the problem framing step of AFWIC's analysis and the complexity presented by the redesign or modernization of such individual enabling functions as PNT and C4I.

6. Example Applications of the Problem Framing Process

In its first years of existence, AFWIC will be building both its bench of talent and its base of experience in working its way through the full cycle of the analytical roadmap. In Chapter 4, we describe in broad terms what each step might look like and what kinds of deliverables should be produced to guide decisionmaking, document the technical underpinning of decisions, and communicate decisions to a wider audience outside the Air Force. We also cite examples of unclassified RAND studies that illustrate the forms that AFWIC-like analysis could take.

In this chapter, we focus specifically on the problem framing process of the roadmap in Figure 4.1 in Chapter 4 that links the operational problem to be solved with the setup of a scenario analysis and force assessment, an identification of capability gaps, and the development of alternative future CONOPS and future force structures. Getting the problem framing process right is critical to setting the course for subsequent analysis and the shaping of options. Clearly explaining the reasoning that leads to a particular problem framing will be one of AFWIC's most-important initial products (see Table 4.11 in Chapter 4). In many contexts inside and outside the Air Force, the problem framing step receives insufficient attention. Problem statements sometimes can include a predetermined outcome (e.g., a globally networked system in the case of C4I) or fail to account for interdependencies across systems and organizations (e.g., through poor problem scoping).

We use examples of two notional problem sets: the robust provisioning of PNT and the goal of creating operational synergies by interconnecting C4I in a federated system of systems. PNT and C4I already have been identified by AFWIC as present-day areas of interest but also as opportunities for rethinking and transforming in support of alternative future CONOPS. In addition, these examples clearly cut across functional and mission lines in the Air Force and face substantial vulnerabilities in terms of the threat environment. Innovative solutions for each will depend in large measure on new CONOPS. Having each MAJCOM tackle the problem is both impractical and ill-advised.

To keep the examples simple, we assume that two distinctly different CONOPS are under consideration. In a stand-in CONOPS, Blue forces engage using manned aircraft intended to penetrate an adversary's air defenses. In a stand-off CONOPS, Blue forces will maintain their

assets outside the range of adversary fire and instead fight from a distance. These unclassified examples are intended to be illustrative of the reasoning process that AFWIC teams will need to employ as they provide the intellectual leadership in the Air Force with the appropriate questions that might lead to effective and feasible solutions.

Steps in Problem Framing

Problem framing establishes the question or questions to be addressed by the analysis. Over time, AFWIC will inform the choice of problems it will address, but for the foreseeable future, AFWIC will be tasked with questions from senior leadership or by other high-level guidance. Whatever their provenance, the questions likely will undergo changes as analysts think about their underlying motivations. Problem framing is a translational process of correctly diagnosing the operational challenge and is best accomplished in a team setting with diverse perspectives and expertise among team members (Kent and Thaler, 1993). Problem scoping is intended to account for the tractability of a particular research approach and resources available to tackle the analysis. The process typically proceeds through a sequence of questions, which might include

- scoping questions:
  - Is this a problem for AFWIC? AFWIC's bandwidth will be limited and, therefore, it should focus its energies on problems that other components of the Air Force or DoD cannot address because of limits to their scope or limits in their expertise. The answer to this question might need to await the resolution of some of the other questions.
  - Should the operational problem be viewed through the lens of a single adversary or through a variety of adversary types (e.g., near-peer, lesser states, nonstate actors)?
  - Over what time frame should the problem be considered?
- objectives and performance metrics:
  - What operational objectives and associated performance measures should be used to diagnose the existence of a problem? Consensus on objectives and performance measures is not a decision for analysts alone, but instead requires engagement with senior leaders. Getting this step wrong will set any subsequent analysis on a dead-end path. Implicit in this step is a collective understanding of what success or a solved problem might look like in terms of the performance measures.
- alternative CONOPS and design choices:
  - How might future CONOPS lead to reframing the operational problem? Will different CONOPS lead to different solution sets?
  - What are candidate solutions, whether materiel or nonmateriel?

  - What elements of force design are under the control of the Air Force and which elements might be beyond the USAF's control or taken as constraints?
- treatment of uncertainty:
  - What assumptions should be made about the threat environment and changes over time in Red and Blue technological and operational capabilities?
  - How should uncertainties be treated?
- approach to analysis:
  - What approaches to analysis might be the most suitable for the problem as framed, accounting for modeling complexities, uncertainties, and time constraints on analysis?

These kinds of questions require a thorough airing of perspectives within AFWIC and extended consultations with others outside AFWIC before any analysis begins. In the next two sections, we consider what these discussions might look like in the context of PNT and C4I, each of which will need to undergo some degree of transformation to meet future needs. We then summarize the common themes and their implications for AFWIC's work.

Options for PNT

PNT is a key function for the employment of both combat and enabling forces. PNT not only provides positioning for such systems as aircraft and munitions but also enables myriad other functions, such as tactical communications via precise, synchronized timing. GPS is the primary provider of PNT capabilities for the Air Force, DoD, international partners, and the civil community.

Three segments comprise the GPS enterprise: (1) a space segment of roughly two dozen satellites in medium earth orbit; (2) a ground segment of globally distributed terrestrial antennas, monitoring stations, and C2 elements, and (3) a user segment of receivers.[18] The system is *centralized*: a single system (space and ground segments) provides PNT services to a variety of users as a public good; the cost of providing the service to the user segment is independent of the number of users. A global compromise of the space or ground segments will lead to a compromise in the service experienced by all users, but individual users can design and procure their own user segment receivers. The system also is *aggregated*: the positioning and timing are provided by the same service. Although some users might consume only one of these services,

[18] For a brief primer on GPS, see Snyder et al., 2007, pp. 7–12.

this aggregation means that many threats to the GPS enterprise present risks to the provisioning of both positioning and timing.

However, the current GPS enterprise increasingly is at risk from a variety of threats from near peers, including jamming, spoofing, offensive cyber operations, and antisatellite capabilities. To ensure PNT functionality, the Air Force will need to rethink the force structure to mitigate these threats and continue to operate in both permissive and degraded environments. Future Air Force CONOPS (e.g., stand-in versus stand-off) will determine which and how PNT functions are likely to be degraded and suggest solutions to maintain these functions.

The PNT/GPS case presents an interesting challenge. If it is found that a centralized, aggregated service can be provided that is adequate for future CONOPS and threat environments, then GPS, a modernized GPS, or perhaps several systems at the operational level (e.g., theater airborne systems) is the solution. Because this is an enterprisewide issue, it would fall within the ambit of AFWIC. If, on the other hand, it is found that no centralized or aggregated service is adequate in light of future CONOPS and threats, solutions might need to be found exclusively at the user-segment level. The latter case would lead to a significant reframing of the problem.

Each user has some unique constraints on their user-segment receivers. These derive from the physical limitations of space; power; cooling; and operational needs, such as needed accuracy and data refresh rates. In this case, individual users, often program offices, would be best situated to address specific technical solutions rather than a centralized organization such as AFWIC. AFWIC would, however, be well placed to set standards for these users to follow to ensure the integrated capabilities necessary to carry out future CONOPS. Because GPS provides services to many more users than the Air Force, decisions about the future of this centralized, aggregated service cannot be made in isolation. If AFWIC analysis found that a centralized, aggregated service were no longer viable in the future, what would the Air Force do with GPS? Would it maintain the system as a peacetime service for all current users? Would it hand the system over to another agency to run because its military utility was assessed as insufficient? How would the nation provide PNT to other users? How would the Air Force conduct operations with other sources of timing and positioning?

The nuance here is that the problem framing depends considerably on the ultimate solution, in this case a centralized, aggregated service or a decentralized, potentially disaggregated service. The lesson is that the AFWIC team will need to first frame the more-

restricted, larger question of which direction this problem will take—centralized or decentralized. Once decided, it would then need to reframe the problem according to the finding. Each case would be framed differently and different organizations would take up separate issues.

The potential power of the AFWIC organization is illustrated by this case. Currently, many view PNT as a mission that is provided by GPS, which is the responsibility of AFSPC. This view limits how the Air Force tends to address the issue of robust PNT services. If PNT is considered to be an AFSPC responsibility, the organizational tendency is to look to AFSPC to find solutions to any future challenges to PNT or GPS. AFSPC naturally will seek solutions that involve space. Such a view unnecessarily excludes potential solutions that do not involve space. AFWIC, because it is an enterprisewide, integrated capability, is free from this organizational myopia.

Options for C4I

The technologies that provide C4I touch nearly every system and capability in the Air Force, along with joint and coalition partners. Unlike GPS, no program office or program executive officer has oversight over all of the systems that provide C4I. The array of communication modes (wireless, fiber-optic, copper cable, etc.), protocols, operational environments, security practices, and waveforms is vast. This variety naturally emerges from the varying operational needs and constraints of the different systems and missions these modes support.

Some platforms have limitations on size, power, and weight that restrict antenna size, output power, and the variety of communications types the system can carry. For example, communications between airborne and spacefaring platforms and ground stations are asymmetric, with larger antennas and more power available on the ground. Complex protocols sometimes are developed for particular security needs. On occasion, trade-offs are made on performance (e.g., bandwidth) to operate in a stressing environment (e.g., trans- and postnuclear bursts). This assortment of needs and constraints prohibits a single connecting network for weapon systems akin to the internet.

However, if one conclusion has emerged from the technology revolution of the past few decades, it has been the power and synergies of information sharing. Weapon systems that can share information potentially are more effective working together as a system of systems than as individual platforms. Senior leaders increasingly emphasize this point and call for the increased

networking of platforms in a federated communications network enabling multidomain C2 (DoD, 2018, p. 6; Machi, 2018).

How should this problem be framed for AFWIC? The problem is not simply how to make platforms more connected so that they can share more data more rapidly. The interconnection of platforms very well could lead, both in design and practice, to a *need* for such interconnection for operational effectiveness. Once a platform needs other platforms to be effective, the mission becomes potentially more fragile. The disruption of one contributing system or interruption of the communication links among the systems can imperil the mission, and the universal connection of systems introduces universal vulnerabilities to cyberattacks.

The question, then, is: What is the right balance between interconnection of platforms and platform autonomy?[19] Interconnection can increase effectiveness but it also can introduce more failure modes for the mission. Platform autonomy limits the individual platform to its own information environment. Furthermore, arrangements prior to AFWIC assumed that all operations of a platform are under the control of a single regional commander when, in fact, many are not. At the same time, the platform might be robust against a wide array of adversary threats. The operational benefits, threat environment, and potential new CONOPS all inform where the right balance is between these two extremes. The right balance also might be found to vary among mission areas. Posed this way, the question of balance between interconnection and autonomy is well suited to exploration by an enterprisewide, integrating capability, such as AFWIC.

This case leads to a broader question: What constitutes an input to AFWIC and what constitutes a product of AFWIC analysis? If the problem presented to AFWIC is posed as how to increase the interconnection of weapon systems to reach a universal federated architecture, we argue that such a framing presupposes the answer by excluding the possible benefits of some weapon system autonomy, an answer that is best arrived at through analysis. There are many other potential ambiguities about what should be a constraint imposed on AFWIC or, alternatively, what should be an output of AFWIC analysis. Reasonable people can disagree on

[19] The issue of interconnectedness has even broader implications. For example, how should the Air Force's approach to C2 evolve to ensure unity of command, synchronization, deconfliction across multiple commands, effective information sharing, and mission assurance when connectivity is degraded?

where these bounds should lie, but the enterprise as a whole, and AFWIC in particular, should agree on a single view of these bounds.

The C4I case illustrates a further point. There often are practical considerations that should be taken into account in the framing of a problem for AFWIC. C4I is so vast that it presents profound implementation challenges. Even if an architecture was identified today for a federated system to interconnect all weapon systems, rolling out that architecture would involve new programs and modifications to nearly every existing system in the Air Force. An endeavor of that scale takes a fair amount of time, and that timescale could be sufficiently long that the evolution of technologies, threats, and CONOPS would change enough to make the architecture obsolete. Interface standards in information technology devices are a good example. Many well-intentioned standards are obsolete within years as devices get smaller than the proposed standard interface and the nature of information desired for transmission changes. The key lesson that C4I illustrates in regard to practical considerations is that the problem should not be framed in a way that is too large to be implemented in a relevant time frame. In practice, AFWIC will be drawing on and coordinating expertise from outside its own ranks to focus on problem framing and the facilitation of conceptual and design processes that lead to more-robust Air Force–wide solutions.

Summary of Insights Gained from the Examples

A poorly framed problem for AFWIC could lead to unproductive outcomes and ineffective use of precious AFWIC resources. The problems need to be framed such that AFWIC is the right body to do the work; that is, a centralized, enterprisewide, integrated capability is the right venue. The problems also should be framed to capture the critical trades the Air Force faces, avoiding the presentation of problems that presuppose a solution best found by analysis. Finally, the problems need to be framed in a way that bounds their scope, enabling the outcomes to be executable.

7. Summary of Findings and Recommendations to Guide Implementation

In Chapters 4 and 5, we propose a roadmap for AFWIC's analysis and a slate of product elements (summarized in Figure 5.2 in Chapter 5) intended to capture AFWIC's coordinating, analytical, and integrating roles across the Air Force planning and programming enterprise. AFWIC's primary analytical products will carry the weight of supporting technically credible and well-reasoned future force design options and associated investment, divestment, and capability development recommendations. AFWIC has the further task of communicating the rationale for its recommendations in ways that will be clear and persuasive to high-level audiences, including those internal to the Air Force and DoD and, through the SECAF and CSAF, to OMB and Congress. In Chapter 6, we use the examples of PNT and C4I to illustrate the importance of AFWIC's problem framing step and the kinds of framing and scoping issues that AFWIC will need to confront as it conducts its analyses.

In this chapter, we summarize our key findings and offer recommendations on how AFWIC could move forward on implementation and make progress in fulfilling its distinctive mission.

Finding 1: The Role of Senior Leadership

The success of enterprise-level future concept development requires advocacy by—and continuous engagement with—the highest levels of senior leadership, including the SECAF, CSAF, and VCSAF. This finding draws on our historical analysis of Air Force experience with earlier AFWIC-like efforts (see Appendix B) and from our interviews with current and former officials in the other services (see Appendix D).

Recommendations

To partially address finding 1, we recommend the following:

- **AFWIC should have frequent, direct access to the SECAF, CSAF, and VCSAF.** The meeting agenda should include discussion and approval of AFWIC problem framing, acceptance of all assumptions used in AFWIC analysis, and an expression of the

confidence of senior leaders in all methods and analytical tools. These meetings should be vigorous discussions of substance, not merely cursory meetings to approve coordinated products. Although senior leaders cannot participate directly in the analysis, the more they are involved in the foundations of the analysis, the more confidence they will have in the results and the more equipped they will be to advocate for those results. The meetings will need to be more frequent than CORONA meetings. Such meetings also will need to be structured more like working meetings. Although senior leaders have enormous demands on their time, the centrality of these activities to the future Air Force should compete for time on their schedules.

- **AFWIC activities should be a discussion topic at all CORONA meetings, with the CSAF leading those the discussions.** Because future CSAFs and VCSAFs will be drawn from the pool of CORONA participants, CORONA engagement will facilitate continuity in these relationships despite changes in senior leadership.
- **The Air Force should consider making AFWIC a direct report to the CSAF, led by a three-star general.** This arrangement would ensure that the CSAF and AFWIC have the necessary engagement, both in substance and frequency. At the same time, a three-star–led AFWIC would change its role from supporting A5 strategy, integration, and requirements functions to an organization independent of the A5. Therefore, it might be difficult to implement under the current HAF structure. An alternative would be for the AFWIC's two-star general to establish a regular meeting with the CSAF.

