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Research Report

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The Forces We Need

Building Multi-Capable Airmen to Enable Agile Combat Employment

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About This Report

This report documents the findings and recommendations from a RAND Project AIR FORCE study focused on helping the Air Force refine its emergent Multi-Capable Airmen (MCA) concept and identify next steps for developing an Air Force–wide approach to develop and sustain MCA. The report provides an overview of relevant policy and guidance around the MCA concept, including background on its development and previous precedent for multi-skilling efforts. It then presents stakeholder perspectives on MCA-related concepts, training, implementation, and deployment. This is followed by case study analysis of lessons learned from five select MCA training efforts and related Agile Combat Employment exercises. The report also documents the extent to which new training technologies could benefit MCA training. The report concludes by providing recommendations for steps the Air Force can take to develop a force-wide approach to develop and sustain MCA.

The research reported here was commissioned by Air Force Strategy, Integration and Requirements (AF/A5/7) and conducted within the Workforce, Development, and Health Program of RAND Project AIR FORCE as part of a fiscal year 2022 project, "Developing and Utilizing Multi-Capable Airmen in Preparation for Future Multi-Domain Conflicts."

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Summary

Issue

In *Accelerate Change or Lose*, then-Air Force Chief of Staff General Charles Q. Brown, Jr., proposes that, in response to strategic challenges, "The forces and operational concepts we need must be different," and he specifically notes that "Our Airmen must be multi-capable."[1] The Air Force's Multi-Capable Airmen (MCA) initiative is a critical workforce enabler of the Agile Combat Employment (ACE) operational concept. But whereas ACE is relatively well developed, MCA, as of late 2022, remains in a formative stage. To further institutionalize the MCA initiative, the Department of the Air Force asked RAND Project AIR FORCE to help refine the emergent MCA concept and provide recommendations on how to effectively develop and sustain MCA moving forward.

Approach

Our project consisted of four main efforts. First, we examined the evolution and structure of the MCA initiative and potential lessons from related precedents. Second, through semistructured interviews, we assessed Air Force stakeholder perspectives on MCA, identifying key areas of convergence and divergence. Third, we conducted case studies of five wing-level MCA programs to identify crosscutting lessons learned. Finally, we engaged Department of Defense and private-sector experts to identify opportunities for using advanced technologies to enhance MCA training.

Key Findings

How has the MCA initiative evolved, and what can the Air Force learn from MCA precedents?

- The value of MCA for ACE is derived from team employment, but the Air Force's current organizational construct for building and designating MCA centers on the individual.
- There is tension between the idea of MCA as a broad shift in Air Force culture and the idea of a narrowly focused MCA for ACE operations.
- Multi-skilling can degrade workforce effectiveness if overdone, and the benefits are contingent on the effective design and management of a multi-skilled team.

[1] Charles Q. Brown, Jr., *Accelerate Change or Lose*, Chief of Staff, U.S. Air Force, August 2020, pp. 3 and 6.

How do stakeholders perceive the MCA initiative?

- Stakeholders understand conceptually the links between MCA and ACE but are unclear about what is new with the MCA initiative and are skeptical about its benefits.
- Stakeholders have widely disparate views about how many airmen should be designated and trained as MCA and the level of proficiency that is needed.
- Stakeholders see value in training MCA as teams and in deploying those teams from the same base or unit; stakeholders also perceive a need to better align MCA with the Air Force Force Generation model.
- Stakeholders are divided on the extent to which the force provider should tailor MCA to unique theater requirements.
- Stakeholders view the degradation of airmen primary skills and inadequate proficiency in secondary skills as the main risks of the MCA initiative; they also assess Air Force culture as a major hurdle to implementation.

What are the key trends and lessons learned from wing-level MCA programs?

- Wing-level MCA programs vary greatly. Across wings, there is no *best* MCA program, but different wings exhibit positive practices with potential for scaling.
- Wings have solidified initial MCA training but conduct little sustainment training. Furthermore, they lack the means to evaluate and track MCA proficiency.
- Wing-level MCA programs are constrained by a lack of resources and rely on the buy-in of local leadership.
- Some wings recognize the value of MCA and are trying to implement a team-based approach for developing and sustaining the concept, but these efforts are local and ad hoc.

How can new training technologies enhance MCA training?

- Augmented reality is particularly well suited for training MCA; in contrast, computer-based training and virtual reality offer marginal benefit.
- Beyond training delivery, new technologies can aid the development of training content, assessment of proficiency, and performance of MCA tasks in day-to-day operations.
- Training technologies, although not uniquely applicable to MCA, add distinct value given the added impetus to avoid overtraining in secondary skills.

Recommendations

- Establish a single office to lead and coordinate MCA efforts.
- Build baseline workforce and funding requirements for wing-level MCA programs.
- Continue to standardize MCA cross-utilization training tasks but also establish training standards and proficiency measures.
- Formalize a team-based approach to the development and sustainment of MCA; award a Special Experience Identifier for training and experience on an MCA team.
- Incorporate progressive goals for MCA within the Career Field Education and Training Plan; correspondingly, deemphasize MCA levels as an organizing construct.
- Integrate lessons learned from wing-level MCA exercises into standard training plans.

- Conduct cognitive task analysis of MCA skill sets and develop a model of skill set links.
- Invest in augmented reality training systems with dual use for performance support and prioritize training technologies that can measure and assess proficiency with a high degree of granularity.

Contents

Figures and Tables

Figures

Tables

Chapter 1. Introduction

In the seminal document *Accelerate Change or Lose*, then-Air Force Chief of Staff General Charles Q. Brown, Jr., proposes that in response to strategic challenges, "The forces and operational concepts we need must be different."[2] Through the Agile Combat Employment (ACE) operational concept, the U.S. Air Force seeks to enhance the survivability and effectiveness of combat aircraft within the adversary's anti-access and area denial envelope through a combination of dispersed basing, minimal footprint, and rapid and unpredictable movement. Under this concept, small teams of airmen are forward deployed to austere air bases with the mission of launching, recovering, and maintaining combat aircraft. After supporting air operations from a given site for a relatively short period of time, these teams pack up and move to a different site to stay ahead of and to complicate adversary targeting.[3]

As such, ACE presents two distinct labor problems. First, the concept hinges on a significant number of airmen operating from austere forward sites with little external support and under the near constant threat of enemy attack. In some Air Force occupations, such as Combat Control and Special Reconnaissance, this might be the norm. However, among airmen in most career fields accustomed to working from secure main operating bases, there is a shortage of the requisite advanced expeditionary skills. Second, the concept requires a small personnel footprint at dispersed locations to limit exposure to adversary attack, reduce logistical demand, and facilitate rapid movement. But, when adding up all the Air Force specialties needed to stand up, operate, and protect a forward site, as well as launch, recover, and maintain combat aircraft, team size quickly becomes unwieldy.

The Air Force's nascent Multi-Capable Airmen (MCA) initiative represents a solution to both problems. The Air Force defines *multi-capable airmen* as those who are able to accomplish tasks outside their core Air Force specialty, specifically to provide combat support and combat service support to ACE force elements as part of cross-functional teams in an expeditionary environment.[4] The MCA initiative is a critical workforce enabler of ACE, but whereas the ACE concept of operations is relatively well defined and well developed, MCA, as of late 2022, remains very much in a formative stage. Over the past few years, diverse stakeholders across the Air Force have worked on various pieces of MCA, and there has been substantial experimentation at the local Air Force wing level. Now, Air Force leadership is evaluating how to formalize, standardize, and ultimately institutionalize MCA across the service.

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[2] Charles Q. Brown, Jr., *Accelerate Change or Lose*, Chief of Staff, U.S. Air Force, August 2020, p. 3.

[3] See Air Force Doctrine Note 1-21, *Agile Combat Employment*, U.S. Air Force, August 23, 2022.

[4] Air Force Doctrine Note 1-21, 2022, p. 3.

Study Objective and Approach

To support these efforts, the Air Force Directorate for Integration and Innovation within Air Force Futures (A5I) asked RAND Project AIR FORCE to help refine the Air Force's emergent MCA concept and to provide recommendations on how the Air Force can effectively develop and sustain MCA. The associated RAND Corporation project consisted of five main tasks.

Task A: Review the evolution, current construct, and precedents of MCA. First, to better understand current conceptualizations of MCA and Air Force goals for MCA utilization, the project team reviewed relevant policy and doctrine documents, reports, briefings, and senior leader statements relevant to MCA. Because MCA was still nascent at the time of this project, this review also served to highlight key gaps and remaining decision points regarding the MCA concept, MCA training and development, and the potential utilization of MCA. We also reviewed relevant precedents in terms of earlier efforts within the Air Force and the Army to develop a multi-skilled workforce.

Task B: Examine stakeholder perspectives on MCA. Building on the findings from Task A, the project team conducted interviews with key stakeholders involved in MCA efforts across the Air Force. A primary goal of these interviews was to determine the extent to which stakeholder perspectives converge or diverge on important aspects of the MCA initiative. Specifically, we focused on understanding stakeholder perspectives linked to MCA concepts, training, implementation, and deployment or force presentation. To capture the views of a diverse set of stakeholders with different roles, we targeted our interviews across four stakeholder groups:

1. policy and oversight, including career field managers (CFMs)
2. force development
3. force provider, primarily Air Combat Command (ACC)
4. force employment—Pacific Air Forces (PACAF) and U.S. Air Forces in Europe–Air Forces Africa (USAFE-AFAFRICA).

Task C: Identify trends and lessons learned from wing-level MCA training programs and ACE exercises. With Tasks A and B, we identified multiple MCA training programs at different wing levels across the Air Force. However, because there was little Air Force–level guidance at the time of this study, various wings were pursuing MCA training and sustainment in different ways. Our goal with this task was to examine distinct MCA training efforts at specific locations and to identify trends and lessons learned from these efforts that could be applicable for scaling and standardizing across the Air Force. In addition, we sought to identify lessons learned from local ACE exercises that incorporated MCA. As a representative sample of wing-level MCA efforts taking place across the Air Force, we conducted in-depth case studies at the following locations: 23rd Wing (Moody Air Force Base [AFB]), 18th Wing (Kadena Air Base [AB]), 52nd Fighter Wing (Spangdahlem AB), 140th Wing (Buckley Space Force Base [SFB]), and 27th Special Operations Wing (Cannon AFB).

Task D: Assess how new training technologies can enhance MCA training. A consistent observation from Tasks B and C was that limited time and resources for training represents a major hurdle in the development and sustainment of MCA. Department of Defense (DoD) and private industry are developing various new training technologies, some of which might be applicable to MCA. With this task, we sought to assess a wide number of training technologies that are currently under development and to identify those that could offer distinct value for training MCA. Toward this end, we assessed the attributes of a core subset of mission-essential tasks (METs) that the Air Force has identified for MCA cross-utilization training (CUT). We then conducted a literature review and interviewed subject-matter experts (SMEs) to characterize the advantages and disadvantages of various training technologies. From this, we correlated MCA-relevant METs to suitable classes of training technologies.

Task E: Develop recommendations to further refine the Air Force's MCA initiative. Drawing on our analysis and findings from the preceding tasks, we derived recommendations to help the Air Force further refine, develop, and institutionalize its MCA initiative.

We note that the findings and recommendations in this report reflect work that was conducted as part of a fiscal year 2022 project. The construct of the MCA initiative outlined in Chapter 2 of this report served as the baseline for our stakeholder interviews and remained in place at the time this research was finalized. However, we recognize that this construct will likely continue to evolve over time.

Structure of This Report

The remaining chapters in this report provide additional background on the Air Force's MCA initiative and document our analysis, findings, and recommendations. Chapter 2 provides an overview of the origin and early evolution of the MCA initiative and presents the basic construct of the initiative (Task A). The chapter also looks at earlier efforts within the Air Force and the Army to develop a multi-skilled workforce, noting potential lessons learned that are relevant to MCA. Chapter 3 presents an assessment of stakeholder perspectives on MCA across the Air Force, highlighting significant areas of convergence and divergence (Task B). Chapter 4 provides observations and insights from our in-depth case studies of five wing-level MCA programs (Task C). Chapter 5 outlines potential opportunities for leveraging different types of training technologies to support MCA training (Task D). Finally, Chapter 6 presents a summary of the project's main findings and associated recommendations (Task E). The report also includes several appendixes that provide more detail on the project's methodology.