Finding 2: The Importance of High-Quality Analysis

Significant changes to CONOPs and force structure will elicit institutional resistance, both within and outside the Air Force. The quality of AFWIC's work, the consistency of its analysis, the transparency and timeliness in its consultations, and the ability of its senior leadership to advocate for the results will be critical to its success. Furthermore, results and insights necessarily will come from multiple lines of analysis and evidence, placing a burden on AFWIC to demonstrate what integrated analysis looks like across MAJCOMs and other functions. This finding draws on our historical analysis of Air Force experience with earlier AFWIC-like efforts (see Appendix B) and from prior RAND research (for example, see Kent, 1983; Kent et al., 2008; and Fernandez and Rainey, 2006).

Recommendations

To partially address the consequences of finding 2, we make the following recommendations:

- **AFWIC should aim to become the organization within the Air Force with the highest standards for quality of analysis.** No critique of a proposed future CONOPS or

force structure option should come from a source outside AFWIC that was not already identified and assessed within AFWIC. To do so, AFWIC and its leadership should

  - cultivate a culture of skepticism and introspection within the organization
  - expose AFWIC's ideas to rigorous internal and external reviews that will expose weaknesses in evidence and logic
  - be frank in expressing any uncertainties and limitations of the analyses to senior leadership.

- **The products of the work should be—and should be perceived to be—Air Force products rather than AFWIC products that have been foisted on the MAJCOMs.** To do so, we recommend that

  - AFWIC involve MAJCOM personnel early and often in AFWIC activities so that they have ownership in the process and results; MAJCOMs should not be brought in late in the process for coordination
  - senior leadership create incentives for career development for personnel in AFWIC and those seconded to AFWIC by MAJCOMs to encourage the best talent in the Air Force to work on AFWIC problems and persuade MAJCOMs to contribute to that talent.

- **AFWIC should develop and follow a rigorous process for analysis, interfacing with external organizations, quality assurance, and product production.** We describe a template for such a process in detail in Chapter 4.
- **AFWIC should develop more-sophisticated means of communication to establish connections and credibility with key audiences.** Deliverables for top-level decisionmakers in the Air Force—and those subsequently conveyed by the CSAF to OSD, OMB, and Congress—should be short and visually attractive, with a clear bottom line, and they should clearly indicate the existence of rigorous, transparent, and authoritative analysis to support conclusions and recommendations.

Finding 3: Barriers to Innovation

Large institutions, such as the Air Force, must break down barriers between organizational units and cultures to achieve agreement on innovative, enterprisewide solutions to future problems. This finding draws on studies on organizational design, such as Mintzberg, 1979; Rumelt, 2011; Burton, Obel, and Håkonsson, 2015; and Schein, 2017; and on innovative, high-performance organizations, such as Light, 2005, and Gertner, 2013.

Recommendations

To partially address the consequences of finding 3, we make the following recommendations:

- **AFWIC should be populated by staff with a wide variety of skills representing all disciplines in the Air Force who are selected with an emphasis on independence, innovation, and critical thinking.** To produce truly integrated analyses, the Air Force will need to support AFWIC in finding talent with deep functional expertise paired with a commitment to embracing an enterprisewide, systems view.
- **AFWIC should avoid any internal organizational structure that follows functional or mission boundaries.**
- **AFWIC should avoid physically seating personnel by functional or mission specialties.** This would help discourage a culture of functional or mission association and would foster interdisciplinary interactions.
- **The Air Force should encourage the participation of MAJCOMs in AFWIC analysis.**
- **AFWIC should be selective in its choice of problems.** Topics should force enterprisewide thinking by crossing missions and functional disciplines and should be responsive to both near-term and longer-term decisionmaking needs.

Finding 4: Staying Above the Fray of Current Operations

To successfully address future challenges, CONOPs and force structure options, AFWIC needs to stay above the fray of current operations and work in a time frame beyond the FYDP. However, any solutions identified by AFWIC will need to eventually shape the POM and be plausible enough to gain stakeholder buy-in. These considerations are somewhat in tension with one another and will need to be managed carefully. This finding primarily draws on our historical analysis of Air Force experience with earlier AFWIC-like efforts (see Appendix B) and our interviews with current and former Air Force and other service leaders (see Appendix D).

Recommendations

To partially mitigate the tensions of finding 4, we make the following recommendations:

- **The Air Force should avoid placing AFWIC on a battle rhythm synchronous with the POM cycle.** AFWIC problems are set by the changing military, technological, and political environment that the Air Force must respond to and shape. Its tempo needs to follow those driving factors and should be conducive to consistent, high-quality analysis.
- **AFWIC should provide concrete options for the POM, and all options offered by AFWIC should include assessments of feasibility (e.g., cost, logistics support, sustainment considerations) and potential offsets.**

AFWIC's Challenges

With the establishment of AFWIC, the Air Force renewed its long-standing aspiration to take an enterprisewide, integrated perspective in shaping the future force structure and guiding near-term investment and divestment decisions. In essence, Air Force leaders have asked AFWIC to

- envision the Air Force of the future as capable of responding to highly demanding threats from major power adversaries and less demanding but more-frequent limited threats
- frame and conduct analyses to develop future force options and inform trade-offs in light of future threats and opportunities
- insert a design element into the existing SP3 process with its many (competing) stakeholders and existing products and guidance
- recommend and defend investments and divestments in weapon system platforms, technologies, and enabling functions
- fulfill the above tasks in a manner that is transparent, collaborative, analytically rigorous, understandable, and compelling to internal and external stakeholders.

Generations of Air Force leaders have attempted to achieve these goals, but as our review of Air Force history shows, they have been unable to sustain and institutionalize such enterprises. Like previous efforts, AFWIC faces institutional pressures that make its survival beyond the current leadership cycle challenging. In operational terms, AFWIC is expected to demonstrate its immediate value to Air Force leaders while standing up a new organization with a distinct mission and culture and while developing its own battle rhythm that is synchronized with the SP3 and POM processes. Even stronger institutional forces within the Air Force will challenge AFWIC's ability to put forward and defend options for divestments and investments. As an example of how these challenges might play out in practical terms, MAJCOMs must find ways to handle near-term needs with reduced capacity, having given up staff and billets to AFWIC, while continuing to provide subject-matter expertise to AFWIC.

The implementation path for AFWIC will be filled with conceptual, technological, and bureaucratic challenges, but the potential benefits to national security of a better-focused Air Force investment strategy consonant with new warfighting concepts likely will vastly outweigh the costs of trying to solve the long-range planning problem.

Appendix A: AFWIC CONOPS

The following is a reproduction of AFWIC's CONOPS (USAF, 2018), the final version of which is dated June 26, 2018. The footnotes at the bottom of the page are part of the CONOPS document.

Air Force Warfighting Integration Capability (AFWIC) Concept of Operations (CONOPS)

A more lethal, resilient, and rapidly innovating Joint Force.

National Defense Strategy, 2018

WHY? *"We are emerging from a period of strategic atrophy, aware that our competitive military advantage has been eroding."*[20]

WHAT? *"Long-term strategic competition requires the seamless integration of multiple elements of national power. We have to out-innovate revisionist powers."*[21]

HOW? *"Organize for innovation. Department leaders will adapt their organizational structure to best support the Joint Force . . . or restructure as needed. Streamline rapid, iterative approaches from development to fielding . . . enable design trade-offs in the requirements process."*[22]

The 2018 National Defense Strategy calls for a re-imagined, dynamic Joint Force and a family of systems that is "more lethal, resilient, and rapidly innovating." To transform at the pace necessary to meet the challenges of global competition, as well as operations in a denied environment, the Air Force must develop integrated concepts for how we fight across all domains, a future force design, and capability development guidance that more clearly links Strategy to Planning. We must then use each of these to drive the prioritization of resources to achieve the unified vision. The Air Force Warfighting Integration Capability is how the Air

[20] Summary of the 2018 National Defense Strategy for the United States of America: *Sharpening the American Military's Competitive Edge*, https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf, p. 1.

[21] Ibid, pp. 4–5.

[22] Ibid., pp. 10–11.

Force will answer this challenge to rapidly evolve a more lethal force. This CONOPS describes how the Air Force Warfighting Integration Capability meets these requirements.

Air Force Warfighting Capability (AFWIC)

AFWIC Vision

Drive enterprise-wide integration and future force design enabling the Air Force to rapidly transition into a networked multi-domain 21st Century force.

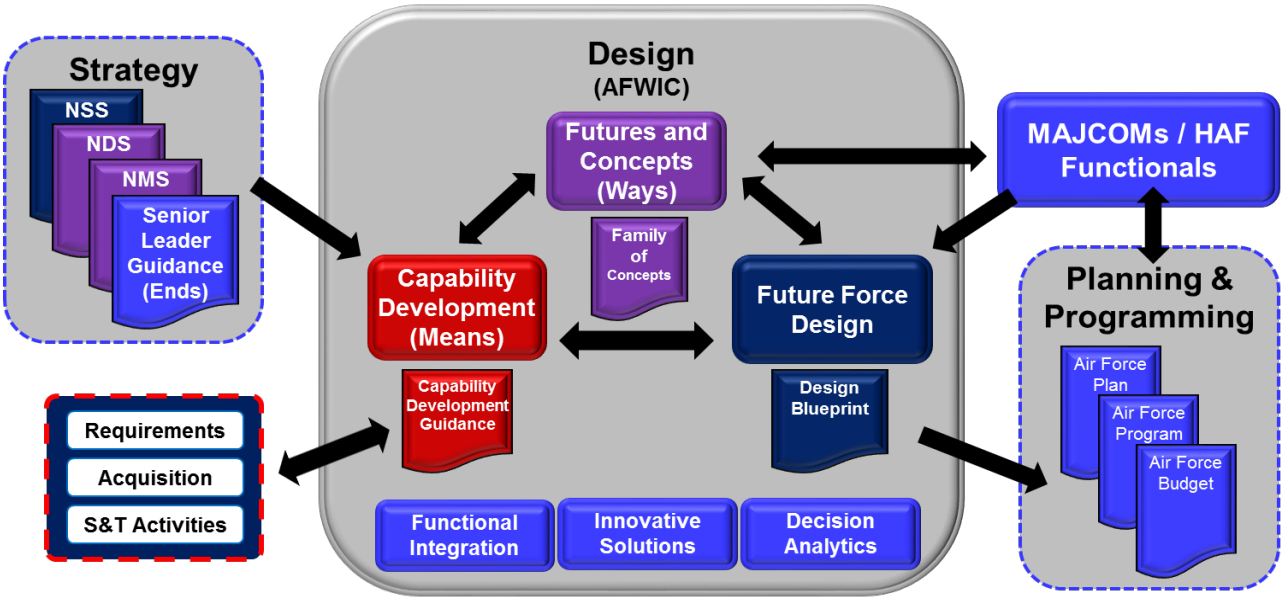
AFWIC Mission

Develop Total Force, multi-domain operating concepts to implement the National Defense Strategy and drive integration through centralized enterprise design and capability planning. AFWIC identifies prioritized ways and means to guide resourcing priorities improving Air Force lethality and enhancing the joint and coalition fight.

CONOPS Summary

Through a process of innovative exploration and concept development, the Air Force Warfighting Integration Capability produces a future force design and capability development guidance that synchronizes acquisition, planning, and programming activities. The Strategy-Planning-Programming-Budgeting-Execution (SPPBE) process is the cycle in which the Air Force Warfighting Integration Capability operates. Importantly, the Air Force Warfighting Integration Capability bridges the current gap between Strategy and Planning by performing the critical future force design function (see Figure A.1) across a 15-year time frame. This activity does not currently occur at the enterprise level of the Air Force.

Figure A.1. AFWIC Process Flow



Key inputs to the Air Force Warfighting Capability include National, Department of Defense, and Air Force senior leader guidance that provide the strategic vectors for the Air Force. AFWIC key outputs, approved by SecAF and CSAF, include an authoritative Family of Concepts, Capability Development Guidance, and a Design Blueprint. The Concepts capture the Air Force's vision for future warfighting within the joint, interagency, and coalition contexts. The Capability Development Guidance is implemented within the requirements, acquisition, and technology processes to drive the development of the capabilities and systems the future force needs to fulfill the Family of Concepts and meet the Design Blueprint. The Blueprint describes the future force we need to fight as an integrated family of systems. It is the direct output of the future force design process and becomes the primary input into the planning and programming processes.

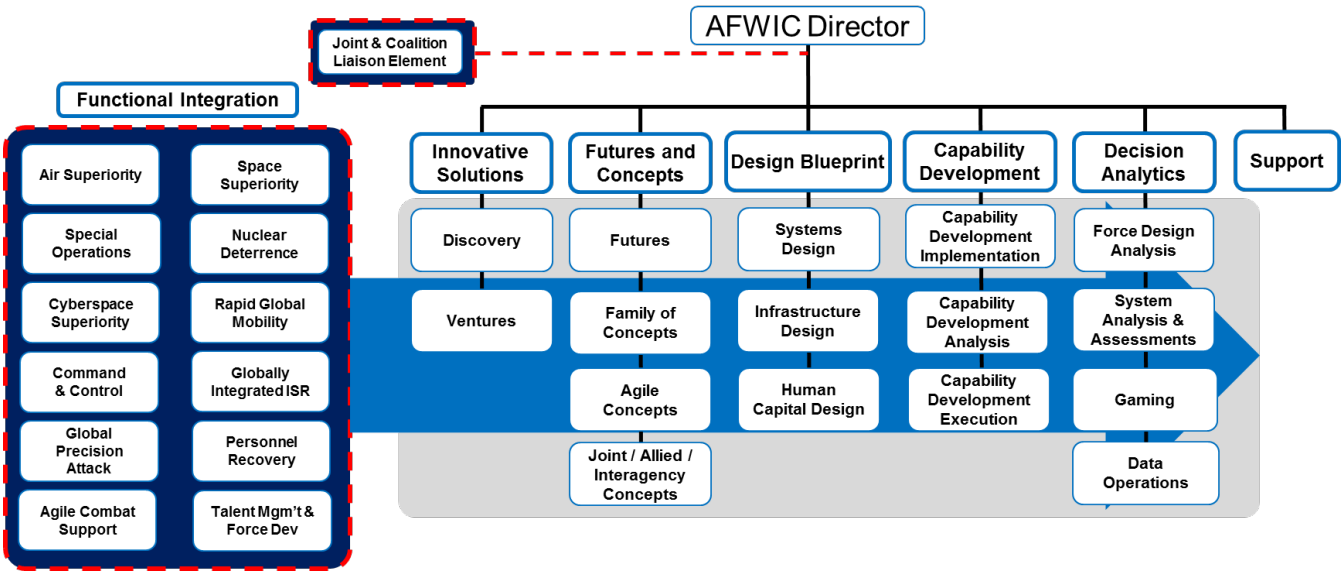
AFWIC will focus on integrated future force design while allowing Major Commands to better focus on readiness and lethality of the joint and coalition force, especially against peer adversaries. Lead Command/Lead Agent, Headquarters Air Force/Secretariat Air Force (HAF/SAF) Functional, and Major Command inputs will remain vital and be provided throughout the entire cycle, but AFWIC will be responsible for designing the future force.

Inside the AFWIC

The Air Force Warfighting Integration Capability operates in an agile and iterative manner with simultaneous inputs/outputs from throughout the enterprise and across all Directorates. The Air Force Warfighting Integration Capability takes advantage of a cross-matrixed structure, with five process directorates, one integration directorate, and a staff function. This allows the organization to apply a holistic perspective and reduce timelines. The Air Force Warfighting Integration Capability's organization construct is illustrated below (Figure A.2).