Chapter 2. Multi-Capable Airmen Evolution, Construct, and Precedent

This chapter provides background for our analysis, specifically looking at the origin and early evolution of the MCA initiative, the basic construct of the initiative, and relevant precedent in terms of earlier efforts within the Air Force and the Army to develop a multi-skilled workforce. Over the course of our analysis, the MCA initiative was a moving target. For our brief overview of the evolution of the MCA initiative, we focused mainly on the period up to the Air Force's December 2021 publication of the ACE doctrine note, which established the official definition of MCA and its link to ACE. The construct of the MCA initiative outlined in this chapter served as the baseline for our stakeholder interviews and remained in place at the time this report was finalized. However, we recognize that this construct will likely continue to evolve over time.

The Evolution of Multi-Capable Airmen: Where Did the Multi-Capable Airmen Initiative Come from and What Does the Air Force Hope to Achieve?

The MCA initiative is a key workforce enabler of the Air Force's ACE concept of operations and thus is inextricably tied to the development of ACE. It is well-known that, given the advances in adversary conventional weapon systems, U.S. air bases in the PACAF and USAFE-AFAFRICA theaters of operation are highly vulnerable to attack. China, particularly, has invested heavily in anti-access and area denial capabilities that place U.S. air bases at risk and would hinder U.S. Air Force operations in the event of armed conflict. The Air Force has responded in at least two important ways. The first is by bolstering a stand-off posture that allows the Air Force to operate outside the adversary's weapon employment zone—or at least outside the worst part of the zone.[5] The second is by developing ACE to enhance the ability of the Air Force to operate within the adversary's weapon employment zone.[6]

[5] Eric Heginbotham, 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, *The U.S.-China Military Scorecard: Forces, Geography, and the Evolving Balance of Power, 1996–2017*, RAND Corporation, RR-392-AF, 2015; Mila Cisneros, "Air Force Awards Contract for New Standoff Weapons Complex at Anderson AFB," Pacific Air Forces, March 1, 2021; Jordan Rozsa, *Improving Standoff Bombing Capacity in the Face of Anti-Access Area Denial Threats*, RAND Corporation, RGSD-363, 2015.

[6] Air Force Doctrine Note 1-21, 2022; Department of the Air Force (DAF), "Summary of Adaptive Operations in Contested Environments," May 27, 2020; PACAF, "Agile Combat Employment (ACE): PACAF Annex to Department of the Air Force Adaptive Operations in Contested Environments," Department of the Air Force, June 2020.

PACAF validated ACE in 2017 via a series of exercises and then in early 2018 published its first Agile Combat Employment Concept of Operations document, which envisions the development and use of multiple hub-and-spoke basing clusters spread throughout the Indo-Pacific region.[7] USAFE-AFAFRICA soon followed suit, working on a modified version of ACE given different geographical constraints. Under the ACE concept, small teams of airmen are forward deployed to austere air bases with the mission of launching, recovering, and maintaining combat aircraft. After supporting air operations from a given site for a relatively short period, these teams pack up and move to different spoke locations to stay ahead of and to complicate adversary targeting. As the PACAF commander described to the media, "The tenets of ACE are . . . to disperse the forces to many hubs and spokes so that you would be moving about between hubs and spokes multiple times per day, multiple times per week. And you would be quite agile and quite mobile . . . and it creates a targeting problem for any adversary."[8]

The introduction of the ACE concept of operations presented two distinct challenges for Air Force personnel. As explained in Chapter 1, the introduction of the ACE concept of operations presented two distinct challenges for Air Force personnel. First, a greater number of airmen must operate from austere forward sites with little external support and under the near constant threat of enemy attack. And second, a small personnel footprint is required at dispersed locations to limit exposure to adversary attack, reduce logistical demand, and facilitate rapid movement.

The Air Force's solution to both challenges is MCA. Early ACE-related documents did not specifically mention MCA but instead elaborated more generally on the need for small, agile teams of airmen who are enabled through CUT. Thus, concurrent to the early establishment of ACE, Air Force leadership emphasized the need to develop and employ multi-capable or multi-functional airmen, but there was little central guidance as to what this meant in practical terms. By 2019, Air Force wings across PACAF, USAFE-AFAFRICA, and ACC had started building local MCA training programs and experimenting with MCA-related concepts in local exercises without much major command (MAJCOM), let alone Air Force–level, direction.

The cross-MAJCOM Air Force Agility Conference, held in August 2019, was something of a watershed. This conference included a lengthy discussion of a multi-qualified, multifunctional, or multi-skilled workforce to support ACE. The conference produced a Record of Agreement, signed by attending MAJCOM deputy commanders, that assigned the U.S. Air Force Expeditionary Center (USAFEC) as the office of primary responsibility to "define Multi-qualified/ACE Airmen and create a training syllabus that will result in certification or qualification to perform tasks outside AFSC (Air Force Specialty Code) core in support of

[7] See Greg Erwin, "Tropic ACE Observers Collaborate on Fueling the Future," Pacific Air Forces, September 14, 2017; Westin Warburton, "Service Members Exercise New Operational Concepts During ARCTIC ACE," Pacific Air Forces, August 9, 2017.

[8] Remarks by Gen. Ken Wilsbach, quoted in Phill Leon Guerrero, "Military Using Hub-and-Spoke Strategy," *Guam Daily Post*, June 7, 2021.

ACE."[9] To address this task, the Air Force assembled a working group, or tiger team, of experts from USAFEC, Air Education and Training Command (AETC), Air Mobility Command (AMC), ACC, PACAF, and USAFE-AFAFRICA. This group settled on the MCA terminology and, in late 2019, published a white paper that proposed an MCA definition and laid out the basic tenets of the Air Force's MCA initiative that generally remains in place as of late 2022.[10] USAFEC followed with the release of its "Multi-Capable Airmen (MCA) Training Syllabus for Agile Combat Employment (ACE)" in early 2020.[11]

In March 2021, an Air Force General Officer Steering Group (GOSG) reviewed progress on the MCA initiative and determined that there was an acute lack of coordination and standardization across MAJCOMs.[12] The GOSG accordingly tasked the MAJCOMs to institutionalize the initiative and specifically to create an Air Force standard for MCA tasks in line with PACAF and USAFE-AFAFRICA requirements. The GOSG also established some basic guidance on AFSC CUT. These inputs prompted USAFEC to host an MCA conference in October 2021 for a variety of MAJCOM and Air Force headquarters staff representatives. At this meeting, participants finalized the official definition of MCA to be included in the upcoming Air Force ACE doctrine note and, more importantly, to come to a cross-MAJCOM consensus on the CUT Table of Authorizations (TOA) for fighter aircraft mission generation (MG). The resultant TOA outlined the tasks and AFSCs designated for CUT and thus, in effect, specified the multi-capabilities of MCA within a given mission area. Although this initial TOA was limited to fighter MG tasks, it provided a template for other aviation platforms and mission sets. Finally, in December 2021, the Air Force published the ACE doctrine note, which established the official definition of MCA under the broader ACE concept.[13]

The Structure of Multi-Capable Airmen: What Does the Multi-Capable Airmen Initiative Look Like?

Air Force Doctrine Note 1-21, *Agile Combat Employment*, defines MCA as follows:

> Airmen trained in expeditionary skills and capable of accomplishing tasks outside of their core Air Force specialty. Specifically, these personnel are often trained as a cross-functional team to provide combat support and combat service support to ACE force elements. They are enabled by cross-utilization training

[9] DAF official, email correspondence with the authors, November 2021.

[10] See ACC, "White Paper on Growing Multi-Capable Airmen for Agility Operations," November 13, 2019.

[11] See USAFEC, "Multi-Capable Airmen (MCA) Training Syllabus for Agile Combat Employment (ACE)," version 2.0, January 8, 2020a.

[12] DAF official, email correspondence with the authors, November 2021.

[13] Air Force Doctrine Note 1-21, 2022. For an earlier reference to the official definition, see USAFEC, "Annex A to Adaptive Operations in Contested Environments: Agile Combat Employment for Force Providers," June 11, 2020b.

> and can operate independently in an expeditionary environment to accomplish mission objectives within acceptable levels of risk.[14]

Beyond characterizing MCA, this definition provides evidence of how the Air Force intends to train and use these airmen. Particularly, the development of MCA extends across combat support and combat service support specialties and requires both occupational CUT and training in the skills necessary to operate independently in an expeditionary environment. These definitional elements, in turn, are reflected in the basic construct of the MCA initiative.

Multi-Capable Airmen Training Tiers

The MCA initiative is structured around three tiers of MCA skill types and associated training requirements.[15] Tier 1 constitutes expeditionary skills. The relevant expeditionary skills are generally not assigned to any specific AFSC but instead reflect what any airman needs to survive and operate within an austere combat environment. For MCA, these skills go beyond those already covered by Basic Airman Readiness or Basic Deployment Readiness in accordance with Air Force Instruction 10-405, *Expeditionary Readiness Training*.[16] Examples of more-advanced MCA expeditionary skills include weapon sustainment, tactical movement, combat casualty care, land mobile radio use, and air cargo preparation.[17] USAFEC built, and has subsequently maintained, a list of Tier 1 expeditionary skills training (EST) requirements and associated training plans, with the most up-to-date versions available via an Air Force SharePoint site. USAFEC also provides Tier 1 EST to a limited number of airmen in-house at its Expeditionary Operations School, but most of this training takes place at the local Air Force wing level.

MCA Tier 2 consists of cross-occupational or cross-AFSC skills attained through what the Air Force has termed CUT.[18] Whereas Tier 1 EST applies more generally across MCA-relevant AFSCs and thus is largely AFSC agnostic, Tier 2 CUT is purposefully varied by AFSC. In other words, specific Tier 2 requirements are, at least in theory, standardized for a given AFSC associated with MCA but differ from one AFSC to the next. As discussed, the MCA TOA aligns different AFSCs with different sets of secondary occupational skills. The intent of CUT is for airmen to learn and maintain a certain level of proficiency in skills that typically fall under a different AFSC. This is what effectively allows the Air Force to shrink the size of its footprint at distributed sites for ACE, with the assumption being that one MCA can take the place of several

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[14] Air Force Doctrine Note 1-21, 2022, p. 3.

[15] See USAFEC, "Multi-Capable Airmen (MCA) Training Program for Agile Combat Employment (ACE)," version 3.0, March 31, 2021.

[16] USAFEC, 2021, p. 6. See also Air Force Instruction 10-405, *Expeditionary Readiness Training Program*, Department of the Air Force, September 24, 2018.

[17] USAFEC, 2020a.

[18] Air Force Instruction 36-2650, *Maintenance Training*, Department of the Air Force, June 22, 2022.

single specialty airmen. Beyond facilitating a smaller footprint, CUT is also intended to enhance team resiliency in the event of casualties, as the members of an MCA team will have overlapping, and thus duplicative, capabilities.

Finally, MCA Tier 3 is a broad, catchall category of Air Force wing- or theater-specific requirements. The Air Force's intent with both Tier 1 and Tier 2 is to standardize skill sets across Air Force wings and MAJCOMs, but the Air Force recognizes that every wing and every combat deployment is unique. Accordingly, per Air Force guidance, wings and MAJCOMS can, but are not required to, establish Tier 3 MCA training requirements beyond what is covered under standard Tier 1 and Tier 2 MCA training requirements. Table 2.1 outlines the Air Force's plan for the three training tiers.

Table 2.1. Multi-Capable Airmen Training Tier Structure

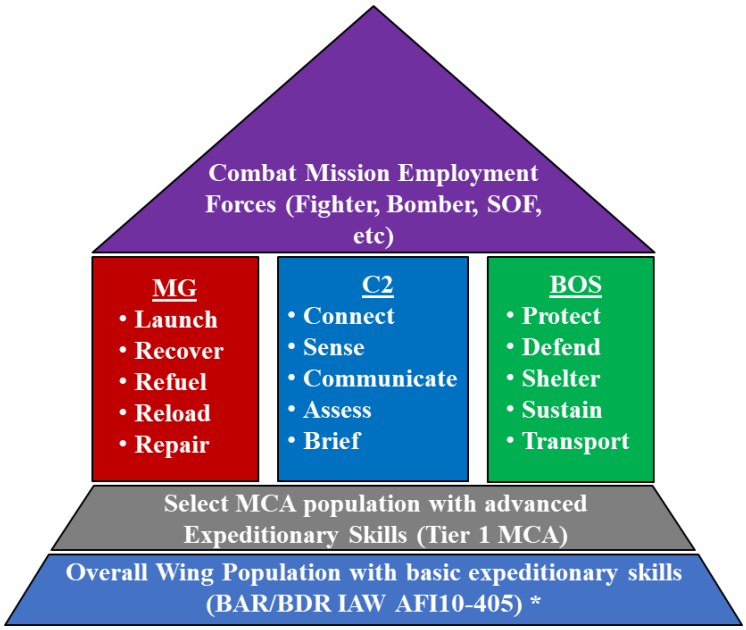
Type	Description	Delivery Method
Tier 1	MCA EST course	Taught at the USAF Expeditionary Operations School[a]
Tier 2	AFSC-specific training	Wing level
Tier 3	Wing- or theater-specific	Wing level

SOURCE: Adapted from USAFEC, 2021.
NOTE: USAF = U.S. Air Force.
[a] Until USAFEC is resourced, Tier 1—MCA EST—will be delivered and organized at the wing level.

Multi-Capable Airmen Mission Pillars

Beyond these three training tiers, the MCA initiative is structured around three mission set pillars (see Figure 2.1), which roughly equate to AFSC clusters: MG, command and control (C2), and base operating support (BOS). Combined, these pillars encapsulate the occupational specialties that are required in the ACE environment and thus define the *potential* scope of MCA Tier 2 CUT. Within the first pillar, MG personnel are responsible for the launch, recovery, refuel, reload, and repair of aircraft; relevant career fields include aircraft maintenance, aircraft armament systems and air traffic control. Within the second pillar, C2 airmen—such as command post and weather personnel—connect, sense, communicate, assess, and brief. Within the third pillar, BOS airmen protect, defend, shelter, sustain, and transport to enable air operations, which translates to operating and maintaining base infrastructure, including the expeditionary infrastructure at ACE spoke locations. Career field examples include civil engineers, security forces, logistics personnel, ground fuel handlers, and transportation specialists.

Figure 2.1. Multi-Capable Airmen Mission Pillar Structure



SOURCE: Reproduced from USAFEC, 2021.
NOTE: SOF = Special Operations Forces.

In contrast to the current pillar construct, an early iteration of the MCA concept characterized MCA as being formed at the intersection of where MG, C2, and BOS overlap. This characterization is depicted in Figure 2.2. This intersection model reflected a relatively expansive vision of MCA CUT. In a series of precursor exercises in 2018, the Air Force demonstrated this expansiveness by using the example of civil engineers on the flight line launching and recovering aircraft and conducting basic aircraft maintenance. An Air Force spokesperson pointed to these exercises as highlighting a "new type of Airman." Specifically, "This new Airman is capable of employing not only their specific task, but those outside of their career field. This allows an Airman to be more than just a maintainer or a security forces member, or even a civil engineer. *He or she can be all three and more*" (emphasis added).[19]

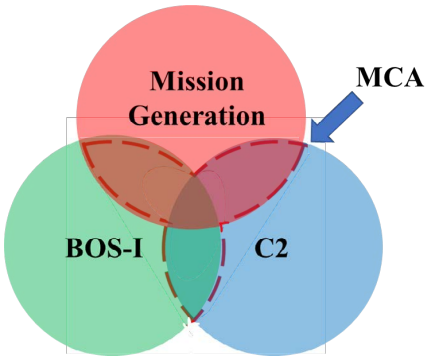
Subsequent conceptualizations of MCA, however, dropped this expansive idea of CUT and the associated graphic, as the Air Force refined its approach toward linking MCA with a single mission pillar. For example, stakeholders now talk in terms of MG MCA versus BOS MCA. This represents a nuanced but important evolution in the Air Force's thinking. As one Air Force official observed, "We've moved away from the idea of putting finance personnel out on the flight line turning wrenches on aircraft."[20] However, as we discuss more in Chapter 3, there is

[19] Remarks by Senior Airman Harold Gross III, quoted in Veronica Kemeny, "Combat Support Wing Exercise Showcases Agile Lethality," U.S. Air Force, October 1, 2018. Of note, this series of exercises took place shortly before the adoption of MCA terminology.

[20] DAF official, interview with the authors, November 2021.

still disagreement among stakeholders about how much CUT should be conducted across mission pillar boundaries.

Figure 2.2. Early (Since Deleted) Version of the Multi-Capable Airmen Mission Set Concept



SOURCE: Reproduced from USAFEC, 2020a. The terms *BOS* and *BOS-I* are used interchangeably.

In June 2022—well after our main discussions with Air Force stakeholders—Air Force headquarters staff proposed adding levels of MCA as an additional layer of structure, on the basis of the idea that some MCA will be more multi-capable than others. More specifically, the Air Force is considering either a two- or three-level model. With the two-level model, MCA would be categorized as either Agile MCA or ACE MCA, with the latter distinguished by more-extensive Tier 1 expeditionary skills and Tier 2 CUT. The proposed three-level model is similar, with MCA Level 1 and MCA Level 2 roughly equating to Agile MCA and ACE MCA, respectively. The Air Force would then add an MCA Level 0, which does not focus on specific expeditionary skills or CUT but instead emphasizes "MCA education to build the mindset,"[21] targeted primarily at Basic Military Training and Technical Training students. With these models, the staff envisions awarding a Special Experience Identifier (SEI), but exclusively to ACE MCA or MCA Level 2; only those airmen designated as ACE MCA or MCA Level 2 would be expected to operate from austere forward locations in the ACE environment.[22]

The formal delineation of levels of MCA stems at least in part from a recent move by Air Force leadership to emphasize the MCA initiative as the core of a broader cultural shift, extending beyond the narrow operational focus of ACE. In May 2022, General Brown characterized the MCA initiative as a "philosophy," noting that "Multi-Capable Airmen represent a foundational change in how we think, fight, and empower our Airmen."[23] More than

[21] DAF official, email correspondence with the authors, July 2022.

[22] DAF official, email correspondence with the authors, July 2022.

[23] Charles Q. Brown, Jr., "CSAF Leadership Library: May 2022," Secretary of the Air Force Public Affairs, May 18, 2022.

just training in new set of skills, being multi-capable reflects a new mindset that begins as early as Basic Military Training. In effect, "All Airmen should be MCA" to some extent.[24]

Multi-Capable Airmen Precedent: What Can the Air Force Learn from Previous Multi-Skilling Initiatives?

The Air Force's current MCA initiative is not an isolated or completely novel endeavor. The MCA initiative is uniquely tailored to the Air Force personnel structure and the operational demands of ACE, but the underlying concept of multi-skilling has a long and expansive history within DoD and even more so across private industry. For decades, private industry has looked to multi-skilling or cross-training as an important human factor and resource management tool. Correspondingly, there is a vast amount of literature expounding on the benefits, costs, limitations, and challenges associated with developing and managing a multi-skilled workforce. It is beyond the scope of our project to provide a review of this extensive literature; additionally, there are publications that provide comprehensive summaries.[25] Instead, as context for the current MCA initiative, we look briefly at previous Air Force experience with multi-skilling and at one particularly relevant example from the Army.

What Can the Air Force Learn About Multi-Capable Airmen from Prior Air Force Efforts?

Consistent with trends in private industry, the Air Force has engaged in numerous multi-skilling initiatives at least since the mid-1980s, whether in the form of analyses, experimentation, or implementation. Most of these efforts have centered on aircraft maintenance career fields and skill sets, with a key example being the Rivet Workforce launched in 1984 with the aim of creating "a more flexible, mobile and survivable workforce which meets future employment concepts."[26]

Previous Air Force initiatives demonstrate clear benefits to multi-skilling. However, these initiatives also suggest clear limits, with significant workforce degradation if multi-skilling is not

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[24] DAF official, email correspondence with the authors, July 2022.

[25] See Araz Nasirian, Mehrdad Arashpour, and Babak Abbasi, "Critical Literature Review of Labor Multiskilling in Construction," *Journal of Construction Engineering and Management*, Vol. 145, No. 1, January 2019; Behrouz Afshar-Nadjafi, "Multi-Skilling in Scheduling Problems: A Review on Models, Methods, and Applications," *Computers and Industrial Engineering*, Vol. 151, January 2021; John L. Cordery, "Multi-Skilling: A Discussion of Proposed Benefits of New Approaches to Labour Flexibility Within Enterprises," *Personnel Review*, Vol. 18, No. 3, March 1989; James Hoyt and Tish Matuszek, "Testing the Contribution of Multi-Skilled Employees to the Financial Performance of High-Tech Organizations," *Journal of High Technology Management Research*, Vol. 12, No. 2, September 2001; Hodaka Morita, "Multi-Skilling, Delegation and Continuous Process Improvement: A Comparative Analysis of US-Japanese Work Organizations," *Economica*, Vol. 72, No. 285, February 2005.

[26] Ronald G. Elliott, *Project Rivet Workforce and the Air National Guard*, Air Command and Staff College, Report No. 88-0860, April 1988, p. 4; see also Thomas Light, Daniel M. Romano, Michael Kennedy, Caolionn O'Connell, and Sean Bednarz, *Consolidating Air Force Maintenance Occupational Specialties*, RAND Corporation, RR-1307-AF, 2016.

appropriately implemented and managed. In assessing the relevance of these previous initiatives, it is important to recognize that MCA is focused almost exclusively on the employment of a multi-skilled workforce in an overseas contingency context. This is in sharp contrast to the bulk of Air Force multi-skilling initiatives, which emphasize in-garrison use. Most relevant analyses in some form weigh the relative costs of building and maintaining a multi-skilled workforce with the benefits for routine, steady state operations. With MCA, however, the Air Force will pay the full cost of developing and maintaining a multi-skilled workforce but will reap the full benefits only in the scenario of a major war versus a peer or near-peer adversary. There might be some overlap with in-garrison requirements, but the focus of MCA is clearly not peacetime. Accordingly, any sort of relative cost-benefit analysis is problematic and caution must be taken when evaluating MCA through a comparative lens of in-garrison multi-skilling initiatives. That said, there are potentially valuable lessons the Air Force can glean from its own experience.

Multi-Skilling Can Boost Workforce Efficiency and Flexibility, Reducing Personnel Demand and Personnel Costs

Aligned with findings from private industry, the Air Force has demonstrated that multi-skilling can yield significant benefits in terms of workforce efficiency and flexibility. Through multi-skilling, the Air Force can reduce workforce team size without losing production or maintain team size while increasing production.[27] A multi-skilled workforce thus offers notable advantages for short-handed, strained, or limited career fields. A study of the Air Force's KC-135 maintenance workforce shows that although the consolidation of skill sets reduces the availability of maintenance personnel because of increased training requirements, the boost in performance gained through multi-skilling more than makes up for this loss in availability. In this case, multi-skilling yielded the *net* outcome of a 17 percent reduction in personnel without a corresponding drop in sortie generation capability.[28] Research on the effects of cross-training in the F-35 maintenance workforce suggests similar results. Looking at the Air Force's F-35 Blended Operational Lightning Technician (BOLT) and Lightning Integrated Technician (LIT) initiatives, RAND researchers determined that cross-functional maintenance teams reduced staffing requirements by up to 15 percent; furthermore, "the cost-savings potential in terms of fewer maintenance personnel needed is greater than the increase in training costs."[29] Such benefits translate to Air Force civilian employees as well. An Air Force study of Air Logistic Complex operations found that the "utilization of employees and available labor hours improves

[27] Light et al., 2016.

[28] Light, et al., 2016.