The Air Force Warfighting Integration Capability's five process directorates—Innovative Solutions, Futures and Concepts, Design Blueprint, Capability Development, and Decision Analytics—provide the core expertise in each of the primary processes. The warfighting and domain experts in the Functional Integration Directorate partner with the process experts to form Design Teams that provide integrated functional expertise and support to continuously work on new and emerging concepts, capability development, and design. These Design Teams leverage the best concepts from previous cross-functional teams and Enterprise Capability Collaboration Teams but implement several key improvements to address their shortfalls. The Air Force Warfighting Integration Capability becomes the primary organization responsible for Design Teams. It will be responsible for both the execution and, unlike previous ad hoc teams, follow-on implementation of the Design Team's work.

Figure A.2. AFWIC Organizational Construct (Notional)



Joint & Coalition Liaison Element: One of the fundamental reasons for establishing the Air Force Warfighting Integration Capability is to drive enterprise-wide integration. That certainly encompasses integration across core missions and functions of the Air Force. But just as critical is the early and deliberate integration of joint and coalition partners. The Air Force Warfighting Integration Capability will establish working relationships with sister services, allies, and partners, and establish a network of liaisons to improve communication and collaboration. The Joint and Coalition Liaison Element (see Figure A.2) will establish a critical and permanent presence inside the Air Force Warfighting Integration Capability, leveraging joint and coalition embeds, to ensure tight linkages and improved integration with joint and coalition partners. This will allow integration at the earliest and most beneficial points, from initial concept development all the way through wargaming and capability development.

Innovative Solutions Directorate (ISD): Informed by senior leader guidance and the Design Capstone Concept and in close partnership with the Secretary of the Air Force's Acquisition, Technology, and Logistics (SAF/AQ) team, the Innovative Solutions Directorate generates and explores high-payoff opportunities and drives the integration of resulting concepts into future force design. The Innovative Solutions Directorate's role is to bridge the gap between operators and the labs, and present prioritized operational needs for Science & Technology, prototyping, and experimentation campaigns to facilitate rapid fielding of emerging technologies. This process of "bridging" is specifically designed to fill the void many leading industries call "the valley of death", which refers to the difficulty in actually transitioning technology into operations. AFWIC is the primary operational representative, and SAF/AQ is the primary technology representative; together, they will focus daily on this function. The directorate establishes linkages to the global innovation community and monitors new developments and technology trends. Specific linkages include the operational community (leveraging the Functional Integration Directorate and the MAJCOMs), the Science & Technology knowledge base (to include Air Force Research Laboratory (AFRL), AFWERX, industry, academia, and other government organizations), commercial innovators, and the Air Force experimentation resources (e.g., AFRL, Strategic Development Planning & Experimentation (SDPE), and MAJCOMs). The Innovative Solutions Directorate will work with the Science & Technology community and the Capability Development Directorate to identify where emerging technologies can be leveraged to fill key operational gaps and facilitate the process of integrating emerging

technologies into existing concepts and designs (the technology "pull" approach). The Innovative Solutions Directorate also works with the technology community to understand when emerging technologies could alter existing operational concepts or drive entirely new operational designs (the technology "push" approach). These outputs both inform the Capability Development Guidance as well as identify viable new concepts based on emerging and demonstrated opportunities that drive the Futures and Concepts Directorate.

Futures and Concepts Directorate (FCD): The Futures and Concepts Directorate establishes the conceptual foundation for the future force design and how the Air Force fights within the joint, interagency, and coalition contexts. The Futures and Concepts Directorate will develop agile, multi-domain concepts to solve emerging challenges and guide the future force. These are presented as an authoritative Family of Concepts (Design Capstone, Operating, and Functional). Approved by the Secretary of the Air Force and the Chief of Staff of the Air Force, these documents define and prioritize the "ways" required to meet the Air Force's future needs. The Design Capstone Concept describes the design vision for the future Air Force, its institutional characteristics, and key attributes to include in design. It lays out the bold vision of the future Air Force that the Air Force Warfighting Capability will design to. The Operating Concept articulates "how the Air Force will fight"—how Air Force capabilities integrate with and employ as part of joint, interagency, and coalition teams to solve future operational challenges. The Functional Concepts articulate in detail how concepts and capabilities merge to enable future operations. Additionally, the Futures and Concepts Directorate directs and guides the development of subordinate concepts from Lead Commands/Agents, and other Air Force organizations. This role is critical to ensuring synchronization and alignment of concepts, roadmaps, and flight plans across the Air Force. Finally, as the Air Force's primary representative for concept development, the Futures and Concepts Directorate, in collaboration with the Joint and Coalition Liaison Element, integrates Air Force concepts into sister service, joint, interagency, and partner nation concept development.

Design Blueprint Directorate (DBD): The Design Blueprint Directorate uses the Family of Concepts as its primary input, but it also integrates inputs from Lead Commands/Lead Agents. The Design Blueprint Directorate's mission is to articulate—in specific detail—what kind of future Air Force the Joint Force needs in order to achieve strategic ends. This Design Blueprint represents a detailed expression of the future total Air Force—people, systems and

infrastructure—across Doctrine, Organization, Materiel, Leadership, Personnel, Facilities, and Policy (DOTMLPF-P). The Design Blueprint considers complimentary international partner air force capabilities in order to ensure mission success and/or mitigate Air Force operational risk. Expressed as risk-based force structure, the Design Blueprint guides and directs capability development and informs resource planning, ultimately influencing programming decisions. In this way, the Design Blueprint Directorate transforms how the Air Force approaches planning by providing the Secretary of the Air Force and the Chief of Staff of the Air Force a way to shape and promulgate a top-level master plan that incorporates their direction into the design of the future Air Force. The Design Blueprint culminates the Air Force Warfighting Integration Capability's contribution to the Strategy, Planning, Programming, Budgeting, Execution cycle and represents the primary output to the Headquarters Air Force Planning community. To remain relevant, the Design Blueprint must adapt to the resource constraints identified in the planning, programming, and acquisition processes. As such, the Design Blueprint Directorate will continuously update the Design Blueprint according to real-world constraints and restraints.

Capability Development Directorate (CDD): The Capability Development Directorate—informed by the Family of Concepts, fed by Innovative Solutions Directorate, and pursuing the realization of the Design Blueprint—prioritizes, sequences, and directs integrated capability development activities to address known capability gaps as well as emerging opportunities. The Capability Development Directorate identifies, plans, and directs those activities that will develop capabilities from concepts into acquisition programs for the future force, to include oversight/tasking of Capability Based Assessments (CBA) and Analysis of Alternatives (AoA). These actions ensure an enterprise-wide, joint and allied force-informed, holistic understanding of future capabilities that guide resource investment priorities. To effectively direct these activities, the Capability Development Directorate produces the Capability Development Guidance, signed annually by the Secretary of the Air Force and the Chief of Staff of the Air Force. This document provides strategic-level Air Force guidance and prioritization to the science and technology, experimentation, and acquisition communities. The Capability Development Directorate closely interfaces with Air Force Requirements (A5R) to support the development of the Joint Capabilities Integration and Development System (JCIDS) requirement documents. Finally, the Capability Development Directorate provides a current assessment of ongoing capability development. This assessment, in coordination with the acquisition

enterprise, identifies tradespace opportunities and ensures consistency with the Design Blueprint. The Capability Development Directorate, in coordination with SAF/AQ, functions as the secretariat for the Vice Chief of Staff of the Air Force-chaired Capability Development Council providing more directive guidance and executive coordination of future force design decisions across the blueprint and ensuring alignment of capability development efforts with the future force design.

Decision Analytics Directorate (DAD): As the other directorates execute their missions, the Decision Analytics Directorate collaborates with them to provide the analytical rigor and decision-quality assessments required to underpin all Air Force Warfighting Integration Capability products. The Decision Analytics Directorate serves as a forum where analysts, assessors, and wargamers confer over their Air Force Warfighting Capability-wide tasks and bring their collective experience and expertise to bear on Air Force Warfighting Integration Capability challenges. Because the Air Force Warfighting Integration Capability is the bridge between strategy and planning, it drives new analytic needs, as well as new requirements for existing types of analysis, beyond those currently conducted in other areas in the Air Force. The Decision Analytics Directorate leverages existing capabilities across the enterprise to include AF/A9, Air Force Life Cycle Management Center, and others, but will apply new analytic approaches to address concepts and capabilities as an organic part of the Air Force Warfighting Integration Capability organization. Air Force Warfighting Integration Capability conducts activities like weekly "concept runs" that rapidly explore new concepts and capabilities. These require new tools and approaches to include adaptive wargaming, systems analysis, strategic vector assessments, as well as campaign and mission analyses that can be executed rapidly, rather than annually. The Decision Analytics Directorate also provides the core repository for Air Force Warfighting Integration Capability data, enabling data analytics in support of Air Force Warfighting Integration Capability-wide activities.

Functional Integration Directorate (FID): Finally, within the Air Force Warfighting Integration Capability, perhaps the most unique directorate is the Functional Integration Directorate. The Functional Integration Directorate is at the very heart of the Air Force Warfighting Integration Capability's mission, responsible for fusing multi-domain and cross-functional concepts into everything that the Air Force Warfighting Integration Capability does. The Functional Integration Directorate is the integration engine of the Air Force Warfighting

Integration Capability (see Figure A.2). This gathering of operational specialists from across the Air Force's core missions and key functions supports the Air Force Warfighting Integration Capability process directorates with a diverse mix of functional expertise. Whereas previously, integration occurred at the four-star level, and after independent plans, concepts, and budgets were already built, the Functional Integration Directorate integrates at the earliest and lowest possible levels, driving integration at the very beginning of concept development and future force design. The Functional Integration Directorate has three key responsibilities and functions:

1) Key Focal Point for MAJCOM/Panel integration. The Functional Integration Directorate, organized along core functions similar to the Planning and Programming Panels, will be the key interface throughout the process of shepherding Design into Planning and Programming. Team members will have daily interface with the Panels and will sit as representatives of the Air Force Warfighting Integration Capability on all Planning and Programming Corporate Structure activities. The Functional Integration Directorate will also serve as the key linchpin between the work of the Air Force Warfighting Integration Capability and the MAJCOMs. To ensure MAJCOMs have a clear point of injection into the Air Force Warfighting Integration Capability and all of its processes, the Functional Integration Directorate members will maintain close and direct coordination with the MAJCOMs across the Air Force Warfighting Integration Capability's mission portfolio and must stay abreast of all MAJCOM capability development efforts.

2) Subject Matter Expertise to the Air Force Warfighting Integration Capability's process directorates. The process directorates, such as the Futures and Concepts Directorate, and the Capability Development Directorate, are primarily focused on delivery of key products such as the Family of Concepts and Capability Development Guidance. Necessarily, they are comprised of key experts in those processes. They will require subject-matter experts to participate in agile concept development, wargaming, experimentation, red teams, capability development assessments, etc. The Functional Integration Directorate is the standing organization that provides operator/warfighter expertise in each of these cases. Specifically organized to reduce overall manpower needs, and reduce the demand on MAJCOMs, rather than placing subject-matter experts in each process division, the Functional Integration Directorate uses its manpower to matrix across multiple activities within the Air Force Warfighting Integration Capability simultaneously to ensure maximum manpower efficiency.

3) Design Team Execution and Implementation. As previously described, one of the key missions of the Air Force Warfighting Integration Capability is to run the Air Force's Design Teams. The Functional Integration Directorate is the primary manpower pool for forming and executing Design Teams. At Final Operational Capability, the Air Force Warfighting Integration Capability will be able to simultaneously execute multiple Design Teams with the Functional Integration Directorate as the primary source of manpower. The Design Teams may last in duration from weeks to months, and will focus on solving the most important, enterprise-wide problems of the future Air Force. The biggest advantage of the Design Teams is that, unlike previous efforts, once a Design Team completes its work and publishes an action plan, the members of the Functional Integration Directorate will be responsible for shepherding and tracking the implementation activities through final completion. This will require a significant manpower investment but was one of the key shortcomings of previous efforts like Enterprise Capability Collaboration Teams.

Partnerships and Alignment

While the internal organization of the Air Force Warfighting Integration Capability will be essential to success, Air Force Warfighting Integration Capability's external relationships with HAF/SAF Functionals, MAJCOMs, and outside organizations will be critical. The MAJCOMs provide key inputs at each phase of the future force design process, from the initiation of the Family of Concepts, through the development of the Capability Development Guidance and the Design Blueprint. MAJCOMs will also provide initial billets and personnel to establish the Functional Integration Directorate, which is composed of representatives from each of the traditional Service Core Functions. MAJCOMs will also be afforded an opportunity to embed Liaison Officers (LNOs) within the Air Force Warfighting Integration Capability. The key concept with respect to the MAJCOMs is to be as open, transparent, and collaborative as possible, leveraging MAJCOM subject-matter expert talent and senior leadership perspectives at key points.

AFWIC must stay aligned with Air Force Strategy (A5S) team; close partnership is key to defining the right future "ends" towards which the Air Force will drive. Similarly, close alignment with the Joint Capabilities Integration and Development System team—managed by Air Force Requirements (A5R)—is also critical, as the Capability Development Guidance drives

the development and fielding of specific systems requirements through the Air Force Requirements (A5R) Air Force Requirements Oversight Council and Joint Requirements Oversight Council processes. The Air Force Warfighting Integration Capability's delivery of the Design Blueprint to the Planners is a critical activity. The intent of the Air Force Warfighting Integration Capability mission will be realized if the overall organizational alignment ensures that the Design Blueprint is correspondingly planned and programmed. For this reason, the activity between the Air Force Warfighting Integration Capability and the Air Force Planners (A8X) and Air Force Programmers (A8P) will be iterative, collaborative, and fully teamed. Finally, to help realize the National Defense Strategy vision of seamless integration of multiple elements of national power, the Air Force Warfighting Integration Capability will incorporate concepts and capabilities from joint, interagency, and partner nation forces into Air Force design.

Summary

This CONOPS defines the overall alignment of the Strategy-Planning-Programming-Budgeting-Execution cycle in which the Air Force Warfighting Integration Capability fills a key design void with respect to previous processes. It clearly articulates the Air Force Warfighting Integration Capability's scope of responsibility, internal processes, its inputs and outputs, and the relationships of key elements both internally and across the broader Air Force Corporate Structure. The Air Force Warfighting Integration Capability drives enterprise-wide integration and alignment across a 15-year time frame. The Air Force Warfighting Integration Capability's centralized future force design establishes a singular Air Force blueprint and sets priorities for investment. The Air Force Warfighting Integration Capability's capability development functions address our previously stovepiped modernization processes and provide clear priorities for the acquisition and technology development communities. Together, these processes and activities allow the Air Force to more clearly and consistently articulate our design and priorities with a single voice and transform into a truly networked multi-domain force.

Appendix B: The History of Air Force Long-Range Force Planning

In this appendix, we provide a chronological overview of the Air Force's earlier attempts to develop and sustain long-range planning processes. From this history, the PAF team extracted findings that are summarized in Chapter 2 that, in conjunction with other lines of evidence (e.g., interviews with current and former officials, a review of guidance documents and other published literature), inform our recommendations.

USAF Long-Range Planning and Capability Development in the 1970s–1980s: A Survey of Selected Efforts

Air Staff Planning Efforts

In 1977, SECAF John Stetson chartered a study group to examine institutionalizing long-range planning in the USAF. This group had three objectives:

1. study the long-range planning practices across the government and throughout industry and determine the feasibility of adapting these practices and processes for use in the Air Force
2. develop a process for institutionalizing long-range planning
3. identify threats and opportunities for the Air Force 20 years into the future.

The study resulted in the establishment of the USAF's first *institutionalized* long-range planning effort (Cohen, 2017, p. 20) in the form of the Deputy Directorate for Long-Range Planning within the Directorate of Plans in 1979 (Smith et al., 1987, p. 33). This directorate, originally staffed by about a dozen officers led by a colonel, had regular interaction with the SECAF and Gen Lew Allen (CSAF, 1978–1982).