[29] Anna Jean Wirth, Thomas Light, Daniel M. Romano, Shane Tierney, Ronald G. McGarvey, Moon Kim, Michael J. Lostumbo, Amanda Nguyen, Paul Emslie, and John G. Drew, *Evaluating Alternative Maintenance Manpower Force Structure Concepts for the F-35A*, RAND Corporation, RR-4433-AF, 2020, p. ix.

significantly with multi-skilling," resulting in greater output without increasing workforce size and a substantially reduced need for overtime pay.[30]

Multi-Skilling Can Preserve Capability in the Face of Attrition

Analysis of the BOLT and LIT initiatives shows that beyond enhancing the efficiency of maintenance teams in garrison, cross-training provides significant advantages in combat scenarios or other situations in which these teams experience attrition. In these cases, RAND researchers found that "[p]erhaps the greatest contribution from the new maintenance concepts is their ability to degrade more gracefully under attack," with particularly elevated benefits in situations that have both fairly high sortie demands and fairly high attrition.[31] Modeling the first seven days of armed conflict versus a near-peer adversary, RAND analysis demonstrated that, with the baseline force structure, as maintenance personnel drops to 50 percent of the initial requirement, the percentage of sorties flown drops to 65 percent. With the BOLT and LIT workforce structures, the Air Force preserves a sortie flown rate of 80 percent and 81 percent, respectively, with 50 percent personnel attrition.[32]

Airmen Have the Cognitive Capacity for Multi-Skilling

Through a limited set of controlled experiments, the Air Force has also found that individual airmen have a relatively strong mental or cognitive capacity for multi-skilling. Multi-skilling experiments conducted at Hill AFB and Eglin AFB sought to determine whether, all else being equal, a multi-skilled airman could retain knowledge and perform job tasks as well as an airman limited to a single primary specialty. These experiments were designed to hold training—in terms of frequency and intensity—relatively constant, which allowed researchers to isolate and test cognitive capacity for skill retention as opposed to the effects of training. As a central finding, the experiments determined that "skill retention appears not to be significantly influenced by whether the individual was single or multi-skilled," an implication that if airmen have the time to train in multiple skills, they have the cognitive capacity to absorb and perform multiple skills.[33]

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[30] Wesley A. Sheppard, Jr., *Simulating F-22 Heavy Maintenance and Modifications Workforce Multi-Skilling*, thesis, Air Force Institute of Technology, March 2014, pp. 105.

[31] Wirth, et al., 2020, p. 55. Of note, the BOLT and LIT initiatives, although designed primarily for in-garrison use, offer potential advantages in the deployed environment. Similarly, the benefits of multi-skilling for ACE can potentially carry over to in-garrison.

[32] Wirth et al., 2020, p. 42.

[33] Jessica A. Salgado, *Factors Influencing Skill Retention in Multi-Skilled Air Force Aircraft Maintainers*, thesis, Air Force Institute of Technology, March 2016, p. 44. Although this study focuses on a limited set of maintenance career fields, the findings suggest broader applicability, with an important caveat that the skill sets observed in the study were similarly technical in nature.

Multi-Skilling Can Affect Workforce Degradation if Overdone

There are clear benefits to multi-skilling, but, as Air Force studies have also shown, there can be too much of a good thing with multi-skilling. At the organizational level, there are trade-offs between the costs of developing a multi-skilled workforce and the utility of that workforce. At the individual level, there are trade-offs in terms of skill proficiency. Even if an individual has the requisite cognitive capacity for multi-skilling, proficiency is still derived from training and practice. One Air Force study from 2015 warns against the overimplementation of multi-skilling, noting that "the mistake of disregarding proficiency and blindly implementing multi-skilling could be extremely costly to an organization."[34] The appropriate balance will necessarily vary across contexts and will likely be determined only via experimentation; that said, the 2015 study proposes a 25 percent specialization policy, which implies a 75 percent focus on the primary skill set or field of expertise and a 25 percent focus on the additional or secondary skill set in terms of the weight of time and effort.[35] This number represents more of a "not too hot, not too cold" approach than a fined-tuned calculation; as analyses from private industry suggest, the appropriate multi-skilling level is highly contingent on unique objectives, collateral effects, and context.[36] Still, the number highlights the need to carefully balance proficiency across multiple skill sets given limited time for training and practice. This aligns with a RAND study for the Army that similarly found "[t]he payoffs do not increase proportionally with the scope of cross-training. Rather, the benefits are likely to 'tail off' as cross-training broadens."[37]

Effective Multi-Skilling Requires a Strategic Approach to the Pairing of Skill Sets

From the perspective of the individual multi-skilled airman, linking skill sets that exhibit commonalities in type (e.g., pairing skills that involve mechanical aptitude) makes sense given the potential for shared training and reduced adjustment time when going from one skill set to the next. Most studies of multi-skilling concur that pairing similar skill sets reduces the challenges of transfer at the individual level.

At the organizational level, there are additional considerations for skill set pairing. For example, one Air Force multi-skilling experiment suggests value, in terms of use rate, from pairing skill sets by the relative size of the occupational specialty. In this instance, the best case is to pair skill sets from similarly small occupational specialties. The next best case is to pair skill sets from similarly large occupational specialties. The third, and least desirable, case is to pair skill sets from a small occupational specialty with those of a relatively large occupational

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[34] Joshua M. Isom, *Overcoming Hurdles Implementing Multi-Skilling Policies*, Air Force Institute of Technology, March 2015, p. 2.

[35] Isom, 2015, pp. 42–43.

[36] Nasirian, Arashpour, and Abbasi, 2019.

[37] William G. Wild, Bruce R. Orvis, Rebecca Mazel, Iva S. Maclennan, and R. D. Bender, *Design of Field-Based Crosstraining Programs and Implications for Readiness*, RAND Corporation, R-4242-A, 1993, p. vii.

specialty. In this last case, the experiment determined that pairing smaller with relatively large specialties hinders performance "because the smaller specialties do not provide enough additional labor hours to affect overall system performance" and the pairing can "negatively influence the requirements of the smaller specialties."[38]

The Benefits of Multi-Skilling Are Contingent on How Multi-Skilled Teams Are Built

Multi-skilling starts with the individual and individual-level training, but the benefits largely depend on the effective teaming of multi-skilled workers. As described above, the BOLT and LIT multi-skilling initiatives yielded significant improvements in workforce efficiency and resiliency. Both BOLT and LIT rely on explicit multi-skilled teaming concepts. In their analysis of these programs, RAND researchers also looked at other ways to organize multi-skilled F-35 maintenance teams. In some cases, multi-skilling made matters worse, increasing associated workforce costs. The failure of these alternatives had nothing to do with a lack of individual proficiency but instead derived from poor team design.[39]

The Benefits of Multi-Skilling Are Contingent on How the Workforce Is Managed

As noted, Air Force studies and experiments have identified significant potential benefits to multi-skilling within the Air Logistic Complex workforce. In 1993, the Air Force initiated a relatively robust multi-skilling initiative for this workforce, which included establishing an agreement with the American Federation of Government Employees on the use of multi-skilled employees. However, a formal review by Air Force Material Command in 2001 determined that the aims associated with the initiative had largely gone unmet. The Air Force Material Command Review Team uncovered two main reasons for this. First, employees were not incentivized to become multi-skilled; second, supervisors were not well versed on how to fully employ multi-skilled technicians.[40] This reflects a consistent finding from private industry: Even if an organization has a sound plan for developing a multi-skilled workforce, multi-skilling can fail—or at least not provide full value—if the multi-skilled workforce is not appropriately managed.[41] Along these lines, a subsequent Air Force study found that multi-skilled workforce scheduling strategies can have a major impact on the relative costs and benefits of multi-skilling.[42]

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[38] Sheppard, 2014, pp.105.

[39] Wirth et al., 2020, p. 55.

[40] Grover Dunn, Jim C. Barone, and Leif E. Peterson, "Workforce," *Air Force Journal of Logistics*, Vol. 27, No. 1, Spring 2003, pp. 11–12.

[41] Afshar-Nadjafi, 2021.

[42] Isom, 2015, p. 41.

What Can the Air Force Learn About Multi-Capable Airmen from the Army?

Like the Air Force, the Army has experience with various forms of multi-skilling. The Army effort that most resembles Air Force MCA in terms of scope and purpose is the now defunct Multi-Skilled Soldier (MSS) initiative. This initiative emerged around 2001 and gained significant interest and momentum within the organization by 2003, with senior Army leadership endorsing the MSS concept as a "key human-dimension enabler" of the agile force needed for the emerging security environment.[43] Army leadership recognized that the organization already engaged in substantial multi-skilling at the unit level, with a key example being the widespread focus on combat lifesaver training. But the Army championed MSS as something new. It was to be more expansive, formalized, and centralized, with Training and Doctrine Command playing a key role to ease the burden on operational units.[44]

The Multi-Skilled Soldier Initiative Had Aims and Structure Similar to Multi-Capable Airmen

Of course, there is a clear distinction between MSS and MCA in that MSS was not explicitly tied to ACE; however, the purpose of MSS was essentially the same. The Army envisioned the MSS team as strategically deployable and tactically mobile, with the ability to move quickly and operate from dispersed, austere sites. The proposed training for MSS included both advanced expeditionary and cross-Military Occupational Specialty (MOS) skill sets, essentially mirroring the MCA Tier 1 and Tier 2 delineations. By training soldiers outside their specified career fields, the Army expected to gain increased capabilities with comparatively smaller units and enhanced unit resiliency in the event of casualties. As one Army study from 2002 notes, "The multi-skilled, adaptive soldier is thus a key enabler for the Unit of Action to operate resiliently and enduringly as an inherently self-sufficient, agile, combined arms force over comparatively extended distances."[45] And like MCA, the MSS initiative was not about enhancing in-garrison capability but was instead aimed at optimizing the workforce for deployed combat operations.

Multi-Skilled Soldier Was Never Fully Implemented or Institutionalized

Despite Army leadership's enthusiasm for MSS, the concept effectively died prior to full implementation. There was some progress, including minor MOS consolidation linked to the MSS concept. In a 2002 report to Congress, the Army highlighted its success combining infantryman, fighting vehicle infantryman, and heavy anti-armor weapons infantryman into a

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[43] John T. Nelsen II and Allan Akman, *The Multi-Skilled Soldier Concept: Considerations for Army Implementation*, United States Army Research Institute for the Behavioral and Social Sciences, Study Report 2002-06, April 2002, pp. 1–3.

[44] John Nelsen and Marcia Chirico, *Applying a Multi-Skilled Soldier (MSS) Concept to the Stryker Brigade Combat Team (SBCT)*, United States Army Research Institute for the Behavioral and Social Sciences, Study Report 2004-01, October 2003, p. 7.

[45] Nelsen and Akman, 2002, p. 7.

single specialty as evidence of the MSS concept's viability.[46] However, it is important to recognize that the Army exhibited a steady trend of MOS consolidation over the prior decades, so the evidence presented to Congress to highlight the distinct gains of the MSS initiative was not overly compelling.[47] Furthermore, early proponents suggest that even if not explicit, the underlying ideas of MSS have influenced Army training in broad terms over the subsequent two decades. In particular, they point to the Army's efforts to bolster the combat skills of logistics and supply troops following a string of convoy attacks in Iraq.[48] However, although such limited, reactive efforts can be loosely tied to the MSS concept, MSS implementation never came close to matching the original vision and intent.

Given the parallels between MSS and MCA, the Air Force can gain insight from the simple fact that the Army's MSS concept never progressed much beyond a concept. It remains unclear what happened to the initiative. From our research, there was no purposeful decision to cut the program and no clear failure points. Instead, the MSS initiative seems to have just faded away over time without becoming fully institutionalized. Nonetheless, our discussions with Army experts, combined with a review of Army-sponsored studies, shed light on factors that potentially contributed to this outcome.

MSS Suffered from a Lack of Common Understanding, Limited Guidance, and Training Challenges

To start, even though the Army touted the MSS concept in internal documents and in reports to Congress, there was never a consensus among Army stakeholders on the meaning of MSS. There was substantial ambiguity and multiple notions about what MSS entailed, varying from additional training outside MOS requirements to MOS consolidation to broader Army cultural change. Even small differences in perspective could have had significant implications. As one study of MSS noted,

> Throughout the Army different organizations and individuals have disparate views of it [MSS]. . . . [M]ost variations involve emphasizing or highlighting different aspects, sometimes to the exclusion of others. At first blush, these differences often appear relatively minor. However, the nuances tend to influence thinking in quite different directions regarding future concept development and implementation.[49]

Furthermore, MSS implementation never progressed much beyond ad hoc local efforts and was not adequately resourced. In 2002, an analyst observed that there was "no integrated

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[46] U.S. Government Accountability Office, *Military Transformation: Army Actions Needed to Enhance Formation of Future Interim Brigade Combat Teams*, GAO-02-442, May 17, 2002.

[47] Mary E. Layne, Scott Naftel, Harry J. Thie, and Jennifer H. Kawata, *Military Occupational Specialties: Change and Consolidation*, RAND Corporation, MR-977-OSD, 2001.

[48] U.S. defense analyst, interview with the authors, January 31, 2022.

[49] Nelsen and Akman, 2002, p. 3.

planning underway for comprehensive implementation."[50] This gap was never fully remedied.[51] On a related note, the Army did not effectively solve the training challenges at the core of the MSS initiative. To employ key MOS skill sets with confidence in a combat environment, individual soldiers require a highly perishable level of proficiency. This comes with a high training demand and "intense competition for individual training time."[52] Accordingly, with the MSS initiative, the Army found "enormous difficulties in training key non-primary MOS tasks."[53] Units in the field did not have adequate time or resources to adequately train soldiers in additional skills sets; in effect, they had to choose between multi-skilling and proficiency. To address this dilemma, the Army sought ways to develop multi-skilled soldiers that would not saddle field commanders with an increased training burden. However, the Army never fully resolved a way to do this at an institutional scale.[54]

Conclusion

The Air Force has communicated a clear need for MCA to enable the ACE concept of operations. Furthermore, the Air Force has provided a basic definition of MCA and a basic structure for its development. Now, the Air Force faces the challenge of implementation and institutionalization. This is where the Army's MSS initiative floundered. A key takeaway from the MSS case is simply that the combination of operational need and senior leadership enthusiasm is not enough. Previous cases from the Air Force and private industry suggest that the relative costs and benefits of any large-scale multi-skilling initiative are highly contingent on implementation strategies. The underlying multi-skilling concept might be valid and present a great deal of promise for a given organization, but the initiative is prone to fail, or at least underperform, if the multi-skilled workforce is not developed and managed appropriately. As observed in the case of the Army's MSS initiative, even seemingly minor differences in perspective on multi-skilling can have a significant impact, affecting "quite different directions regarding future concept development and implementation."[55] Thus, as the Air Force advances its MCA efforts from defining basic concepts and distributed ad hoc experimentation to full implementation and institutionalization, it is critical for senior leadership to understand the perspectives of key stakeholders, especially those who are responsible for interpreting and enacting broad policy guidance. Additionally, the Army's MSS initiative highlights the

[50] Nelsen and Akman, 2002, p. viii.

[51] As an example of a stand-alone MSS proposal, see Zachery Briscoe, "Combat Sustainment Support Soldiers in Special Forces," *Army Sustainment*, March–April 2012.

[52] Nelsen and Chirico, 2003, p. 24.

[53] Nelsen and Chirico, 2003, p. 25.

[54] Nelsen and Akman, 2002, p. 11.

[55] Nelsen and Akman, 2002, p. 3.

importance of ensuring that there are adequate resources to move such an initiative beyond ad hoc experimentation at local levels and that there is a clear plan for how training will address such a multi-skilling effort. As we discuss in later chapters, these are key considerations the Air Force must also address.

Chapter 3. Stakeholder Views of Multi-Capable Airmen

As proposed in Chapter 2, when moving ahead with implementation and institutionalization of the MCA initiative, it is critical for Air Force leadership to understand the perspectives of key stakeholders, particularly at the junctures where those perspectives converge and diverge. To map the viewpoints of MCA stakeholders across the Air Force, we conducted a series of semistructured interviews to better understand stakeholder perspectives on a variety of MCA issues. The opinions of the average airman matter, but we did not conduct a random sampling. Instead, we carefully targeted specific individuals, mainly field grade officers and senior enlisted personnel, in key organizations and offices who hold the most-direct roles in building and implementing the Air Force's MCA initiative. These are the individuals who are directing wing-level MCA programs, developing MAJCOM MCA training syllabuses, attending cross-MAJCOM MCA working groups, and authoring Air Force MCA policy and doctrine. We assess that, with this targeted sample, we have effectively captured the most-relevant enterprise perspectives, and this chapter summarizes our findings from these interviews.

At a minimum, the data are useful for identifying likely points of confusion, friction, and even resistance as the Air Force continues down the MCA path. Resistance here does not necessarily imply intentional disregard for or the slow rolling of senior leader guidance. Resistance could be the outcome of two highly motivated and well-intentioned actors working at odds because of different views of what an MCA looks like and how best to build one. This is a particularly strong possibility with the MCA initiative, given the diverse array of stakeholders across the Air Force working on their individual parts.

The data can also help senior leaders prioritize resources and attention. At the Air Force level, implementation of the MCA initiative is too big and too complex to be micromanaged. Plus, there are significant advantages to keeping doors open to experimentation and allowing good ideas to bubble up from the bottom. However, keeping the MCA initiative on track will continue to require that senior leaders make appropriate, well-timed inputs and adjustments. The findings described in this chapter can accordingly help senior leaders determine where their attention is most needed and where their personal intervention can be best leveraged.

Interviews with Multi-Capable Airmen Stakeholders Across the Air Force

We conducted a total of 41 interviews with key stakeholders. To ensure we had effective representation from across the Air Force, we divided our interviewees into four stakeholder groups: policy and oversight, force development, force provider, and force employer. For the policy subgroup, we targeted key individuals at Air Force headquarters in A1 (Manpower, Personnel, and Services), A3 (Operations), A4 (Logistics and Engineering), and A5 (Plans and

Integration). We purposely included a relatively large sample of CFMs, given their important role in determining the bounds of MCA CUT within relevant career fields. For the force development subgroup, we focused on representatives from AETC and USAFEC, with the latter tasked to develop a standardized curriculum for MCA Tier 1 EST. Turning to force providers, we looked primarily at ACC—both at the staff and wing level—while also drawing from AMC and Air Force Special Operations Command (AFSOC). With ACC, we targeted organizations designated by the MAJCOM as lead wings in support of the ACE concept of operations.[56] Finally, for force employers, we looked at USAFE-AFAFRICA and PACAF at both the staff and wing levels. (See Appendix A for a breakdown of interviewees per stakeholder subgroup.)

As noted, we focused our stakeholder interview questions around four MC-related topic areas: concepts, training, implementation, and deployment. We tailored the interviews to allow for open, free-flowing discussion and to facilitate structured cross-population comparisons. For the latter, we employed a standard protocol of questions that asked participants to provide categorical responses, which for several questions required a rating on a five-point Likert scale. We then asked participants to further explain their categorical response or rating in more detail.[57] Appendix A provides the full interview protocol and greater detail on our methodology.

What Do Stakeholders Think About Multi-Capable Airmen Concepts?

In the area of MCA concepts, we sought to capture stakeholders' big-picture understanding of MCA and how MCA relates to other Air Force initiatives, including the basic definition of MCA and the importance of MCA for ACE. We also sought to understand how different stakeholders interpret and prioritize some of the key underlying concepts, specifically the three distinct training tiers and the three functional pillars of MG, C2, and BOS. Furthermore, we asked about the extent of change that would be required in the Air Force to implement MCA.

Although we treated MCA concepts as a separate area in the interview protocol, we note that the perspectives we captured have significant implications for stakeholder perspectives in other areas. For example, an individual who views MCA as "more of the same but with a different name" is likely to have different thoughts on training requirements and the challenges of implementation than someone who perceives MCA as a transformational shift in the way the Air Force does business. We outline key observations from stakeholder responses in the following discussion.

[56] Kaitlyn Ergish, "Defining Lead Wing's A-Staff," Air Combat Command, April 1, 2022.

[57] On the basis of the initial rating on the five-point Likert scale and the subsequent discussion explaining their rating, we coded responses to relevant questions on a three-tier (low, moderate, high) scale.

Stakeholders Concur on the Definition and Aims of Multi-Capable Airmen

As noted in Chapter 2, in December 2021, the Air Force released Doctrine Note 1-21, *Agile Combat Employment*, which included a formal definition of MCA. This release was after the start of our study but prior to most of our interviews. Most of our interviewees were aware of this definition of MCA, even before publication, and many had played a role in crafting the definition. Therefore, it is not surprising that there was a relatively high degree of convergence on the basic meaning of MCA across our targeted audience of key stakeholders. Stakeholders were also generally aligned on the main goals of MCA, noting the connection to ACE and the impetus to build small, resilient teams to conduct air operations at austere forward sites.

After recounting the official definition, several stakeholders took the opportunity to offer various opinions about MCA up front, foreshadowing subsequent questions and lines of discussion. Some linked the definition of MCA to what they considered to be inherent shortcomings and limitations:

> I define it as a tasking to do more with less . . . we're asked to do more with less. It's a confusing term. It's not possible. You can't do more with less resources.
>
> The more you start piling on to these guys, the less deep they are. You just make a bunch of airmen that are a mile wide but not the deep technicians that we want.
>
> One of the things I've seen with MCA is that it is ill defined, people try to grab at it.

Others emphasized that, beyond what is specified in the definition, MCA represents a much broader culture shift for the Air Force:

> I think the term MCA is being used as a vehicle to ignite a culture change.
>
> MCA is about culture and the overall aspect of what it means to be an airman.

Stakeholders Identified Similar Risks Associated with Multi-Capable Airmen

Beyond consensus on the goals of and motivation for MCA, there were also consistent themes around what stakeholders saw as potential risks associated with MCA. Specifically, most stakeholders voiced concerns about the potential for the degradation of primary skills and a lack of proficiency in the secondary skills associated with CUT. For example, one stakeholder stated that MCA "can get us into a situation where we are creating far more jacks of all trades but aces of none," while another proposed, "The risk is you start losing some of the technical competencies if not careful." Still another explained,

> Once you're putting them [MCA] into a different role, you're losing out on some experience, some granularity. Are you losing out on speed? Probably. Are you losing out on experience? Absolutely. Safety? Potentially. You're trying to stay light; you're trying to maintain that lethality. You can buy that down with continual training . . . but you're going to have to accept a bit more risk and a bit more degradation of capability.

As a secondary but still common theme on risk, stakeholders also noted the potential for overstressing the workforce:

> The second risk is you are gonna burn out the airmen. There are some career fields that already demand extremely long hours, so you are adding more stuff down range by asking them to take on additional responsibilities.
>
> We run the risk of not identifying the correct people to do this. And, even if we pick the right people, the high performers, we run the risk of burning the high performers out because they'll be asked to do a lot more. If we don't structure it effectively, it could lead to some manning problems.

Stakeholders Disagree on the Significance of the Multi-Capable Airmen Initiative

Interestingly, although there was broad consensus on the definition of MCA and its importance to ACE, there was substantial disagreement on the extent to which MCA represents a change for the Air Force. Stakeholder responses here ranged from "It's not anything that we haven't done before" to "This is a major shift because in order to do it right, we need to affect cradle to grave the systems we use." Overall, we found that approximately 45 percent of stakeholders viewed MCA as a major change, 35 percent viewed MCA as a moderate change, and 20 percent viewed MCA as a small or insignificant change.

In addition to this baseline assessment, stakeholders had different opinions about what was distinct or new about MCA. Some pointed to variation across career fields, with the opinion that MCA represents a big shift for some career fields but not others:

> This is not something new. SOF [Special Operations Forces] has been doing it for years.
>
> For the Air Force, it's a major shift. For [aircraft] maintenance, it's relatively low. . . . The maintainers, I would argue, are already multi-capable.

Some proposed that Tier 2 CUT represents a more significant change than Tier 1 EST, but others thought the opposite:

> The shift of training people in more than one thing is not new or special. The expeditionary mentality is the big shift.

Finally, stakeholders proposed that the multi-skilling aspect of MCA is not new, but the associated approach to training and managing airmen is relatively novel:

> A lot of Airmen are already multi-capable and do a lot of things outside of their primary specialty, but the structure and standardized plan of MCA is new.
>
> Airmen are doing things outside of their specialty, but they are not documented, and the training is ad hoc. The training aspect of MCA is new, but not the idea.