During the first year of this effort,

> The Long-Range Planning Division members, along with the Director of Plans (a major general), meet privately with the Secretary . . . and . . . Chief of Staff each month and address a specific long-range planning issue. . . . After a 20- to 30-minute briefing, a number of "candidate strategies" are suggested. The Chief and the Secretary are asked to pick the strategy with which they are most comfortable. The long-range planners take this guidance and enter the suggestions . . . into the regular planning process (Smith et al., 1987, p. 10).

The products from the first year of this planning process were the USAF Global Assessment and the PGM (Smith et al., 1987, p. 10). The USAF Global Assessment looked 15 to 20 years into the future and was intended to explain the background data used in the PGM, "bring long-range considerations to bear on the current planning process," and inspire debate about how to achieve the long-term goals of the USAF (Smith et al., 1987, p. 34). The resulting document was quite long, about 200 pages, and many of the planners themselves did not read it in its entirety (Smith et al., 1987, p. 34). However, it served primarily as a reference document for the much shorter (10–12 page) PGM. The PGM memorialized the leadership's priorities for planning based on the results of discussions between the long-range planners and leadership over the course of the first year of the planning process.

These documents informed a suite of products that prioritized the capabilities needed for the USAF to succeed in its missions with an aim to provide "a well-reasoned, long-range planning perspective" to the POM process (Smith et al., 1987, p. 35). Once these products were created, the planners went to each of the MAJCOM staffs and briefed them on the contents. Although reactions to the briefing were positive, the MAJCOMs did not display much interest or support. Therefore, "Air Force long-range planning ended its first year as a process largely isolated in Washington" (Smith et al., 1987, p. 36).

In late 1980, in the context of an Air Staff reorganization, the Deputy Directorate for Long-Range Planning was eliminated and the long-range planning function was realigned under a Deputy Directorate for Planning Integration in the Office of the Deputy Chief of Staff for Plans and Operations. This reorganization was intended to strengthen the link between long-range planning and the DoD PPBE cycle. However, the only change in the office's functions was to formally coordinate long-range plans with the MAJCOMs. After this transition, exchanges with the USAF leadership continued to occur, but did so less frequently. The documents produced, based on input from SECAF Hans Mark and Allen, were intended to serve as the "point of departure for the POM process" (Whiting and Dale, 1996, p. 35). In 1981, the main product from the long-range planning process was renamed the "Consolidated USAF Global Assessment" and was slated to be published only once every four years; it was to be kept current via annual supplements (Whiting and Dale, 1996, p. 35).

Additionally, in the early 1980s, the USAF produced a study called *Air Force 2000*. This study was led by the director of the Deputy Directorate for Planning Integration and was

intended to look at the threat environment 20 years into the future (Whiting and Dale, 1996, p. 36). The resulting report "called for investments in three major priorities—stealth, precision, and reliability" (Cohen, 2017, p. 20). Stealth and precision were clearly operationalized in the 1990s with the F-117 (unveiled in the opening minutes of Desert Storm) and with weapons guided by GPS. Additional long-range planning efforts continued throughout the 1980s, such as Project Forecast II, although it appears that little came of them. It is unclear, based on the literature, what exactly came of these various efforts because no details are provided about their eventual demise (Whiting and Dale, 1996, p. 36).

Air Force Systems Command Planning Efforts: Project Vanguard

While the Air Staff was implementing its long-range planning process, in late 1978, Gen Alton D. Slay, commander of the Air Force Systems Command (AFSC), established a new development planning process within AFSC called Project Vanguard (Weishoff, 1990, p. 39). This effort was intended to "relate user requirements, threat, and current and future force structure into future weapon systems concepts to increase the nation's warfighting capability" (Weishoff, 1990, p. 76).

The planning process was divided into two parts. The first part was focused on acquisition and on the approach of identifying user requirements and then determining the systems, plans, and costs needed to meet these requirements. The second part was technology-driven and focused on coordinating R&D within the Air Force with a particular emphasis on exploratory development and advanced development. The planners also attempted to provide links among the users (COCOMs), the S&T community, and the acquisition community (National Research Council, 2014, p. 14). The concept behind Project Vanguard " . . . was based on the premise that a good planning system should . . . analyze available capabilities and compare them with what is required; it should synthesize programs to make up the difference; and it should provide a means for integrating these programs into a cohesive, meaningful whole which is tied to the real world of equipment and operations" (USAF, 1979; quoted in Weishoff, 1990, p. 40).

Although little other interaction is recorded between the Air Staff's long-range planning efforts and Project Vanguard, Weishoff, 1990, p. 40, states that "the Vanguard process basically started where the HQ Air Force process left off with the [USAF Global Assessment] and the PGM." However, it is not clear whether the AFSC and Air Staff efforts were part of the same

process. These two documents, along with such plans as the Air Force Strategic Planning Guide and the Joint Strategic Planning Document, were used as inputs. The overall requirements pull part of the process

> started by reviewing the [input] planning documents to determine national objectives, future directions, and projected threats. These factors were analyzed . . . to develop a future force structure that would counter the threat and [meet] the operational objectives. This future force structure was then compared with the current force structure to identify mission deficiencies. Next, a list of proposed weapon system concepts was developed to significantly reduce or eliminate the state mission deficiencies (Weishoff, 1990, pp. 40–42).

This was passed to HQ AFSC, which created a list of "fiscally unconstrained alternative weapons systems concepts" that addressed the various mission deficiencies. This list was constrained within actual budget limitations via an iterative process called *forecast* in order to develop a 20-year investment program intended to "meet operational needs within realistic budget constraints" (Weishoff, 1990, pp. 42–43). The results were presented in a briefing format to a variety of audiences, including relevant MAJCOMs, the HQ AFSC board, and the corporate panel structure at HQ. It also was written up in a Vanguard Planning Summary report (Weishoff, 1990, p. 44).

The Vanguard process did not endure for long enough to have a significant impact. Sources disagree about when the Vanguard planning process met its demise. For example, Raphael Cohen asserts that the process largely fell apart after Gen Slay's retirement in 1981, after which the semiregular face-to-face meetings within AFSC at the four-star level ceased (Cohen, 2017, p. 15). Fredric Weishoff (1990, p. 39) suggests that Vanguard underwent a reorganization in 1981 that weakened it, and under that reorganization, it managed to limp along until 1988 (Weishoff, 1990, p. 76). It should be noted that "Vanguard was an AFSC process and product, and did not influence the long-range planning matters of HQ USAF or the Air Force as a whole" (Weishoff, 1990, p. 76). This lack of enterprisewide leadership involvement—and the lack of a link to long-range planning at the headquarters—certainly contributed to the demise of Vanguard.

Another weak point was that the Vanguard planning process did not have a feedback mechanism to measure planning performance and incorporate lessons learned into the subsequent round of planning. Therefore, with no formalized way to ensure the relevance and sustainability of the effort, over time, "Vanguard deteriorated into a once-a-year, 'update the

previous year's plan' exercise. There was no real correlation and continuity between successive years, very little new mission area analysis, and only a few minor exercises and studies were accomplished" (Weishoff, 1990, p. 78).

In sum, the Air Force undertook several efforts in the late 1970s and through the 1980s to institutionalize long-range planning. None of these efforts at institutionalization had longevity. They were tied to the leaders who initiated them, which made them unable to weather leadership changes over time. They lacked buy-in from leadership across the enterprise, which is critical to both the relevance of these planning efforts and their persistence over time. Without regular meetings of high-level leadership and buy-in from lower echelons, the products of the various planning processes eventually were updated and used less and less frequently. It is curious to note that several efforts in the Air Staff overlapped with efforts from AFSC, but no evidence was found suggesting that these planning efforts were particularly related or linked to each other, especially over time.

A Resurgence in Air Force Long-Range Planning and Capability Development in the 1990s

The demise of the Soviet Union and the planning leading up to the coalition's Desert Storm response to Saddam Hussein's invasion of Kuwait encouraged a renewed focus among Air Force leadership on expressing a single, corporate-level vision of the future Air Force and its *raison d'etre*. In 1990, SECAF Donald Rice penned the *Global Reach—Global Power* white paper, a seminal post–Cold War vision statement that sought to define how the Air Force contributes to national security (Rice, 1990). This became a standard-bearer for future efforts to establish the service's place in the defense of U.S. interests. However, it was not until the mid-1990s that attempts were made to translate the *Global Reach—Global Power* vision into reality in the form of plans and programs.

Fogleman Rejuvenates the Centralized Planning Processes

Following the publication of *Global Reach—Global Power* and subsequent white papers defining the Air Force vision, CSAF Gen Fogleman determined that the Air Force needed to strengthen its ability to conduct centralized, long-range planning—to tie the vision of the future

Air Force to new concepts, capabilities, and programs.[23] At the time, strategic planning was a decentralized activity that resided in the MAJCOMs, precluded cross-function or enterprisewide decisionmaking, and favored MAJCOM-prioritized programs.[24] The MAJCOMs were developing their own mission area plans (MAPs), which were roadmaps for future capabilities that were institutionalized under Gen McPeak. MAJCOM teams, organized around 35 mission areas, would identify shortfalls in capabilities and define how the shortfalls would be ameliorated, often with enhancements to existing systems or through the development of follow-on systems. When Fogleman became CSAF, he noted that the MAJCOM MAPs were "not especially strategic" and that they seemed to focus on "forecasting the need to replace current systems rather than considering how missions might be performed completely differently in the future" (Barzelay and Campbell, 2003, p. 42).[25] The new CSAF believed that the Air Force had lost its innovative edge and he envisioned space as a quickly emerging domain that would become a dominant Air Force mission and influence its culture in subsequent decades (Campbell, 2002, p. 426). According to one former senior Air Force officer,

> We saw that Fogelman started a process of viewing the Air Force as an integrated whole. We thought that was important. Space guys, mobility guys having a chance to talk to each other and understand why we were putting the money where we were. To get the best minds to think about what we ought [to] be doing . . . . One of the problems with MAJCOM commanders is that they don't know all the capabilities that exist (RAND team discussion with a former senior Air Force official, May 2016).

In an October 1995 speech, Fogleman noted that he sought an Air Force vision of the future that would be "an institutional Air Force vision—not my vision, not the long-range planner's vision, but an institutional vision" (Fogleman, 1995). In part, Fogleman's motivation for a common direction for the Air Force originated from external factors, including a debate

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[23] A 1999 RAND report for the Air Force concluded that "current Air Force planning is a highly decentralized process that is conducted within the major commands (MAJCOMs) away from the Air Staff," allowing "no vantage point from which to make Air Force–wide strategic decisions" (Lewis et al., 1999, p. 2). In related, unpublished RAND research conducted in 1996, Leslie Lewis came to similar conclusions. For an in-depth treatment of *Global Reach—Global Power* and other Air Force vision statements, see Cohen, 2017.

[24] See Lewis et al., 1999, pp. 1–5. Gen Merrill McPeak (CSAF, 1990–1994) established a modernization planning process that, although it was dedicated to long-range planning, "at the direction of the AF/XO . . . evolved into a MAJCOM-led process" (Whiting and Dale, 1996, p. 44).

[25] One commonly referenced incident involved an early Fogleman review of a MAP-based plan for a follow-on Airborne Early Warning and Control System (AWACS) that the briefer surmised would be a new dome mounting on a more modern Boeing aircraft. The CSAF asked why the capability might not be based on a space-based sensor in the future, thereby confirming his growing suspicion that the Air Force had lost its penchant for innovation.

over whether space-based capabilities should remain housed in the Air Force, the emergence of unmanned aerial vehicles (UAVs) and the area of information warfare, and the looming start of the congressionally mandated Quadrennial Defense Review (QDR) in 1996 (Barzelay and Campbell, 2003, pp. 39–41). He also based the planning effort on two fundamental principles: *buy-in*, whereby collective support of the strategic vision across the Air Force leadership would be secured to ensure successful implementation of future concepts, and *backcasting* from the future, a term Fogleman coined. Buy-in by key stakeholders to the planning process and methodology would lead to broad understanding and acceptance of the outcomes. As one former senior Air Force official noted,

> I think the process is very important. You gotta hear everybody out [o]r somebody will be shooting at you. You have to have the opportunity to [hash] stuff out. In the military, everyone knows that a decision will eventually be made. But everyone must think they had a fair shot at influencing the decision (RAND team discussion with a former senior Air Force official, May 2016).

Backcasting involved planners using wargames and other tools and settings to formulate a concept of the world's challenges and opportunities in the future and "backcast[ing] from [that] future" to provide a basis for making near-term decisions and identifying trade-offs. This was distinct from the prevailing method of "forecasting from the present"—merely extending the existing programming horizon to account for the future spending implications of current policies and objectives (Barzelay and Campbell, 2003, pp. 42–43). Finally, Fogleman was determined that strategic planning be connected explicitly to programming; he often remarked that "if it ain't in the POM, it ain't."[26]

In September 1995, Fogleman tapped Maj Gen John Gordon to become his Special Assistant for Long Range Planning (AF/LR) to begin to address a perceived lack of a shared long-range vision, a stovepiped, bottom-up planning process focused on the MAJCOMs, and functional and organizational misalignment between planning and resource allocation (Gandy, 2012, p. 2).[27] Gordon was tasked with "developing an institutionalized long-range process and a new Air Force vision for the year 2025 within 18 months," after which the Air Staff would

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[26] Quoted in Murdock, 2002, p. 11. Clark Murdock was deputy of the Air Staff's long-range planning function (in its various incarnations) from 1995 to 2000 and was intimately involved with these internal deliberations and efforts under Gen Fogleman and Gen Ryan.

[27] Gordon was soon tapped for a senior position in the CIA; his replacement, Maj Gen Robert Linhardt, died of a heart attack a few months later and was succeeded by Maj Gen David McIlvoy.

assume responsibility for long-range planning in the Air Force (Whiting and Dale, 1996, p. 49). The 30-year time horizon was criticized for adding overbearing complexity to the backcasting effort, for being too ambitious, and for having a "giggle factor."[28] Fogleman soon scaled back the horizon to 25 years so that "even the average airman could understand and visualize" it (Campbell, 2002, p. 439; Barzelay and Campbell, 2003, p. 48).

Soon after the AF/LR standup, at the fall 1995 CORONA, Fogleman decided that the CORONA scheduled for the following October would be "devoted to long-range planning and [would] consist of a guided discussion of key issues facing the Air Force" (quoted in Murdock, 2002, p. 9). The preparation for the fall 1996 CORONA led to multiple outcomes that helped solidify the institutionalization of long-range planning, at least during Fogleman's term, and that carried over into the term of Gen Michael Ryan (CSAF, 1997–2001).

A key outcome was establishment of a Long-Range Planning Board of Directors (BoD), which was chaired by the Vice Chief of Staff (then Gen Thomas Moorman) and attended by the three-star vice commanders of the MAJCOMs, whose presence was mandatory. The role of the BoD, which met in several sessions over two to three days each, was to identify the key strategic issues facing the Air Force and, in consultation with the CSAF, prepare the issues for discussion at the fall 1996 CORONA (Campbell, 2002, pp. 440–441). The CORONA was extended from the normal three days to five to ensure sufficient treatment of the final list of 16 strategic issues, each of which was addressed in a ten-page CORONA Issue Paper (CIP) that included critical assumptions, options (with pros and cons), and key transition and integration challenges (Murdock, 2002, p. 10).

AF/LR's primary focus during this period was on developing the candidate issues and supporting analyses that the BoD presented at CORONA (Murdock, 2002, p. 9). The office also created several supporting analytic constructs, which included

> Future Seminar Games for the BoD, 10 Future Operating Environments as a surrogate for Alternative Futures, a 2025 Military Toolbox of future concepts for capabilities from both the MAPs and elsewhere, . . . a Capabilities Matrix for scoring the effectiveness of these capabilities, and a methodology for comparing the cost-effectiveness of future Alternative Air Forces (Murdock, 2002, p. 9).

[28] The "giggle factor" refers to a criticism that the time horizon was so far in the future that it would lead to predictions that were difficult for many to believe and therefore plan against.