Stakeholders Do Not Understand How Multi-Capable Airmen Aligns with Other Air Force Initiatives

To delve deeper into stakeholders' understanding of the MCA initiative, we sought to gauge perceptions of the links between MCA and the concurrent lead wing and airbase squadron initiatives, both of which are relevant to these additional efforts of how the Air Force deploys and uses airmen in support of ACE. Of note, both the lead wing and airbase squadron initiatives fall primarily under ACC as a force provider, but they still matter to the Air Force more broadly. Most of the MCA stakeholders were aware of these concurrent initiatives and agreed that there is some connection to MCA. That said, there was significant confusion about *how* the initiatives are linked. Across our slate of interviews, we did not find a single stakeholder who had a clear idea about this or who could describe the links with any confidence. This was even true of stakeholders at units designated by ACC as a lead wing and that are also heavily engaged in building local MCA training programs.

Stakeholders Agree on the Most Important Multi-Capable Airmen Mission Pillar but Disagree on the Most Important Multi-Capable Airmen Training Tier

As described in Chapter 2, the MCA initiative is structured conceptually around three training tiers and three mission pillars. All stakeholders were familiar with this construct. However, we found a divergence of opinion on what the relative weight or priority of the different elements should be for the Air Force. When asked about the most relevant or important mission pillar for MCA, the majority of stakeholders (74 percent) highlighted MG and most of the remainder (17 percent) suggested an even balance across mission areas. However, there were outliers who disagreed completely and suggested that the Air Force should focus its MCA efforts on either BOS or C2. A few stakeholders also questioned the wisdom of the mission pillar structure all together. For example, one stakeholder commented,

> My opinion is that the Air Force is chasing their tails with this effort to bin and compartmentalize. Now it's causing a lot of down-and-in focus in the pillars—focused down and in, isolated in pillars. Pillars cause too much inward looking by AFSCs.

There was more disagreement on the relative priority that should be placed on Tier 1 EST versus Tier 2 CUT. Here, we saw an even split between proponents of Tier 1 (40 percent) and Tier 2 (40 percent), with the remainder (20 percent) in favor of equal prioritization. When asking stakeholders to explain their prioritization, we heard the following perspectives in favor of either Tier 1 or Tier 2:

> Cross-utilization training is more important. I don't know what expeditionary skills we're talking about. Airbases shouldn't be near the FLOT [forward lines of own troops]. It's not COIN [counterinsurgency]. . . . A base might undergo long-range fires, but we're not dealing with ground forces. You don't need to pick up a gun.

> Tier 2 is more important. Tier 1 is just a baseline and basically what we've been doing all along. Tier 2 is key . . . if we don't focus on Tier 2, we'll get lost.
>
> As we tease out ACE and MCA, bolstering expeditionary skills for the entire team may help defeat the threat we're facing. I understand Tier 2 is important, but I think it is secondary to expeditionary skills.
>
> The Air Force is spending too much effort trying to cross-train people. This is not what we need. What they need to be doing is developing baseline expeditionary skills.
>
> We need to train airmen to survive with less support and to help fight the base. Having a second set of skills just distracts. We're spinning our wheels on an ill-defined concept. If we keep focusing on CUT, we're going to lose the ball.

As will be discussed in Chapter 4, different perspectives on the priority that should be placed on the different training tiers have implications for how MCA is being implemented at the Air Force wing level.

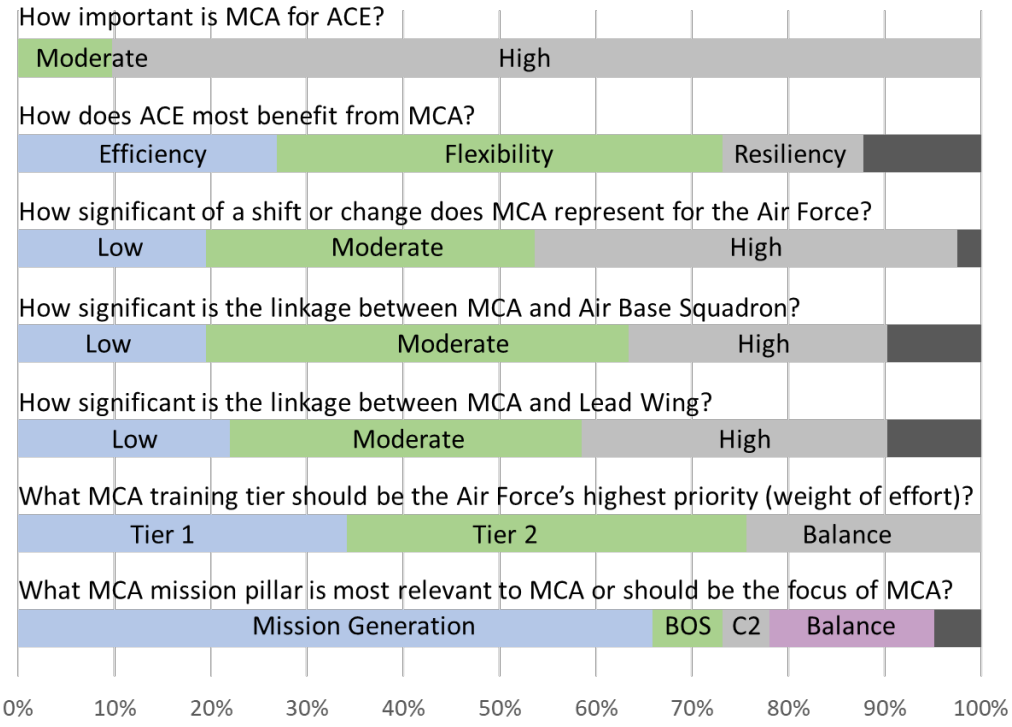
Stakeholders Are Confused About the Basic Guidance for Cross-Utilization Training

To assess how stakeholders were receiving and interpreting senior leader guidance on MCA, we specifically asked stakeholders about the directive to train down but not up that came from the March 2021 GOSG review. Most, but not all, stakeholders were aware of this guidance and recognized that it was associated with Tier 2 CUT. Beyond that, however, interpretation of the guidance varied widely. Some viewed the guidance as pertaining to the technical difficulty of an additional skill set relative to the airman's primary specialty. In other words, to train down but not up means that an MCA should cross-train only in skills that are less technically difficult than the airman's primary specialty. Others interpreted the guidance as relating to the level of proficiency required for an airman's primary versus secondary skill sets, with training down a matter of reduced proficiency requirements for skills outside their core AFSC. At least one stakeholder suggested a link to Armed Services Vocational Aptitude Battery (ASVAB) scores, proposing that training down but not up meant that an airman should cross-train only in AFSCs that had a lower ASVAB score entry requirement than the airman's own ASVAB score. Although just one example, this illustrates how even the most basic, seemingly straightforward senior leader guidance on MCA can get twisted as it filters through the organization.

Summary

Figure 3.1 provides an overview of how stakeholders responded to key questions associated with MCA concepts. Overall, we found that although stakeholders are generally aligned on the definition and aims of MCA, there are diverging perspectives on the overall significance of the MCA initiative, how MCA aligns with other Air Force initiatives, and the importance of the different MCA training tiers. Given the current decentralized nature of MCA development efforts, these diverging perspectives can have a significant impact on how each Air Force wing is approaching MCA training and utilization.

Figure 3.1. Stakeholder Perspectives on Multi-Capable Airmen Concepts



NOTE: The dark shaded areas to the far right of the figure indicate missing or indeterminate data.

What Do Stakeholders Think About Multi-Capable Airmen Training?

Following our discussion of broader MCA themes and concepts, we focused on various issues related to MCA training. Here, we looked at the Air Force's approach to MCA training, potential challenges in training implementation, the emphasis of this training on the different tiers and mission support pillars, and how much autonomy wings do and should have in developing their training programs. We also asked about the potential value of new training methods and approaches for MCA. We outline key observations from stakeholder responses in the next subsection.

Training Approaches for Multi-Capable Airmen Are Still Being Developed and Vary Widely

Although the Air Force has outlined specific tiers of MCA training, it has provided minimal additional guidance to ensure the standardization of training across the Air Force. Therefore, as part of our discussions with stakeholders, we asked them to briefly describe their understanding of how the Air Force was approaching MCA training and their knowledge of specific training efforts underway. Overall, we found that there was not a good understanding of the training taking place across the Air Force. Stakeholders often mentioned the role of USAFEC in

developing a curriculum for training Tier 1 EST while noting that Tier 2 CUT and Tier 3 MAJCOM-specific training was primarily a grassroots effort under development at various Air Force wings.

Stakeholders Identified Several Challenges to Implementing Multi-Capable Airmen Training

When queried on the challenges they were encountering or expected to encounter when conducting MCA training, stakeholders responded with four main themes: resource limitations, time limitations, difficulties achieving and maintaining proficiency, and the need for buy-in across the force.

On resource constraints, stakeholders primarily commented on the lack of adequate financial resources and personnel. Stakeholders noted that current MCA efforts at Air Force wings are being funded and manned "out of hide" (out of existing funds) and that dedicated funding and staffing would be needed for sustainment. As one stakeholder noted, "Many of these wings are not resourced to do this training. There are just great wing commanders that are making it happen and pulling the money from other programs and redirecting things because they understand it's important." Similarly, another stakeholder commented, "It appears that from an installation/site level that you're still being asked to perform the home station mission, as always, and yet you still want a high level of readiness and a high level of training and that's just difficult with the resources and manning that we currently have."

Stakeholders also expressed concern regarding the ability to find time in current schedules to pull individuals out for MCA training. Stakeholders often noted that there was barely enough "white space" on calendars for airmen to complete their primary duties and related training, let alone time to learn new skill sets. Proposing that this can also affect the mission, one stakeholder commented, "If I pulled 18 maintainers [for training], it impacts sortie production."

Stakeholders further raised the issue of defining and measuring desired proficiency as a significant training challenge. Because the Air Force had not provided guidance regarding proficiency levels at the time of this study, stakeholders expressed a need for a clear standard that they would be expected to train to. For example, one stakeholder stated,

> We need to figure out what level of familiarity do we want. What level of competency? Fully proficient? Once you nail all of that down, then you have to look at the training burden on top of that. If we want the MCA to be proficient, what does that look like, and what is the cost in garrison?

Finally, stakeholders commented on the importance of gaining buy-in across the force, including the potential need for a broad culture shift. They noted that buy-in from the average airman to senior leadership levels was critical. On a related note, stakeholders suggested that MCA training was impeded by a degree of career field tribalism. This is reflected in a lack of willingness by some experienced airmen to train others who do not belong to their AFSC because "they don't think others can do their jobs."

The Majority of Stakeholders View Additional Training Costs for Multi-Capable Airmen as Moderate but Disagree on What Training Will Be Most Costly

As part of our interviews, we asked stakeholders how significant they thought additional training requirements and costs associated with MCA would be compared with the status quo and whether they thought those costs would differ for Tier 1 (EST) and Tier 2 (CUT) training. Overall, 29 percent of stakeholders thought MCA training would impose a high cost, 60 percent thought it would impose a moderate cost, and 11 percent indicated there would be little to no additional costs. Stakeholders who indicated that additional training costs would be moderate often noted that the true cost was still unknown and would depend on the future direction of the MCA initiative. Others suggested that cost was dependent on the specialties being trained. Stakeholders who thought that the additional cost was lower often noted that MCA training was not intended to take airmen too far from their core AFSCs. In other words, MCA training would be limited to narrow clusters or families of like AFSCs with correspondingly little additional training demand.

Stakeholders were somewhat split on whether Tier 1 or Tier 2 skills would be more costly and challenging to train: 34 percent of stakeholders indicated that Tier 1 would be costlier, 55 percent indicated that Tier 2 would be costlier, and 11 percent indicated that costs would be roughly equal or balanced between the two tiers. Among those who suggested that Tier 1 training would incur more costs, the comments tended to focus on the need for all airmen to be trained in Tier 1, which would require temporary duty travel to train at centralized locations; in contrast, Tier 2 training was discussed as focused on a select subset of airmen and something that could be accomplished at the wing level. Among those who indicated that Tier 2 would have greater costs and challenges, the comments focused on the need for more-tailored technical training and requirements to make sure those skills do not atrophy. Several stakeholders also commented on the difficulties of pulling airmen away from their primary duties for Tier 2 training. One stakeholder, who was particularly concerned about the cost associated with Tier 2 training, noted,

> I don't know what it would cost to get CUT proficient. But it's going to cost a lot of money and the skills are going to attrit. So, CUT is very costly and doesn't provide much benefit. They're looking at Keesler, building up different tech schools for CUT. I can't fathom what that would cost—millions and millions of dollars just to see skills atrophy.

Stakeholders are Divided on the Degree to Which Multi-Capable Airmen Should Train Across Mission Pillars

As described in Chapter 2, the MCA initiative is structured around three mission set pillars: MG, C2, and BOS. At the time of this study, the Air Force focus was on MG and associated AFSCs with plans to extend to the other pillars. There has also been discussion regarding the degree to which future CUT should extend *across* the three mission pillars. In other words,

should a single MCA be trained in skills that are relevant to multiple mission pillars or remain confined to an individual pillar (with distinct MG MCA, C2 MCA, and BOS MCA)?

Overall, we found that stakeholders were split as to whether CUT for the individual airman should remain within a single mission pillar (40 percent) or should be extended across pillars (60 percent). Among stakeholders who recommended that training remain focused within specific pillars, much of the discussion focused on the risk associated with training in skills that are too far removed from the airmen's primary AFSC. For example, when asked about training across pillars, one stakeholder commented, "Absolutely not; I think it's too difficult in most of those, if not all of those, career fields to really reduce the risk enough to feel comfortable." Similarly, another stakeholder stated,

> No, if you do that it will get more complicated. If you are expecting your guys to do AFSCs outside of the clusters, then it will be hard to track and manage and set standards. I think it needs to stay within a specific cluster [pillar].

Another stakeholder who recommended that training stay within pillars came at the issue from the angle of force management, noting that

> [f]rom the perspective of force generation, or global force management, we have to remain within bins. UTCs [unit type codes] are aligned under these capability clusters. It's the way force packages are built . . . . From an institutional standpoint of how people request airpower, it makes the most sense to bin [by pillar].

Even among stakeholders who indicated that there was room for some training to happen across pillars, several noted that there were limitations and caveats. For example, one stakeholder commented, "It depends. It comes back to training up versus down. For security forces, we already do security forces augmentees. That requires a lot of physical work, so there's room for moving between clusters. It's different when you get more technical." Finally, a few stakeholders noted that there could be some training possible across certain mission pillars, but not necessarily across all mission pillars. Specifically, they see value in training MCA across BOS and C2 skill sets while keeping MCA associated with MG. One stakeholder stated that in PACAF, "We send mission gen [airmen] away and then do C2 and BOS specific training. So, we see mission gen as its own category and the other two mix." Similarly, another stakeholder commented that "maybe mission gen in particular is unique. . . . The air base squadron for base support and C2 are co-located, but the MG MCA will be at a different location."

Most Stakeholders Think That Mission Generation Multi-Capable Airmen Should Be Trained on Multiple Aircraft Types but Also Propose Limitations

Although there are exceptions, most airmen involved in aircraft sortie generation roles train and work on a single aircraft type or a single mission design series (MDS). Given this practice, multi-skilling related to sortie generation can go in either of two directions (or in both directions). The first direction is acquiring skills to perform tasks outside an airman's primary

specialty but on the same aircraft (e.g., an F-16 avionics maintenance troop learning to load bombs on the F-16). The second is acquiring skills to perform tasks within an airman's primary specialty but on different aircraft (e.g., an F-16 avionics maintenance troop learning to conduct avionics maintenance on the F-35). Theoretically, one could combine these tracks by acquiring skills to conduct tasks outside an airman's primary specialty on multiple aircraft types. Senior Air Force leadership has not been enthusiastic about extending MG MCA training to multiple aircraft types given the increased resource demands and risks involved.[58] Specifically, guidance from the 2021 GOSG on MCA included a note that "MCA will not train in multi-MDS outside of normal primary AFSC tasks."[59] But the majority of stakeholders we interviewed endorsed the Air Force moving toward a multiple MDS version of MCA, particularly given the operational demands of ACE. Within the ACE construct, it is possible—if not likely—that a given forward base will support multiple aircraft types. That said, the basic low-to-high preference scale here does not adequately capture variation in stakeholder perspectives. Even among stakeholders who are supportive of a multiple MDS version of MCA, there was still a great deal of variation in terms of timing (how soon the Air Force should pursue a multiple MDS version of MCA), the scope of relevant AFSCs (which AFSCs should cover multiple MDS and which should remain tied to a single MDS), and the variety of aircraft types. With regard to aircraft types, some stakeholders proposed that the multiple MDS version of MCA should be confined to groupings of like aircraft. For example, a given MCA would be limited to fighter aircraft or even to fourth-generation fighter aircraft.

Stakeholders Concur That Wings Have Considerable Autonomy in Their Training Programs but Disagree on the Right Amount of Autonomy Moving Forward

As of 2022, individual Air Force wings have a tremendous amount of autonomy over their MCA training programs, including what they train, how much they train, and how often they train. It is thus not surprising that MCA training programs vary widely across wings and even across wings in the same MAJCOM. Given this observation, we sought stakeholder perspectives on the appropriate level of autonomy for wings moving forward. Most stakeholders proposed that wings retain at least a moderate degree of autonomy with their MCA training programs, with approximately half suggesting that wings retain a high level, near equivalent to what wings currently have. We found the prevalence of this latter response interesting given widespread concerns expressed about the lack of MCA standardization and guidance. Looking at different breakdowns of our stakeholder groups, wing representatives proposed a lesser degree of wing autonomy than proposed by their MAJCOM staffs. Overall, the policy subgroup (Air Force staff) recommended a higher degree of wing autonomy than the MAJCOM staffs. In essence, as one moves up the chain, the impetus to push responsibility down the chain grows. The apparent

[58] U.S. Air Force, "ACE Conference MCA Briefs," September 29, 2021.

[59] U.S. Air Force, 2021.

result is a gap between the level of guidance that wings want and the level of guidance that higher headquarters is willing or able to provide.

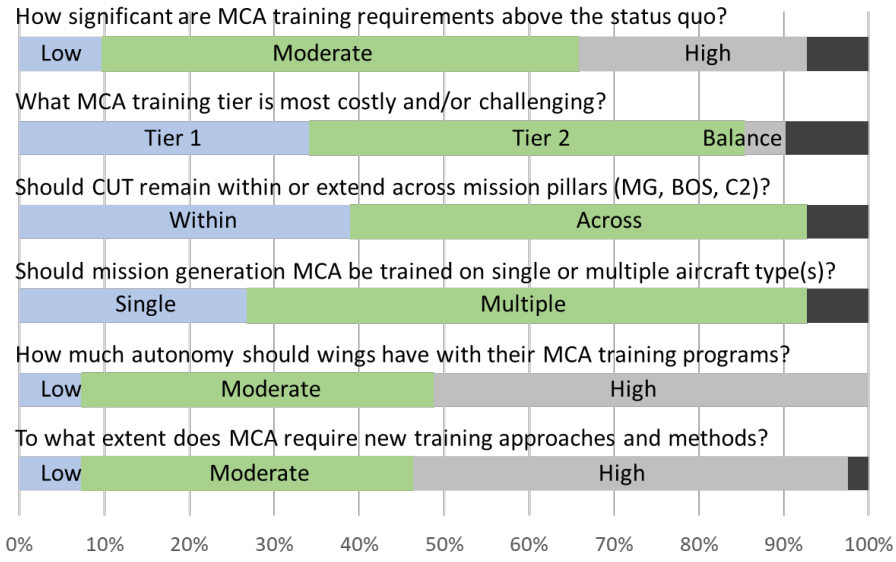
Stakeholders Agree That New Training Approaches and Methods Could Be Beneficial for Multi-Capable Airmen

When asked about the extent to which MCA training could benefit from new approaches or methods, more than 90 percent of stakeholders indicated that there would be moderate (40 percent) to high (51 percent) benefits. Related comments centered on an overall Air Force need to modernize how it trains. Specific comments pointed to the importance of gaining efficiency and time and avoiding the atrophy of secondary MCA skills. When asked about what potential methods and approaches might be most beneficial, stakeholders largely focused on the use of virtual reality (VR) or augmented reality (AR). A few stakeholders also mentioned the importance of adapting the overall training pipeline to incorporate MCA skills earlier in an airman's career. Many stakeholders also noted that there was a need to balance costs when incorporating new methods and training and that the Air Force should refrain from going too far too fast. As one stakeholder stated, "We do need to figure out how to train more effectively with the limited amount of time and people, but it's not necessarily that the system is broken. We need to incorporate new technologies but nothing crazy." Among the stakeholders who indicated that there would be low benefit from new training approaches or methods, comments tended to focus on MCA training fitting into the current system and on in-person training as an essential element for many Tier 2 skills. For example, one stakeholder observed, "I think in person and schoolhouses . . . . I think that is going to be vitally important, in-person training, and those who have lived it. It will take years. I don't think the answer is AR or computer-based training."

Summary

Figure 3.2 provides an overview of how stakeholders responded to key questions associated with MCA training. Overall, we found that training approaches for MCA are still nascent and vary widely. Stakeholders also identified several key challenges to implementing MCA training, including limited resources, time limitations, difficulties sustaining proficiency, and the need for buy-in from across the force. Additionally, although stakeholders generally agreed that MCA could benefit from new training approaches and methods, stakeholders had varied perspectives on the extent to which CUT should combine skills from different mission pillars and the degree of autonomy wings should be able to exercise over their local training programs.

Figure 3.2. Stakeholder Perspectives on Multi-Capable Airmen Training



NOTE: The dark shaded areas to the far right of the figure indicate missing or indeterminate data.

What Do Stakeholders Think About Multi-Capable Airmen Implementation?

Having covered various aspects of MCA training, we moved our discussion to MCA implementation, with the intent of getting at how the Air Force can and should work to institutionalize MCA across the force. The emphasis here was on policy decisions and the barriers associated with full implementation. This included inquiries about regulatory and personnel system changes, plus MCA incentivization, selection, and tracking. We outline key observations from stakeholder responses in the next subsections.

Stakeholders Are Divided on the Need for Regulatory and Personnel System Changes

Apart from the allocation of resources, adjustments to regulations and personnel policies represent two of the main ways the military can formalize and institutionalize large-scale organizational change. We anticipated a strong correlation between these two approaches and the perceived need for change, as well as a connection between these two approaches and stakeholder perspectives on how significant a change MCA represents for the Air Force, but the results were mixed. A slight majority of stakeholders, or 54 percent, agreed on the need for at least moderate change in both Air Force regulations and personnel policies. However, only 10 percent of stakeholders were consistent in the degree of change needed in the two areas, with most placing more emphasis on the need for regulatory versus personnel system change or vice versa.

We also did not see much of a connection between stakeholders' perceptions of the need for regulatory and personnel policy adjustments and their broader views on how significant a change

MCA represents for the Air Force. We anticipated that stakeholders who viewed MCA as a major shift would also see a greater need for changes to Air Force regulations and personnel policies, but this was not the case. Among those stakeholders who rated MCA as a major shift, 61 percent also rated the need for either regulatory *or* personnel system change high and only 10 percent rated the need for change in both as high. Among stakeholders who viewed MCA as a moderate shift, 64 percent rated the need for either regulatory *or* personnel system change as high and 12 percent rated the need for change in both as high. Among stakeholders who viewed MCA as a minor or insignificant shift, 62 percent rated the need for either regulatory *or* personnel system change as high and no one rated the need for change in both as high. This cluster of stakeholders who view MCA as a minor shift but still see the need for big regulatory or personnel system changes likely includes those who argued up front that MCA is just a way of formalizing and documenting what airmen are already doing.

When asked about what specific regulatory changes might be needed, we heard the following spectrum of comments from stakeholders:

> This [MCA] will affect every AFI [Air Force Instruction]. We can just write an MCA AFI, or every AFI will need an MCA caveat.
>
> We need regulatory change that redefines risk and authorities.
>
> There are certain competencies that need to be removed, waiver capability on who has to do certain job sets. Depending on what you need to change, there might be higher need for reg changes. Depends on the cross-functionalities you are trying to implement.
>
> None [regulatory change]. We already do this [MCA] in the CRG [contingency response group].

When asked about what specific changes to the Air Force personnel system might be needed, stakeholder comments included the potential need to develop a selection mechanism for MCA and the need to track MCA, potentially with an SEI. Some stakeholders also mentioned the potential need for changes to promotions and evaluations. For example, two interviewees commented,

> You are going to need to find a way to adjust the personnel system in [a] way that you are tracking who is receiving what sort of training, who is capable across.
>
> They're certainly going to need to change the understanding of what performance-based promotion looks like. You aren't going to have people who will be at the top of their specific career field anymore, they will be spread. We'll have to change evaluations, the rubric of the evaluation system . . . to capture what good performance really means as you spread people thinner.