The CIPs and fall 1996 CORONA discussions formed the basis of strategic guidance and institutionalization decisions. A month after CORONA, Fogleman and SECAF Sheila Widnall released *Global Engagement: A Vision for the 21st Century Air Force*, which was seen as a benchmark and basis for post–Cold War Air Force strategic planning (Cohen, 2017, p. 34). This new vision statement was notable in that it was not just a product of the CSAF and SECAF, but it "was institutionally grounded . . . [and] reflected an intense, nine-month effort by the second-tier leadership" in the form of the BoD sessions supported by AF/LR framing and analysis (Murdock, 2001, p. 16). In addition, Fogleman directed a reorganization of the Air Staff that removed the planning function from the Deputy Chief of Staff for Plans and Operations (AF/XO; renamed Deputy Chief of Staff for Operations) and folded it under a new Deputy Chief of Staff for Plans and Programs (AF/XP). A primary justification for this reorganization was to prevent the longer-range view from competing with the natural focus on current operations, which would take precedence when housed in the same organization.[29]

Following the fall 1996 CORONA, AF/XPX led an effort to develop the Air Force *Long-Range Plan*, which would constitute guidance on the initial steps the Air Force would take to implement *Global Engagement* according to the decisions made at CORONA. In fact, *Global Engagement* stated that

> [t]he Long-Range Plan will identify those initial steps and transition decisions [that] are necessary to reach the goals outlined in this strategic vision document. Transition decisions are critical to formulating meaningful divestment and investment strategies, to making transitions from sunset to sunrise systems and capabilities, and to providing the milestones and feedback mechanisms that ensure accountability. The Long-Range Plan will further guide the Air Force's other planning and resource allocation processes (Fogleman and Widnall, 1996, p. 17).

Fogleman declared that the plan would "be approved at the next CORONA [which was scheduled for early February 1997] in time to affect the [FY 1998] budget" (quoted in Murdock, 2002, p. 11).

The Air Force released an unclassified summary of the 1997 *Long-Range Plan* to encourage dialogue with industry, think tanks, and other external stakeholders. It identified specific areas in which the Air Force would invest. The summary included directive statements

[29] The first AF/XP was Lt Gen Lawrence Farrell, while AF/LR, under the direction of McIlvoy and his civilian deputy, Clark Murdock, was subsumed under AF/XP and renamed the Directorate of Strategic Plans (AF/XPX).

with end states, tasks for achieving the end state, and assumptions and constraints in each of the 16 strategic issue areas discussed at CORONA. Notably, the summary also identified an office of primary responsibility (OPR) for the overall end state and OPRs for supporting specific tasks (USAF, 1997, pp. 4–21; see also Cohen, 2017, p. 37). The aim of the plan was to provide guidance to planners and concept developers in the Air Staff and MAJCOMs to exploit or generate innovative concepts. It also aimed, through the Annual Planning and Programming Guidance, to provide guidance to the programmers to establish initial wedges and offsets to build toward the new capabilities.

In the end, the development of the *Long-Range Plan*—especially in time for the February 1997 CORONA—proved to be "hasty and poorly coordinated" (Campbell, 2002, p. 442). More fundamentally, however, implementing the end states would prove to be expensive, involving annually increasing wedges of $2 billion in FY 1998 to $8.7 billion in FY 2003, with almost 60 percent of the projected increases going to "future space operations" (Murdock, 2002, p. 17). However, the Air Force could not identify divestitures of legacy systems to offset the increases. The Air Force absorbed an end-strength cut of 35,000 (from about 374,000) through the QDR, but this was not sufficient to pay for the modernization investments; concurrent Air Force readiness and operating tempo problems further constrained the budget environment. In the end, the BoD mandated additional resources for an air and space basic course, space, and UAVs, but left it to the discretion of the programmers to decide how much. According to Murdock (deputy AF/XPX), "the 1997 *Long-Range Plan* lost credibility because most of its 'mini-plans' [to accomplish the end states] were never funded. . . . [T]here is little doubt that long-range planners in the Air Force had lost clout because they failed to ensure that the strategic decisions made during the planning process were actually implemented" (Murdock, 2002, pp. 17–18).

Ryan Continues Fogleman's Pursuit of Centralized Planning Linked to Programming

After Fogleman's early retirement, Ryan sought to continue his predecessor's focus on long-range planning and adopted the structures established during Fogleman's tenure. In fact, Ryan exemplified the buy-in principle that motivated Fogleman: The new CSAF referred to *Global Engagement* and the 1997 *Long-Range Plan* as the Air Force's and corrected those who referred to them as Fogleman's (Campbell, 2002, p. 443). It should be noted, however, that Ryan brought a different focus to strategic planning that centered around the more–near-term and

practical concerns of protecting the readiness and deployability of the Air Force (in this case, through the Expeditionary Air Force construct) at a time when the defense budget was under pressure and the Air Force was being asked to support ongoing operations in Iraq and, later, in Kosovo. Still, Ryan saw great value in the processes that his predecessor had begun and sought to continue the institutionalization of planning and the link to programming.

In practice, though, several factors coalesced during Ryan's tenure that either weakened the existing process or facilitated a return to decentralized planning. The BoD membership also became less exclusive when it was expanded beyond the three-stars to include the Secretariat and political appointees. The expansion reportedly made the military members more cautious in airing their views, while the discussion of sensitive issues was limited because the civilians and appointees from the Secretariat frequently tended to base their contributions on how they thought the SECAF would react (Barzelay and Campbell, 2003, p. 86). Moreover, Ryan initiated a rather "fluid consultative process" by meeting separately with the other four-stars every six to eight weeks to discuss strategic issues, sometimes on a one-on-one basis, thereby making the input of their three-star deputies on the BoD less relevant (Barzelay and Campbell, 2003, p. 88). The BoD was less able "to function as a bridge between the Air Staff and the major commands," and the MAJCOM commanders "thus took less interest in its proceedings" (Barzelay and Campbell, 2003, p. 87). With the BoD operating less effectively and with somewhat diminished relevance, an overworked AF/XPX was forced to tee up strategic issues for the 1999 fall CORONA without the appropriate guidance from the BoD (Barzelay and Campbell, 2003, p. 88). This would not be sustainable because it suggested a staff exercise that negated the original idea of obtaining buy-in from across the enterprise.

Second, follow-on efforts to close the gap between integrated planning (the *Long-Range Plan*) and programming were unsuccessful. In 1998, the Air Staff developed a process for Thrust Area Transformation Plans (TATPs) "to serve as bridges between the core competencies that [*Global Engagement*] specified for the future and the programmatic investments necessary to reach those objectives" (Barzelay and Campbell, 2003, p. 75). Each of the six plans[30] would define desired future capabilities and associated capability targets, identify key decision points

[30] The six thrust areas were Airman of the Future, Seamless Aerospace, F2T2EA (find, fix, track, target, engage, assess), Expeditionary Air Force, Credible Nuclear Deterrent, and Sized Infrastructure (Murdock, 2002, p. 23).

for investment and divestment along a transformation path, and work backward to guide resource allocation in the POM (Murdock, 2002, pp. 21–22). The transformation paths would then be integrated and prioritized across TATPs. However, the TATP process faced resistance and ultimately failed. Murdock, still deputy AF/XPX and an architect of the process, remarked that "the enterprise essentially collapsed of its own weight" because of complexity, dogmatic adherence to the plan, and a lack of consensus over which areas to prioritize. He also noted that building the TATPs was "too ambitious, too resource-intensive, too all-encompassing" (Murdock, 2002, p. 25).

Concurrent Efforts in the 1990s to Operationalize Long-Range Planning

During this period, various initiatives were undertaken to operationalize long-range planning functions to support the pursuit of institutionalization at HQ. Among these initiatives were USAF-commissioned efforts at PAF to define frameworks for linking capabilities to strategic and operational objectives and for pursuing innovation in capability development. These have particular relevance to AFWIC analyses.

One initiative involved the development under Lt Gen Glenn Kent, then at RAND, of the "strategies-to-tasks" framework, which links means (such as weapon systems and operational concepts) and ends (high-level U.S. objectives) (Kent, 1983; Thaler, 1993). As the head of Studies and Analyses advising several Chiefs of Staff in the 1970s, Kent had devised and employed strategies-to-tasks as a structured way of thinking to defend the AWACS, F-15, and C-5 programs, which were under threat of cancellation by Congress. The framework deconstructs high-level national security and defense objectives into more-specific objectives and tasks and requires that end-to-end CONOPS for accomplishing those tasks be defined, assessed, and implemented. It provides a basis for organizing defense planning in an operationally relevant way and forces the planner to link a candidate system or concept to military strategies and national security objectives. Generally, the framework specifies

- *national security objectives* to attain to secure U.S. interests
- *strategies* (in particular, military strategies) to carry out to achieve the national security objectives
- *operational objectives* to achieve that implement the strategies
- *military tasks* to accomplish to achieve the operational objectives
- *force elements and systems* that enable the execution of CONOPS to achieve the various military tasks (Kent et al., 2008, p. 118).

Strategies-to-tasks served as an entry point into other planning constructs that were developed at RAND in the 1990s. At about the same time, Kent was developing and refining a framework for pursuing innovation and modernization in the Air Force and beyond. This framework involved the delineation of several functions for modernizing forces, including

- *strategists* and *definers*, who define the operational challenges that the force needs to address in the future to achieve critical military objectives
- *proponents* and *conceivers*, who define, evaluate, and demonstrate concepts of employment for meeting the operational challenges and CONOPS for accomplishing attending operational objectives and military tasks
- *technologists*, who provide the conceivers with insights into promising new technologies to enable innovative CONOPS
- *acquirers*, who develop and produce new systems to implement CONOPS to be pursued
- *organizers* or *providers*, who organize, equip, train, and sustain forces and incorporate the new systems and concepts into operations
- *deciders* (nominally, the SECAF and CSAF), who oversee all of the above and determine which concepts to demonstrate and implement and who determine the allocation of resources accordingly (Kent and Thaler, 1993, pp. 4–5; Kent et al., 2008, pp. 11–20).

Of greatest relevance to AFWIC are the proponents and conceivers. These functionals must find innovative ways to address the key operational challenges by developing countervailing concepts that are operationally viable and effective, technically feasible, and affordable, and that would enable the Air Force to help achieve operational objectives in the presence of future threats. They also would need to propose new CONOPS to the deciders for demonstration and implementation in the Air Force program.

Kent suggested that these concepts be developed in forums called conceiver action groups (CAGs).[31] These are interdisciplinary groups of operators, technologists, intelligence analysts, development planners, and other experts who can match mission needs with technical opportunities—and produce end-to-end CONOPS to enhance military capabilities. A principal idea is that, among the members of the interdisciplinary group, "operators should be central to conducting concept development. . . . Certainly, an activity with an explicitly operational orientation should be run by persons with operational mindsets" (Kent and Thaler, 1993, p. 10). Kent applied this framework in several contexts, including in developing and advocating the missile launch–detecting Defense Support Program satellite system in the late 1960s and in

[31] These also have been referred to as concept options groups (COGs) or concept action groups (also CAGs).

defining new conventional weapons for the Air Force's attack platforms in the early 1990s (leading to the Joint Direct Attack Munition) (Kent et al., 2008, pp. 160–164, 191–197). A RAND team convened a CAG in early 1998 with members of the military, RAND researchers, and members of other organizations to develop concepts to prevent artillery, mortar, and sniper attacks against designated targets and to maintain persistent surveillance of selected areas (Birkler, Neu, and Kent, 1998).[32]

The 2000s: Air Force Integrated Long-Range Planning Atrophies

The 2000s heralded a period of major change in the national security environment that tended to reduce the USAF's focus on centralized, long-range planning. The terrorist attacks of 9/11 and the subsequent intensive U.S. counterinsurgency operations in Afghanistan and Iraq naturally accounted for the bulk of the leadership's time and attention. One former senior Air Force leader summarized the post–9/11 tension between current demands and long-range planning as follows:

> We were at war. . . . We were fairly consumed with dealing with wartime matters. We did institutionalize the Capability Review and Risk Assessment guidelines. But there was the glare of the immediate situation. It consumed all our time. I spent my time in the [Area of Responsibility] with our folks and getting our capabilities right. And I was constantly working on the combat situation. And then after this we moved straight away into a QDR and a [Base Realignment and Closure] (RAND team discussion with a former senior Air Force official, October 2016).

Although there were attempts to develop the "Air Force story," publish planning documents, and look out to the future beyond the FYDP, Air Force leaders, planners, and analysts were consumed with improving the capability of the Air Force in the current fight to conduct irregular warfare (IW) and fight the "long war"—as counterinsurgency and counterterrorism were termed.[33] This was undertaken at the same time that defense strategy called on the services to be prepared to conduct conventional operations against state adversaries. Severe readiness and

[32] The CAG was referred to as a COG in this context.

[33] RAND researchers were involved in supporting Air Force efforts to define how its IW capabilities could be enhanced and incorporated into the force. See, for example, Mesic et al., 2010. This research was conducted with organized, intensive Air Staff and MAJCOM input and included options to procure aircraft, stand up new organizations, and expand relevant skill sets in the Air Force. It also included the costs of each option for use in the POM and out to 2030.

retention problems emerged; for example, combat pilots had difficulty maintaining currency in their assigned flight requirements during long deployments overseas, while equipment was used at a much faster rate than plans had forecast. Simultaneously, by the early 2010s, partisan budgetary squabbles resulted in Congress passing legislation that placed spending caps on the budget, including for defense, thereby constraining service options and placing trade-offs between current readiness and future modernization in stark relief (Public Law 112-25, 2011).

During this period, although the succession of CSAFs and SECAFs continued to set the direction of the Air Force through white papers, transformation plans, and roadmaps—each with little evident effect on the Air Force program—the processes for planning, concept development, and programming reverted to a more-distributed approach dominated by the four-star MAJCOMs. Late in the decade, the Air Force developed the organizing construct of core functions championed by the MAJCOMs, each with a CFL integrator (normally the MAJCOM commander) who had responsibility for planning and programming.[34] The CFL integrators would draft their own Core Function Master Plans, which would have to be integrated after the fact at the corporate level in developing the Air Force POM.

However, it became clear that an integration function was needed at the corporate level. The creation of the 2015 Strategic Master Plan was motivated in part by a need for "an Air Force–wide single 'master plan' that would rationalize the planning within the core function–specific documents" (Mazarr et al., 2017, p. 62). In addition, the Air Force sought to better integrate concept development by creating the Air Staff CDC, which "establishes strategic objectives for USAF capability development activities, validates the prioritization of capability gaps, directs capability development activities, and serves as the primary USAF decisionmaking body for capability development decisions" (Thaler et al., 2018, p. 21). It was supported by a Capability Development working group whose key role was to ensure that the formulation of new operational concepts at the MAJCOMs incorporated cross-enterprise stakeholders and interests from the outset.

[34] The 12 core functions and related MAJCOM champions were air superiority, C2, global integrated ISR (intelligence, surveillance, and reconnaissance), global precision attack, and personnel recovery operations, all of which were under ACC; space superiority and cyberspace superiority under AFSPC; rapid global mobility under AMC; nuclear deterrence operations under AFGSC; special operations under Air Force Special Operations Command; agile combat support under AFMC; and education and training under Air Education and Training Command (Thaler et al., 2018, p. 10).

Appendix C: Summary of Legacy SP3 Products and Purposes

The documents listed in Table C.1 are largely historical artifacts of prior efforts by the Air Force to shape its long-term approach to strategy, planning, and programming. As of this writing, AFWIC does not own any of these products. Current ownership is noted for those products that are still in use.

Table C.1. Summary of Key SP3 Products and Purposes

Product	Purpose	Lead Organization
AFSEA	A statement produced with inputs from the IC that describes the likely future security environment. The intent of the AFSEA is to set the stage for the environment in which the Air Force must be prepared to operate 20 to 30 years in the future.	Eliminated
AFFOC	A memorandum signed by the SECAF and CSAF designed to provide a vision for how the Air Force will operate in the future environment described in the AFSEA. The vision in the AFFOC is a foundation for other key documents in the SP3 process.	Eliminated
Air Force Strategy	A high-level bridge between the AFSEA and AFFOC and subsequent products in the SP3 that provides directive guidance to functional areas for their future decisionmaking.	AF/A5S
SMP	A document that translates the Air Force strategy into tangible priorities and actions. It provides authoritative planning direction in the form of goals and objectives for servicewide planning and organizational and professional development. It also is designed to align the activities of disparate functional communities across the USAF and provide a mechanism to track progress toward achieving the Air Force Strategy.	Eliminated
Force Development Concepts	A document developed by Air Force planners to explore and advance new ideas for employing Air Force forces. These concepts could be in response to current needs, such as capability gaps; future needs, such as those presented by anti-access area denial (A2AD) threats; or even opportunities. Concepts proven effective often find their way into subsequent revisions to Air Force Strategy.	Eliminated
SPG	A guidance memorandum produced to translate Air Force strategy into planning and resourcing direction for the forthcoming planning cycle.	AF/A8X
30-year RAP	A resource-informed plan highlighting major force structure plans. Shifts in force structure are debated and decided in the process of developing the 30-year RAP, which is constrained by expected top-line budgets for the Air Force. The RAP is a critical product in the SP3, is deliberated through the aforementioned planning choices process, and is fundamental to the directing actions of functional areas in the programming process.	AF/A8X
Ten-Year Integrated Plan	A plan that projects FYDP content another five years into the future to gauge how well the Air Force is moving toward the vision and objective stated in the AFFOC and Air Force Strategy.	AF/A8X
PPG	A guidance memorandum that directs the POM development outcomes of the planning cycle. In response to the PPG, functional communities subsequently would develop and advocate for their budget through the POM process.	AF/A8X

Appendix D: Approaches to Integration by the Other Military Services

This appendix provides background information on other military services' recent experience with integration efforts that was gathered by the PAF team and on which the summary at the end of Chapter 3 is based.

Research Approach

To conduct this assessment, the PAF team consulted internal DoD guidance documents and publicly available (unclassified) guidance documents and sourced media reports. The team also interviewed—on an "off the record" basis—current and past senior civilian DoD staff and military officers with knowledge of the respective services' ongoing integration efforts. As noted in Chapter 3, within each military service, we sought to identify the existence of

- a process driven by clear and consistent guidance reflecting military and civilian leaders' strategy-based priorities
- an independent, objective analytic culture that is able to envision alternative CONOPS and translate cross-domain, joint CONOPS risks and capability shortfalls into investment and divestment options
- a programming culture that is able to convert analytically derived options into a variety of resourcing trades (including major trades) that can be presented to leaders with nonadvocacy-based logic and explicit implications.

Using these criteria as a qualitative measuring stick, we sought interviews with knowledgeable current and former officials to assess the successes and shortcomings of these elements of integration in the military services.

Navy

The Navy's primary integration efforts are strategy-driven resourcing via the Office of the Chief of Naval Operations (OPNAV) staff in the Pentagon. A major product at the start of this process is a guidance document written by the office of the Deputy Chief of Naval Operations (DCNO) for Operations, Plans and Strategy (N3/N5), called the CNOG. Of several service documents the RAND team assessed, including those of the Air Force, the CNOG was the most

explicit in converting strategic objectives into detailed priorities related to a service's missions. The document contains sections on "ends" (Navy strategic objectives with the Joint Force), "ways" (Navy employment of the Joint Force), and "means" (Navy warfighting capabilities with the Joint Force). The Navy warfighting capabilities chapter provides a select and potentially manageable list of priority investment areas. However, because every paragraph in the CNOG is classified, it is not possible to provide examples from the document in this unclassified review (the titles of the sections on ends, ways, and means are unclassified).

Given that all CNOG priorities are classified and that RAND does not have access to the Navy POM submission, we cannot assess the extent to which CNOG priorities are reflected in the Navy program. The RAND team does have access to the FYDP, although the 2020 version was not released within the time frame of this report, but the FYDP is not a pure reflection of Navy priorities because it includes changes to the Navy POM as directed by the Secretary of Defense. OPNAV (specifically, the DCNO for Integration of Capabilities and Resources [N8]), conducts risk assessments comparing the CNOG priorities with iterations of Navy resourcing positions, but the RAND team was unable to ascertain how influential these risk assessments are (interview with a DoD official, September 18, 2018).

Although the CNOG is a valuable document, the Navy has faced a recurring problem: a divergence of vision and strategic priorities between the Secretary of the Navy and the Chief of Naval Operations. For example, during the administration of Barack Obama, Secretary Ray Mabus directed robust resourcing for shipbuilding, while others saw the need for a different balance among modernization; current readiness; and nonplatform capabilities, such as weapons and communications (Cavas, 2016). Also, as discussed below, CNOG priorities are weighed and interpreted by the very influential resource sponsors in OPNAV, who are organized by platform. Overall, the process struggles to generate major resourcing trades in support of integration (interview with a DoD official, September 19, 2018).

A key Navy attempt to better integrate capabilities is end-to-end "kill chains" or, more recently, "kill webs," which identify gaps in executing Navy CONOPS. The kill webs address 24 mission areas, such as air, strike, and amphibious warfare, and attempt to capture all assets, including enablers, that contribute to a kinetic outcome. The kill webs also explore alternative ways to achieve a given result. The kill webs are highly detailed and only a limited number can be updated each year (interview with a former DoD official, December 4, 2018). On the

downside, these products tend to be Department of the Navy–centric and the organization responsible for kill webs—the integration division in the N9, DCNO for Warfare Systems (N9I)—might not have the analytic capability and bureaucratic muscle to set forth and effect major reprogramming resources that potentially result from kill web shortfalls (interview with a DoD official, September 19, 2018).

OPNAV analytic organizations, such as N81, contribute to the kill webs and conduct campaign- and mission-level modeling of platform and weapon capabilities and survivability. However, as with other services, the campaign- and mission-level modeling typically involves limited cross-domain analysis: Weapon performance is well understood, but difficult problems concerning enablers, such as bandwidth availability, might get downplayed (interview with a former DoD official, December 4, 2018). Metrics addressing, for example, intelligence, communications, space, and cyberspace, if even considered, tend to be simple and derived from judgment, although analysis of electronic warfare is more sophisticated. Another critique is that OPNAV has produced too few data analytics products, which can yield important insights on such topics as ship maintenance and aircraft mission capabilities and which contribute to a fact-based integrated program (interview with a DoD official, September 19, 2018). There have been major changes in the way N81's study budget has been constructed, and those changes have the potential of hindering N81's role in generating key resource trades in support of integration (interview with a DoD official, September 18, 2018).

The platform-centric nature of OPNAV is evident in the powerful influence exerted by four two-star resource sponsors in the DCNO Warfare Systems (N9) organization: Expeditionary Warfare (N95), Surface Warfare (N96), Undersea Warfare (N97), and Air Warfare (N98) (interview with a DoD official, September 19, 2018). These resource sponsors own all of the resources for amphibious ships, personnel, operations, maintenance, and procurement along with the surface, air, and submarine Navy. With some variation from year to year, the resource sponsors account for the bulk of the Navy's costs.[35] The resource sponsors manage trades among funding for ship and aircraft acquisition plus their associated personnel, training, supply, maintenance, and other elements of readiness. Without a strong integration function led by the

[35] This information was provided by Irv Blickstein, former Assistant DCNO, Resources, Requirements and Assessments; former director, Acquisition Program Integration, OSD; member of this project team and co-author of this report.

Integration Organization, N9I, the two-star N9 resource sponsors must absorb the cost of cross-domain improvements "out of hide," thus hindering integration. The three-star advocate for capabilities—such as intelligence, C2, cyber and electronic warfare, and the DCNO for Information Dominance (N2/N6)—notably has less budget scope and bureaucratic influence than the N9 leadership in the Navy's POM process.

Overall, the OPNAV process has strong, centrally managed direction, but has been affected by notable differences in strategic priorities at the four-star level and the lack of a strong advocate for integration overall and for enabler funding in particular. Although OPNAV has several fairly robust analytic activities, its platform-oriented budget and culture shape its ability to reenvision CONOPS, prioritize cross-domain investments, and effect major resourcing trades in support of integration.

Marine Corps

The Marine Corps has a top-down, structured process for enterprisewide design that is supported by a strong ethos in integrated air and ground CONOPS. The Marine Corps' approach, the Force Development System, places high importance on concept development (e.g., how the Marine Corps will operate in the future) as a driver of integration in developing capabilities, leadership, doctrine, and test and evaluation. The Marine Corps produces various documents related to operational concepts, including a Capstone Operating Concept; Distributed Maritime Operations; Special Operations Command Integration, Interoperability, and Interdependence; and Multi-Domain Battle.

The Marine Corps Force Development Process kicks off with a campaign of learning, which, according to marines, relies heavily on wargaming, modeling and simulation, lessons learned, experiments, exercises, and studies and analysis. The Marine Corps defines its campaign of learning, which is part of a Capabilities Based Assessment (CBA) process, somewhat enigmatically as "intellectual and physical activities . . . integrated and synchronized using the framework of warfighting challenges to describe the vision and attributes of the future force" (U.S. Marine Corps, 2018b).

CBA integration managers address Joint Capability Areas, such as force support, battlespace awareness, force application, and logistics. The campaign of learning and the CBA work feeds the Joint Capabilities Integration and Development System and the planning portion

of the PPBE system. CBA activities are organized through a warfighting challenge framework that includes such topics as integrating the naval force to fight at and from the sea, conducting information warfare, conducting maneuver warfare, and developing situational understanding. The Marine Corps Combat Development Command and Concept Development & Integration organizations manage most of these activities and co-lead forums on integration, strategic plan synchronization, and future force reviews (U.S. Marine Corps, 2018b).

Although Marine Corps process charts on the Force Development System display a complex array of activities, there are fundamental questions and issues about the link between strategy and resourcing priorities. One issue is how well strategic guidance is translated into Marine Corps planning priorities and whether the Marine Corps has a compelling CONOPS with which to address pacing threats (DoD, 2018). How Marine Corps ground forces, which are traditionally associated with close combat, will feasibly contribute in an anti-access environment is not entirely clear.

Achieving and refining an anti-access strategy and CONOPS appear to be a key focus of Marine Corps analytic activities. For example, the Marine Corps is actively engaged in using wargaming and other analysis to explore logistics and other obstacles in adapting Marine Expeditionary Unit operations to address pacing threats (interview with a RAND staff member, March 3, 2018). It is not yet clear to what extent independent analysis will generate resourcing trades or whether pacing threats will drive more focus on enabling capabilities, such as infrastructure and logistics resiliency, electronic warfare and protection, and communications, compared with the past.

Complicating the advancement of resource trades in support of integration is the Marine Corps' programmatic history of prioritizing manpower levels and current readiness over the modernization of ground forces. Increased ground force capacity and readiness were critical during the major conflicts with Iraq and Afghanistan. To improve effectiveness versus pacing threats, however, the Marine Corps might have to develop and analytically justify major trades that change the balance of resourcing to favor future capabilities.

Army

The Army's new integration approach aims to link concepts and requirements to deliver capabilities faster. The Army has indicated that its existing organizations are too slow and

stovepiped to convert requirements into needed warfare capability. To realize its goals, the Army has created a fourth four-star command expressly to advocate for future modernization and tie together requirements, S&T, and acquisition. This effort was announced only recently and is thus in its early stages, but press reports indicate that it has the full support of both the Secretary of the Army and the Chief of Staff of the Army (Murray, 2018; Freedberg, 2018).

Army Futures Command (AFC) will be headquartered in Austin, Texas, and will access DARPA-like expertise in a high-technology region geographically insulated from the Pentagon. AFC will lead concepts, S&T, and—with the Under Secretary of the Army—the acquisition communities to address emerging capabilities, including hypersonics, artificial intelligence, and robotics.

AFC has established design teams, apparently similar to AFWIC's design teams, to develop requirements and conceptualize, engineer, and produce solutions for eight modernization priorities. However, it is not clear how strategic objectives drive an overarching vision that would link and integrate these separate efforts or how these efforts—individually and as a whole—will relate to joint capabilities. Five of the eight design teams align to powerful branch affiliations (long-range fires, next-generation combat vehicles, future vertical lift, air and missile defense, and soldier lethality). The remaining three are synthetic training environment, networks, and assured PNT. Six of the eight design teams will operate in separate locations throughout the United States. The Army has not announced any key AFC decisions or described the nature of its products, but indicates that it is examining trade space options, starting with the equipment accounts.

As in the case of the Marine Corps, the Army's operations over the past two decades have reflected threats and priorities that are quite different from the threats and priorities faced now and in the near future. After years of fighting counterinsurgency wars and preparing to deter or defeat North Korea (with its large but aging conventional capabilities), the Army must now plan for a modern, anti-access pacing threat. Pacing threats have capabilities that add substantial risk to traditional approaches to close combat, which makes operational innovation and force integration (including joint integration) all the more important.

In a potentially important development, recent articles have indicated that the Futures and Concepts Center in AFC is working on a new multidomain operations concept and hopes to involve other services in solving the multidomain command-and-control problem. The idea is to

conduct wargames and experimentation in the form of simulations and seminars to envision and evaluate future technology and operating concepts. However, given that the technology being considered includes assets that do not currently exist, such as 1,000-mile missiles, high-speed helicopters, robotic logistics, and smart networks, AFC efforts will need to achieve a balance of innovative thinking and achievable options to avoid experimentation for its own sake.

Although AFC's positive publicity indicates its importance to the Army, it must compete in a skilled programmatic culture that has prioritized manpower, force structure, and current readiness over modernization for more than a decade. Compared with the Air Force and Navy, the Army has a smaller acquisition budget, and although it has succeeded in managing incremental upgrades to existing weapon systems, the Army's performance on major modernization has been criticized—specifically, the expenditure of $32 billion on 22 cancelled weapons programs or efforts from 1995 to 2009 (U.S. Army, 2011; Censer, 2011).

The four-star authority of AFC suggests that the integration of future capabilities is a major priority for the Army, but it is too early to assess AFC's accomplishments. It remains to be seen whether the Army will be able to engage its analytic culture and transform a strong tradition of prioritizing force capacity to rebalance the program between force structure and current readiness and new, integrated service and joint capabilities to address the pacing threat.

Summary

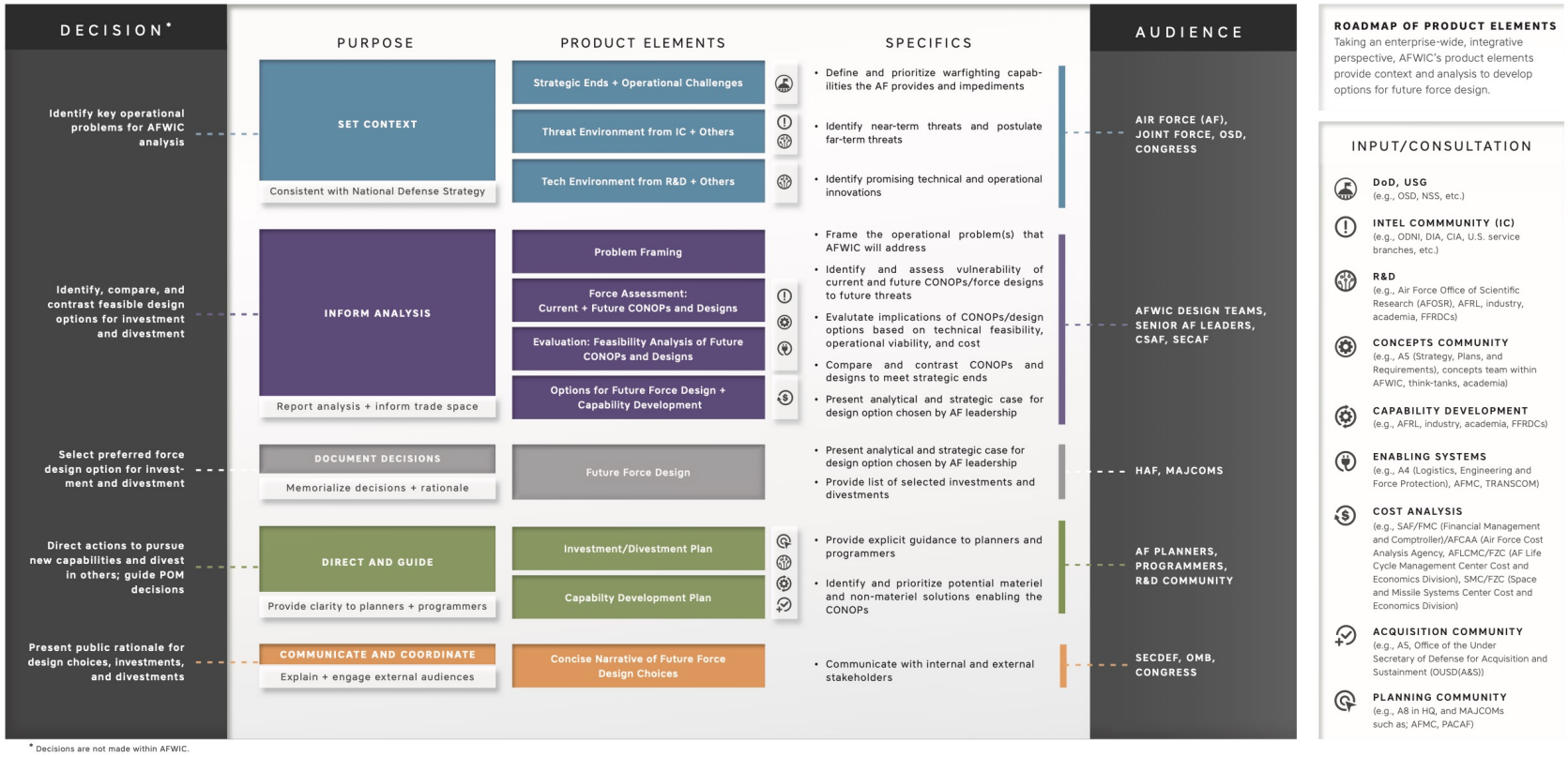
The Navy, Marine Corps, and Army have somewhat different approaches to integration but share the same key challenge of converting strategic guidance into major, analytically defensible investment and divestment options to move beyond legacy approaches and drive a program that is highly focused on anti-access pacing threats. The RAND team assesses that the Navy approach to strategic guidance and kill chains and kill webs is potentially useful to the Air Force, but all three of the services we reviewed face impediments to integration from platform- or branch-centric thinking, emphasis on manpower and current readiness, and/or the need to develop or refine anti-access CONOPS as a unifying driver for investment.

Appendix E: Large-Format Versions of Flow of Analyses and Proposed Product Elements

We provide large-format and more-detailed versions of Figure 4.1, Figure 5.1, and Figure 5.2, as Figure E.1, Figure E.2, and Figure E.3, respectively. They are intended to provide readers with a clear and concise roadmap of our recommendations for AFWIC's analytical products, including the key decisions that the analysis addresses and the variety of consultations that would advance AFWIC's analysis throughout the process.

Figure E.1. Flow of AFWIC's Analyses to Guide Force Design (Large-Format Version)

TABLE E.1. SUMMARY OF AFWIC-RELATED PRODUCT ELEMENTS



* Decisions are not made within AFWIC.

Figure E.2. Relationship of Product Elements to Analytical Steps (Large-Format Version)

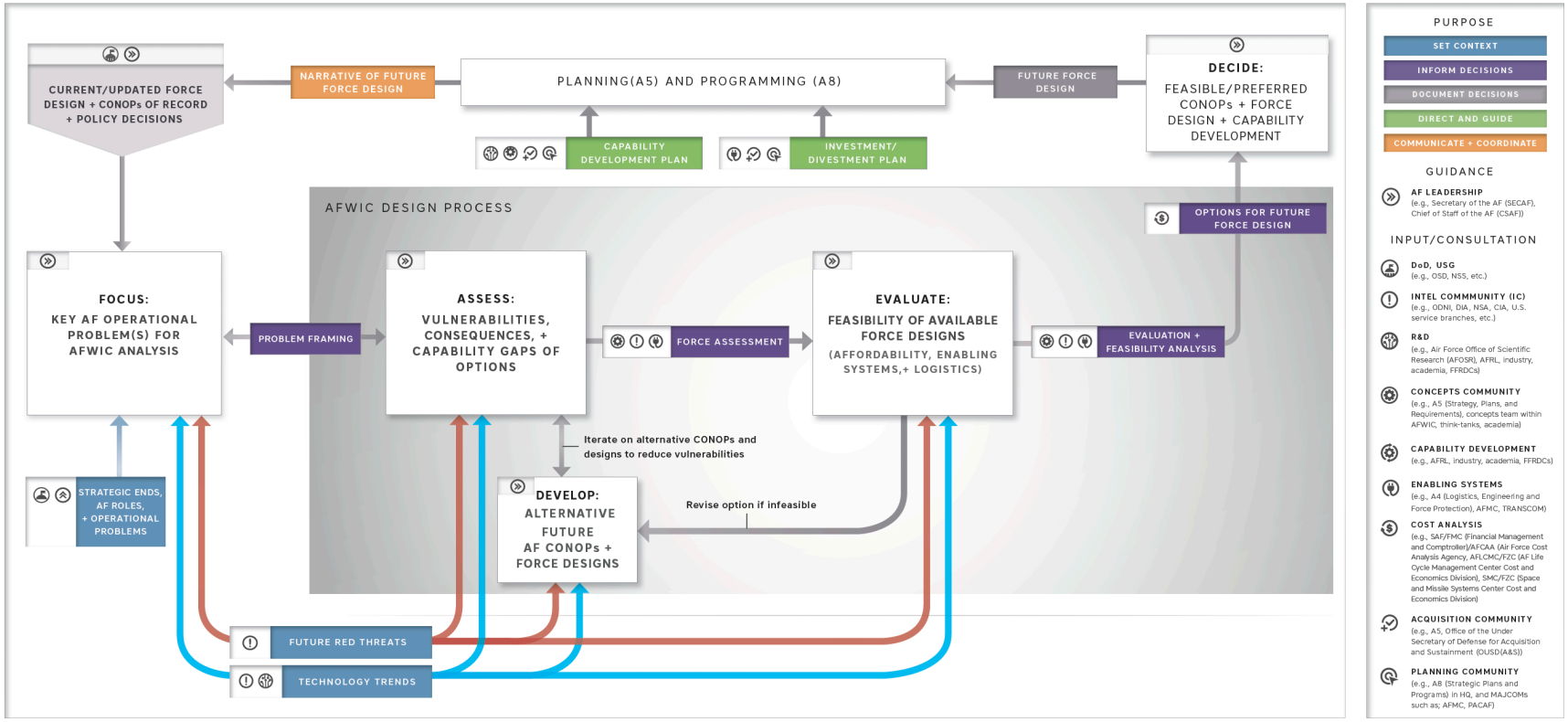
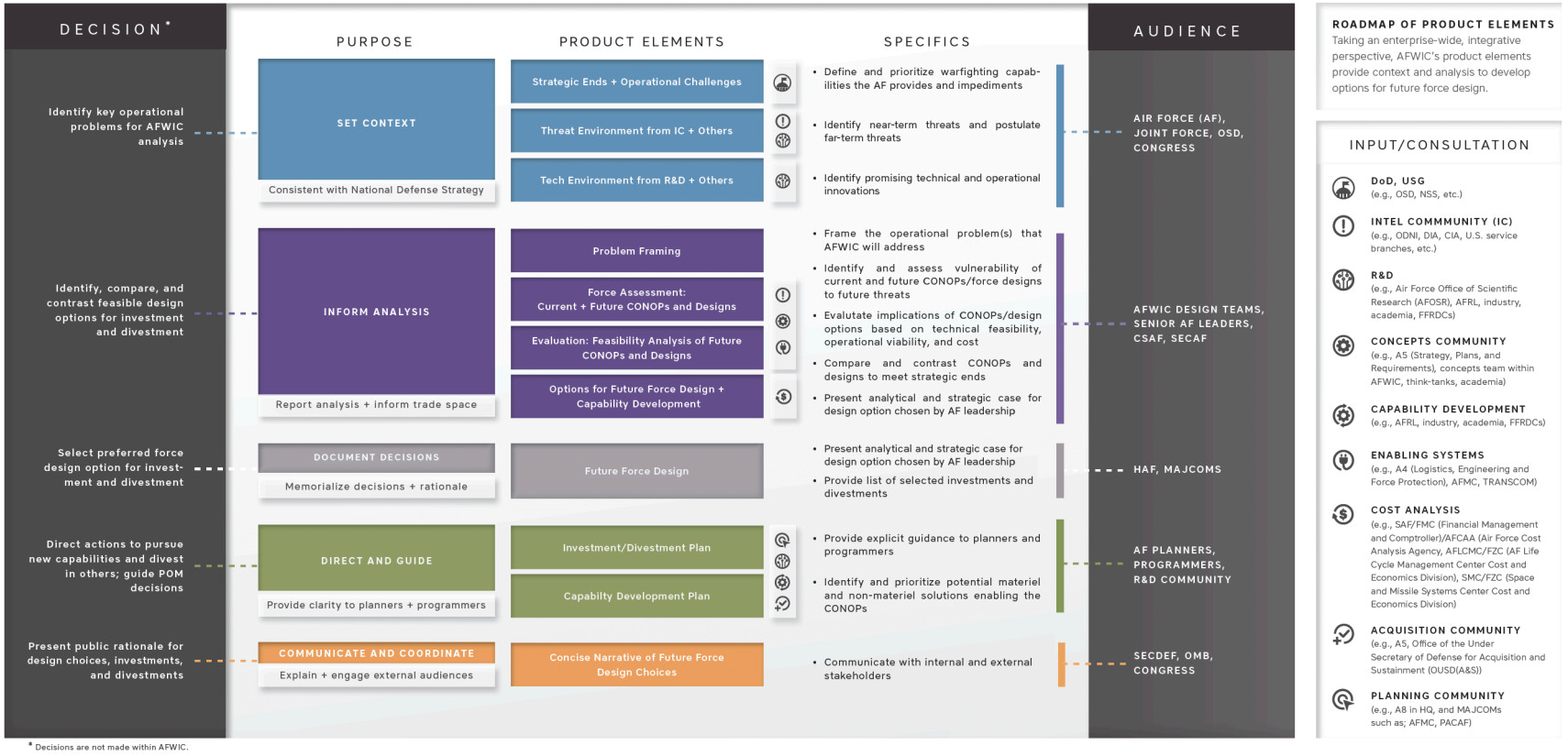


Figure E.3. Summary of AFWIC-Related Product Elements (Large-Format Version)



References

AFWIC—*See* Air Force Warfighting Capability.

Air Force Warfighting Capability, "AFWIC: Corona South '18," briefing presented at CORONA South, Maxwell Air Force Base, Ala., February 25–28, 2018.

Barzelay, Michael, and Colin Campbell, *Preparing for the Future: Strategic Planning in the U.S. Air Force*, Washington, D.C.: Brookings Institution Press, 2003.

Birkler, John, C. Richard Neu, and Glenn A. Kent, *Gaining New Military Capability: An Experiment in Concept Development*, Santa Monica, Calif.: RAND Corporation, MR-912-OSD, 1998. As of February 25, 2019: https://www.rand.org/pubs/monograph_reports/MR912.html

Boston, Scott, Michael Johnson, Nathan Beauchamp-Mustafaga, and Yvonne K. Crane, *Assessing the Conventional Force Imbalance in Europe: Implications for Countering Russian Local Superiority*, Santa Monica, Calif.: RAND Corporation, RR-2402, 2018. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR2402.html

Burton, Richard M., Børge Obel, and Dorthe Døjbak Håkonsson, *Organizational Design: A Step-by-Step Approach*, 3rd ed., Cambridge, UK: Cambridge University Press, 2015.

Campbell, Colin, "Long-Range Corporate Strategic Planning in Government Organizations: The Case of the U.S. Air Force," *Governance*, Vol. 15, No. 4, October 2002, pp. 425–453.

Cavas, Christopher P., "Defense, Navy Secretaries Spar Over Budget," *Defense News,* December 8, 2016. As of February 19, 2019: https://www.defensenews.com/naval/2016/12/09/defense-navy-secretaries-spar-over-budget/

Censer, Marjorie, "Army Report: Military Has Spent $32 Billion Since '95 on Abandoned Weapons Programs," *Washington Post*, May 27, 2011. As of July 9, 2019: https://www.washingtonpost.com/business/capitalbusiness/army-report-military-has-spent-32-billion-since-97-on-abandoned-weapons-programs/2011/05/23/AGwuqjCH_story.html

Clark, Colin, "'Rolling the Marble:' BG Saltzman on Air Force's Multi-Domain C2 System," *Breaking Defense*, August 8, 2017. As of February 4, 2019: https://breakingdefense.com/2017/08/rolling-the-marble-bg-saltzman-on-air-forces-multi-domain-c2-system/

Cohen, Raphael S., *Air Force Strategic Planning: Past, Present, and Future*, Santa Monica, Calif.: RAND Corporation, RR-1765-AF, 2017. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR1765.html

Davis, Paul K., *Lessons from RAND's Work on Planning Under Uncertainty for National Security*, Santa Monica, Calif.: RAND Corporation, TR-1249-OSD, 2012. As of February 25, 2019: https://www.rand.org/pubs/technical_reports/TR1249.html

Davis, Paul K., *Analysis to Inform Defense Planning Despite Austerity*, Santa Monica, Calif.: RAND Corporation, RR-482-OSD, 2014. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR482.html

DoD—*See* U.S. Department of Defense.

Fernandez, Sergio, and Hal G. Rainey, "Managing Successful Organizational Change in the Public Sector," *Public Administration Review*, Vol. 66, No. 2, March–April 2006, pp. 168–176.

Fogleman, Ronald R., "The Future Is Ours—Today," speech delivered at the Air Force Association Symposium, Los Angeles, Calif., October 27, 1995.

Fogleman, Ronald R., and Sheila E. Widnall, *Global Engagement: A Vision for the 21st Century Air Force*, Washington, D.C.: U.S. Air Force, 1996.

Freedberg, Sydney J., Jr., "Army Outlines Futures Command; Org Chart in Flux," *Breaking Defense*, March 26, 2018. As of July 9, 2019: https://breakingdefense.com/2018/03/army-outlines-futures-command-org-chart-in-flux/

Gaim, Medhanie, Nils Wåhlin, Miguel Pina e Cunha, and Stewart Clegg, "Analyzing Competing Demands in Organizations: A Systematic Comparison," *Journal of Organization Design*, Vol. 7, No. 6, December 2018.

Gandy, Jerry L., *The Air Force Long Range Planning Organization: Speaking with One Voice?* Gloucester, UK: BiblioScholar, October 2012.

GAO—*See* U.S. Government Accountability Office (formerly: U.S. General Accounting Office).

Gentile, Gian, Yvonne K. Crane, Dan Madden, Timothy M. Bonds, Bruce W. Bennett, Michael J. Mazarr, and Andrew Scobell, *Four Problems on the Korean Peninsula: North Korea's Expanding Nuclear Capabilities Drive a Complex Set of Problems*, Santa Monica, Calif.: RAND Corporation, TL-271-A, 2019. As of February 25, 2019: https://www.rand.org/pubs/tools/TL271.html

Gertner, Jon, *The Idea Factory: Bell Labs and the Great Age of American Innovation*, New York: Penguin Books, 2013.

Hagen, Jeff, *Potential Effects of Chinese Aerospace Capabilities on U.S. Air Force Operations*, Santa Monica, Calif.: RAND Corporation, CT-347, 2010. As of February 25, 2019: https://www.rand.org/pubs/testimonies/CT347.html

Heginbotham, Eric, Michael Nixon, Forrest E. Morgan, Jacob L. Heim, Jeff Hagen, Sheng Tao Li, Jeffrey Engstrom, Martin C. Libicki, Paul DeLuca, David A. Shlapak, David R. Frelinger, Burgess Laird, Kyle Brady, and Lyle J. Morris, *U.S. and Chinese Air Superiority Capabilities: An Assessment of Relative Advantage, 1996–2017*, Santa Monica, Calif.: RAND Corporation, RB-9858/3-AF, 2015. As of February 25, 2019: https://www.rand.org/pubs/research_briefs/RB9858z3.html

Keller, John, "Air Force Eyes Next-Generation Tactical Data Links Gateway for Jet Fighter Communications," *Military and Aerospace Electronics*, March 9, 2016. As of February 3, 2019: https://www.militaryaerospace.com/articles/2016/03/tactical-data-links.html

Kent, Glenn A., *Concepts of Operations: A More Coherent Framework for Defense Planning*, Santa Monica, Calif.: RAND Corporation, N-2026-AF, 1983. As of February 25, 2019: https://www.rand.org/pubs/notes/N2026.html

Kent, Glenn A., and David Ochmanek, *A Framework for Modernization Within the United States Air Force*, Santa Monica, Calif.: RAND Corporation, MR-1706-AF, 2003. As of February

25, 2019:
https://www.rand.org/pubs/monograph_reports/MR1706.html

Kent, Glenn A., David Ochmanek, Michael Spirtas, and Bruce R. Pirnie, *Thinking About America's Defense: An Analytical Memoir*, Santa Monica, Calif.: RAND Corporation, OP-223-AF, 2008. As of February 25, 2019:
https://www.rand.org/pubs/occasional_papers/OP223.html

Kent, Glenn A., and David E. Thaler, *A New Concept for Streamlining Up-Front Planning*, Santa Monica, Calif.: RAND Corporation, MR-271-AF, 1993. As of February 25, 2019:
https://www.rand.org/pubs/monograph_reports/MR271.html

Lawrence, Craig, "Adapting Cross-Domain Kill-Webs (ACK): A Framework for Decentralized Control of Multi-Domain Mosaic Warfare," Defense Advanced Research Project Agency, Proposer's Day briefing, Arlington, Va., July 27, 2018.

Leftwich, James A., Debra Knopman, Jordan R. Fischbach, Michael J. D. Vermeer, Kristin Van Abel, and Nidhi Kalra, *Air Force Capability Development Planning: Analytical Methods to Support Investment Decisions*, Santa Monica, Calif.: RAND Corporation, RR-2931-AF, 2019. As of November 6, 2020:
https://www.rand.org/pubs/research_reports/RR2931.html

Lempert, Robert J., Drake Warren, Ryan Henry, Robert Warren Button, Jonathan Klenk, and Katheryn Giglio, *Defense Resource Planning Under Uncertainty: An Application of Robust Decision Making to Munitions Mix Planning*, Santa Monica, Calif.: RAND Corporation, RR-1112-OSD, 2016. As of February 25, 2019:
https://www.rand.org/pubs/research_reports/RR1112.html

Lewis, Leslie, Bruce R. Pirnie, William A. Williams, and John Y. Schrader, *Defining a Common Planning Framework for the Air Force*, Santa Monica, Calif.: RAND Corporation, MR-1006-AF, 1999. As of February 25, 2019:
https://www.rand.org/pubs/monograph_reports/MR1006.html

Light, Paul Charles, The Four Pillars of High Performance: How Robust Organizations Achieve Extraordinary Results, New York: McGraw-Hill, 2005.

Lingel, Sherrill, Carl Rhodes, Amado Cordova, Jeff Hagen, Joel Kvitky, and Lance Menthe, *Methodology for Improving the Planning, Execution, and Assessment of Intelligence, Surveillance, and Reconnaissance Operations*, Santa Monica, Calif.: RAND Corporation, TR-459-AF, 2008. As of February 25, 2019: https://www.rand.org/pubs/technical_reports/TR459.html

Lostumbo, Michael J., Michael J. McNerney, Eric Peltz, Derek Eaton, David R. Frelinger, Victoria A. Greenfield, John Halliday, Patrick Mills, Bruce R. Nardulli, Stacie L. Pettyjohn, Jerry M. Sollinger, and Stephen M. Worman, *Overseas Basing of U.S. Military Forces: An Assessment of Relative Costs and Strategic Benefits*, Santa Monica, Calif.: RAND Corporation, RR-201-OSD, 2013. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR201.html

Machi, Vivienne, "Air Force Wants Platforms Built with Connectivity in Mind," *National Defense*, February 23, 2018. As of February 25, 2019: https://www.nationaldefensemagazine.org/articles/2018/2/23/goldfein-air-force-needs-platforms-built-with-connectivity-in-mind

Martin, Bradley, Danielle C. Tarraf, Thomas C. Whitmore, Jacob DeWeese, Cedric Kenney, Jon Schmid, and Paul DeLuca, *Advancing Autonomous Systems: An Analysis of Current and Future Technology for Unmanned Maritime Vehicles*, Santa Monica, Calif.: RAND Corporation, RR-2751-NAVY, 2019. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR2751.html

Mazarr, Michael J., Jeffrey Eggers, Diana Gehlhaus Carew, 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*, Santa Monica, Calif.: RAND Corporation, RR-2013-AF, 2017. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR2013.html

Mesic, Richard, David E. Thaler, David Ochmanek, and Leon Goodson, *Courses of Action for Enhancing U.S. Air Force "Irregular Warfare" Capabilities: A Functional Solutions Analysis*, Santa Monica, Calif.: RAND Corporation, MG-913-AF, 2010. As of February 25, 2019: https://www.rand.org/pubs/monographs/MG913.html

Mintzberg, Henry, The Structuring of Organizations: A Synthesis of the Research, Englewood Cliffs, N.J.: Prentice-Hall, 1979.

Murdock, Clark A., "Forging the Vision: An Intellectual History of the Post–Cold War Air Force," draft working paper, October 26, 2001.

———, "The Search for a Systematic Solution: Air Force Planning Since the Persian Gulf War," working paper, February 11, 2002.

Murray, John, "U.S. Army Futures Command Chief: How the New Command Will Change the Service," *Defense News*, December 9, 2018. As of July 9, 2019: https://www.defensenews.com/outlook/2018/12/10/us-army-futures-command-chief-how-the-new-command-will-change-the-service/

National Research Council, *Development Planning: A Strategic Approach to Future Air Force Capabilities*, Washington, D.C.: National Academies Press, 2014.

Ochmanek, David, *Improving Force Development Within the U.S. Department of Defense: Diagnosis and Potential Prescriptions*, Santa Monica, Calif.: RAND Corporation, PE-302-RC, 2018. As of February 25, 2019: https://www.rand.org/pubs/perspectives/PE302.html

Ochmanek, David, Peter A. Wilson, Brenna Allen, John Speed Meyers, and Carter C. Price, *U.S. Military Capabilities and Forces for a Dangerous World: Rethinking the U.S. Approach to Force Planning*, Santa Monica, Calif.: RAND Corporation, RR-1782-1-RC, 2017. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR1782-1.html

Public Law 112-25, The Budget Control Act of 2011, August 2, 2011.

Rice, Donald, *The Air Force and U.S. National Security: Global Reach—Global Power*, Washington, D.C.: Department of the Air Force, white paper, June 1990.

Rumelt, Richard, *Good Strategy, Bad Strategy: The Difference and Why It Matters*, New York: Crown Business, 2011.

Schein, Edgar H., with Peter Schein, *Organizational Culture and Leadership*, 5th ed., Hoboken, N.J.: John Wiley and Sons, 2017.

Scott, W. Richard, *Organizations: Rational, Natural, and Open Systems*, 3rd ed., Englewood Cliffs, N.J.: Prentice Hall, 1992.

Smith, Perry M., Jerrold P. Allen, John H. Stewart II, and F. Douglas Whitehouse, *Creating Strategic Vision: Long Range Planning for National Security*, Washington, D.C.: National Defense University Press, 1987.

Snyder, Don, Patrick Mills, Katherine Comanor, and Charles Robert Roll, Jr., *Sustaining Air Force Space Systems: A Model for the Global Positioning System*, Santa Monica, Calif.: RAND Corporation, MG-525-AF, 2007. As of February 25, 2019: https://www.rand.org/pubs/monographs/MG525.html

Snyder, Don, Sherrill Lingel, George Nacouzi, Brian Dolan, Jake McKeon, John Speed Meyers, Kurt Klein, and Thomas Hamilton, *Managing Nuclear Modernization Challenges for the U.S. Air Force: A Mission-Centric Approach*, Santa Monica, Calif.: RAND Corporation, RR-3178-AF, 2019. As of October 29, 2019: https://www.rand.org/pubs/research_reports/RR3178.html

Thaler, David E., *Strategies to Tasks: A Framework for Linking Means and Ends*, Santa Monica, Calif.: RAND Corporation, MR-300-AF, 1993. As of February 25, 2019: https://www.rand.org/pubs/monograph_reports/MR300.html

Thaler, David E., Beth Grill, Jefferson P. Marquis, Jennifer D. P. Moroney, and Stephanie Pezard, *Factoring Security Cooperation into Core U.S. Air Force Decisionmaking Processes: Incorporating Impact in Planning, Programming, and Capability Development*, Santa Monica, Calif.: RAND Corporation, RR-2351-AF, 2018. As of February 25, 2019: https://www.rand.org/pubs/research_reports/RR2351.html

Thirtle, Michael R., Michael Boito, Ian P. Cook, Bernard Fox, Phyllis Gilmore, Michelle Grace, Jeff Hagen, Thomas Hamilton, Lawrence M. Hanser, Herb Shukiar, Jerry M. Sollinger, and David Vaughan, *Cost-Benefit Analysis of the 2006 Air Force Materiel Command Test and Evaluation Proposal*, Santa Monica, Calif.: RAND Corporation, MG-619-AF, 2008. As of February 25, 2019: https://www.rand.org/pubs/monographs/MG619.html

USAF—*See* U.S. Air Force.

U.S. Air Force, "AFWERX," homepage, undated. As of December 1, 2019: https://www.afwerx.af.mil/

———, *Vanguard: Air Force Systems Command*, Vanguard pamphlet, Andrews Air Base, Md.: HQ AFSC/XR, June 1979.

———, The 1997 Air Force Long-Range Plan: Summary, Washington, D.C., 1997.

———, "AIM-120 AMRAAM," fact sheet, April 1, 2003. As of July 1, 2019: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104576/aim-120-amraam/

———, "Air Force Strategic Planning Process," Air Force Guidance Memorandum (AFGM) 2016-90-1101, October 3, 2016. As of February 25, 2019: https://afacpo.com/AQDocs/afgm2016-90-1101.pdf

———, *Memorandum on the Air Force Warfighting Integration Capability (AFWIC) IOC + Resourcing*, Washington, D.C.: Under Secretary of the Air Force and Vice Chief of Staff, October 3, 2017.

———, *Air Force Warfighting Integration Center (AFWIC) Concept of Operations (CONOPS)*, Washington, D.C., June 26, 2018.

U.S. Army, *Army Strong: Equipped, Trained and Ready: Final Report of the 2010 Army Acquisition Review*, Washington, D.C., January 2011. As of July 9, 2019: https://www.army.mil/e2/c/downloads/213465.pdf

———, "Army Futures Command," homepage, undated. As of July 20, 2019: https://armyfuturescommand.com

U.S. Department of Defense Directive 3000.09, *Autonomy in Weapon Systems*, change 1, Washington, D.C., May 8, 2017. As of February 3, 2019: https://www.esd.whs.mil/portals/54/documents/dd/issuances/dodd/300009p.pdf

U.S. Department of Defense, Director, Operational Test and Evaluation, "Air Operations Center—Weapon System (AOC-WS)," *FY 2017 Annual Report*, Washington, D.C., January 2018, pp. 249–242.

U.S. General Accounting Office, *B-2 Bomber: Cost and Operational Issues*, Washington, D.C., GAO/NSIAD-97-181, August 1997. As of February 25, 2019:

https://www.govinfo.gov/content/pkg/GAOREPORTS-NSIAD-97-181/pdf/GAOREPORTS-NSIAD-97-181.pdf

U.S. Government Accountability Office, *Defense Acquisitions: Assessments of Selected Weapon Programs*, Washington, D.C., GAO-11-233SP, March 2011. As of February 25, 2019: https://www.gao.gov/assets/320/317081.pdf

———, *Defense Acquisitions: Assessments of Selected Weapon Programs*, Washington, D.C., GAO-15-342SP, March 2015. As of July 1, 2019: https://www.gao.gov/assets/670/668986.pdf#page=103

U.S. Marine Corps, "Deputy Commandant Combat Development & Integration," webpage, April 2018a. As of July 20, 2019: https://mrr.dawnbreaker.com/portals/phase3/us-marine-corps/deputy-commandants/deputy-commandant-combat-development-integration/

———, "United States Marine Corps Force Development System User Guide," user guide, April 2018b. As of October 29, 2019: https://www.mccdc.marines.mil/Portals/172/Docs/MCCDC/FDSP/USMC%20Force%20Development%20System%20User%20Guide.pdf?ver=2018-05-01-141537-333

Weishoff, Fredric J., An Evaluation of the Top-Level Air Force Long-Range Planning Model Based on a Set of Planning Factors to Determine the Feasibility for Implementation, thesis, Wright-Patterson Air Force Base, Ohio: Air Force Institute of Technology, September 1990.

Whiting, Stephen N., and Thomas K. Dale, *Air Force Long-Range Planning: Institutionalization Revisited*, Washington, D.C.: Air Force History Support Office in association with the Office of the Special Assistant to the Chief for Long-Range Planning, April 12, 1996.

Zazulia, Nick, "Rejuvenating the Raptor: Roadmap for F-22 Modernization," *Aviation Today*, October 11, 2018. As of January 22, 2019: https://www.aviationtoday.com/2018/10/11/rejuvenating-raptor-roadmap-f-22-modernization/

PROJECT AIR FORCE

The Air Force has long faced a challenge integrating force design and capability development planning with programming. The consequences of not executing the integration function well can lead to imbalances in capabilities, vulnerabilities in subsystems, and insufficient funding for investment in new capabilities. Over the past several years, Air Force leaders have recognized the need to improve both the quantity and quality of the Air Force's enterprise-level analysis and decisionmaking on future force planning. In February 2018, the Vice Chief of Staff of the Air Force and Deputy Chief of Staff for Strategy, Integration and Requirements asked RAND Project Air Force (PAF) to assist the Air Force Warfighting Integration Capability (AFWIC) in conceptualizing and executing analytical and other products to support options for future force design and capability development and their links to planning and programming.

To this end, PAF team members spoke to AFWIC leaders and key staff, other Air Force stakeholders, and individuals familiar with integration efforts in the other services. The team developed a roadmap of analytical and other product elements that could enable AFWIC to sustain its integrating role in future force design. In this report, the authors present their findings, recommendations, and vision for AFWIC's analytical processes and products. For AFWIC to succeed and endure, senior leaders will need to create favorable conditions for independent analysis of new concepts and options for future force design in support of the joint force and their practical implications for Air Force near-term planning, programming, budgeting, and execution.

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