Stakeholders Consider Air Force Culture a Significant Barrier to Multi-Capable Airmen Implementation

As part of the discussion on implementation, we also asked stakeholders what they saw as the most-significant hurdles or challenges to implementing MCA long term. We asked this as an open-ended question to see what challenges stakeholders would raise organically and then also asked them to rate specific potential challenges (e.g., resources, Air Force culture, organizational structure, and perceived operational demand).[60] For those stakeholders who provided an answer to the open-ended question, the most commonly identified challenges were Air Force culture (i.e., the need for buy-in) and a lack of clear guidance on MCA. A few stakeholders also raised concerns about a lack of resources and challenges implementing training and managing MCA talent. Likewise, when asked to assess specific challenges as proposed by the interview team, stakeholders collectively rated Air Force culture as the most significant barrier to MCA implementation.

We also heard multiple comments about a generational gap, with younger officers (O-4 and O-5) suggesting that senior leadership was too stuck in its ways and too risk-averse to take the MCA initiative very far. Several stakeholders commented that the enlisted CFMs were an impediment to change, noting that these senior enlisted leaders had too much invested in the current system and their stovepiped career fields. Given these perceptions, we went back to the interview data and isolated a subset of questions across topic areas that best encapsulated a limited versus expansive view of MCA. Then, we conducted a separate statistical analysis of this subset of questions, treating CFMs as a distinct stakeholder subgroup (see discussion of multiple correspondence analysis in the subsection "How Do Stakeholders Relate in Their Approaches to Multi-Capable Airmen?"). Per this analysis, the CFMs rated near dead center average, with nothing to distinguish them as either highly conservative or aggressive. In contrast, our subgroup of USAFE-AFAFRICA stakeholders emerged as an outlier for relatively conservative approaches to MCA.

Stakeholders Disagree on the Number of Personnel to Be Trained as Multi-Capable Airmen

To assess stakeholder perspectives on the scope of MCA implementation, we queried them on the percentage of airmen that should be designated and trained as MCA. Responses to this question were all over the map, ranging from under 10 percent to more than 80 percent. We found this interesting, particularly given the consensus on the definition of MCA and the linking of MCA to ACE. The associated discussions revealed that this wide divergence was driven by underlying disagreements about the Air Force's management of MCA and whether MCA status is affiliated with the individual airman or a specific billet. The divergence also reflected the fact

[60] Because of time limitations, we were not able to ask all stakeholders the open-ended question.

that, at the time of the interviews, the Air Force had no standards for selecting or labeling an airman as MCA.

Stakeholders Are Sharply Divided on the Need to Incentivize Multi-Capable Airmen

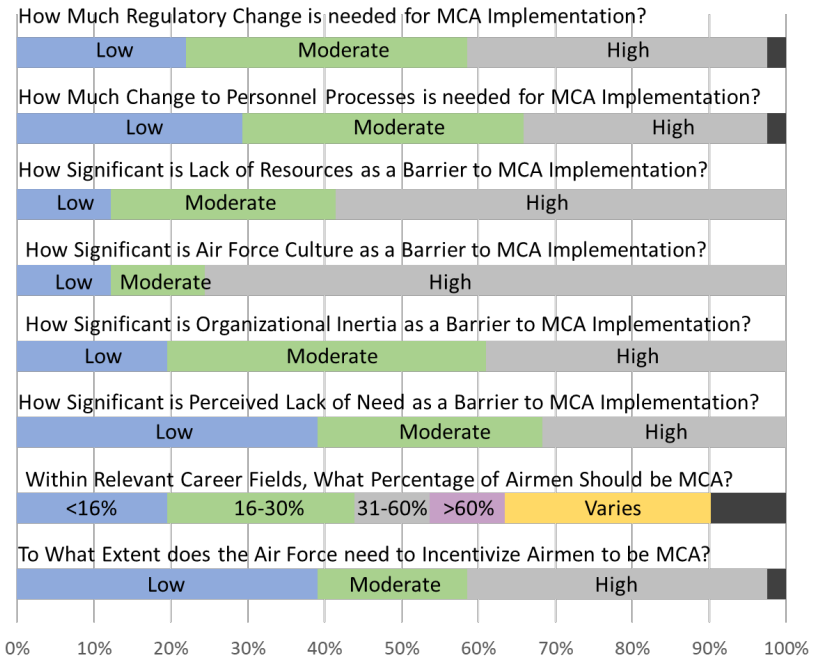
For our final question related to MCA implementation, we asked stakeholders about the need to incentivize airmen to train and serve as MCA, whether through special duty pay, promotion advantages, or any other approach. This topic ended up being the most divisive in our protocol. Not only were stakeholders divided on the topic, but they also clustered on the low or high ends of our rating scale, with relatively few taking the middle ground. In other words, stakeholders tended to be highly opposed to or strongly in favor of incentives, with the latter cluster proposing that, without substantial individual incentives, the initiative would fail. Of note, the most-consistent opposition to incentives came from the enlisted CFMs. We interviewed seven enlisted CFMs, all chiefs with substantial equities in the MCA initiative. All seven rated the need for incentives as low and this accounted for more than half of our total low responses; every other stakeholder subgroup was mixed in their responses. The most consistent perspective of a high need for incentives came from ACC personnel, both on the staff and in the wings. Some examples of stakeholder responses, both for and against individual incentives, are provided as follows:

> I value what I pay people for; and if I value this MCA thing, I need to pay people. They need to see that I value it.
>
> Incentives are not necessary. . . . The airmen that are MCA love being MCA.
>
> If you need more money to do more work, then you're in the wrong job. . . . I think a majority of our folks just want to serve.
>
> Our airmen jump up and down at the opportunity to do this. They love it. Just tell them they can be part of any elite team. The real problem is that too many people will volunteer and we have to make the hard choice. . . . People want to do this.
>
> Depends on the ops tempo. Probably needs to be good incentives. There is the pull from the economy so you probably need a monetary bonus.
>
> We would have to be careful, because not every AFSC is considered MCA, so it would not be fair to give incentives only to some AFSCs. I agree with a special identifier and definitely a patch. Plus, it should go in the EPR [Enlisted Performance Report]. But no money or reenlistment bonus.
>
> When you get down to it, money and promotion is going to get people's attention. If it doesn't result in money and promotion, I just don't think you're going to get the correction.
>
> I think when we change our culture, it will just be normal duty, and there will be less need for incentives. But change is hard, and we need to incentivize initially.

Summary

Figure 3.3 provides an overview of how stakeholders responded to key questions associated with MCA implementation. Overall, we observed that stakeholders disagree on the need for regulatory and personnel system changes to implement the MCA initiative. Although most stakeholders see a lack of adequate resources as a significant barrier to implementation, even more stakeholders agreed that Air Force culture was a significant barrier. We also found that stakeholders have very different views on the percentage of airman that should be designated and trained as MCA, which reflects an underlying disconnect on the meaning of MCA for the Air Force. Finally, the matter of MCA incentives appeared to be polarizing, with stakeholders tending to be strongly in favor or highly opposed.

Figure 3.3. Stakeholder Perspectives on Multi-Capable Airmen Implementation



NOTE: The dark shaded areas to the far right of the figure indicate missing or indeterminate data.

What Do Stakeholders Think About Multi-Capable Airmen Deployment?

Finally, we sought the perspectives of key stakeholders related to MCA force presentation, or the organization and deployment of MCA for combat operations. This discussion centered on theater requirements, the alignment of MCA management with the deployment cycle, and the structure of UTC packages. Although we did not specifically address UTCs, most of our questions in some way related to the size, tailoring, organization, and deployment cycle of an

MCA-based UTC for force presentation. We outline key observations from stakeholder responses below.

Stakeholders Agree That Multi-Capable Airmen Requirements Vary Across Theaters but Differ on Whether the Force Provider Should Tailor Multi-Capable Airmen to These Requirements

Over the course of our stakeholder interviews, there was extensive discussion about standardizing MCA programs across wings, MAJCOMs, and theaters of operation. Within this broader discussion, we focused on the extent to which the force provider (mainly ACC) should tailor how it trains and organizes MCA to meet unique theater requirements. In other words, should the force provider develop and present a standard MCA package or distinct, theater-specific MCA packages? Stakeholders generally noted that MCA requirements vary substantially across theaters—mainly European Command (EUCOM) and Indo-Pacific Command (INDOPACOM)—but were mixed on how much the force provider should be involved in MCA requirements tailoring. Approximately 36 percent of stakeholders thought that the force provider should do little to no MCA tailoring. It is perhaps unsurprising that our force provider subgroup had the least favorable view of force provider tailoring; in this subgroup, 75 percent recommended little to no MCA tailoring. Interestingly, the subgroup most in favor of MCA tailoring was not force employment (USAFE-AFAFRICA and PACAF) but policy and oversight; within this group, fewer than 25 percent proposed little to no tailoring. The force employment subgroup fell somewhere in the middle, with approximately 50 percent proposing little to no tailoring; in this subgroup, USAFE-AFAFRICA exhibited a slightly higher preference for tailoring than PACAF. A representation of stakeholder comments is as follows:

> ACC should not tailor. There's not much time for that. Leave that to the overseas wing once a unit gets to theater. There are times very often when overseas deployments change, so tailoring would be a lost effort by ACC.
>
> I say this [the need to tailor] is low. The force provider needs to train these [MCA] airmen to go in either direction [EUCOM or INDOPACOM]. We'll shoot ourselves in [the] foot otherwise. We need theater-agnostic airmen.
>
> The goal of MCA is to standardize as much as possible. AFFORGEN [Air Force Force Generation] provides time to tailor in a small amount.
>
> You have to tailor to your environment. There's going to be some tailoring, but not off the charts.
>
> Highly tailored . . . . Absolutely.

Most Stakeholders Think That Multi-Capable Airmen Teams Should Deploy from the Same Base, but There Are Important Outliers

Most stakeholders concurred that deployed MCA teams should come from the same base, having trained and worked together prior to deployment. Arguments in favor of a common home

base centered on the elements of team cohesion, trust, and familiarity. The appeal of a cohesive team seems relatively straightforward and intuitive. Because of this, we found the outliers who argued against a common home base more interesting. Of particular note, the most significant cluster of opposition came from PACAF. According to these outliers, MCA training should be standardized across bases and units. In a fluid ACE environment, workforce flexibility is key, and the Air Force should be able to assemble, employ, and backfill effective MCA teams regardless of home basing. Although there are certainly benefits to having MCA teams come from the same base or unit, the Air Force should not rely on or be overly concerned with this. Stakeholder perspectives from both sides of this issue are as follows:

> If we are doing it [MCA] right, the need [for MCA teams to deploy from the same base] is zero. . . . The notion that I need to bring everybody from one team isn't why I created MCA.
>
> We have standards, and we all train to the same standard, no matter the base. The need [for MCA teams to deploy from the same base] is not there. It is a nicety."
>
> I don't think they [teams of MCA] should [all deploy from the same base] because we don't have enough. Everyone should be trained at the baseline.
>
> This [deploying MCA from the same base] is important and is critical to the concept of employment. CUT is standardized at the wing. We don't want to find out differences in capability at the mission edge. That will get people killed.
>
> This [deploying MCA from the same base] is very important. . . . That's always a starting point. We need unit integrity. At a minimum from the same base. That's the last line of risk. They need the same level of training. They need to exercise together.

Stakeholders Are Divided on the Use of Just-in-Time Multi-Capable Airmen Training Prior to Deployment

Most stakeholders agreed that the training and management of MCA should align closely with the AFFORGEN deployment cycle, which is supposed to add structure and predictability to deployments and deployment preparation. Accordingly, we found it interesting that stakeholders were deeply divided on the application of just-in-time training for MCA or training that occurs after a unit is notified of, and in preparation for, a specific deployment (this typically takes place in a relatively short time window prior to the deployment). Most stakeholders who proposed a moderate or high need for just-in-time training were not generally in favor of this type of training but saw it as a necessity stemming from the challenges of maintaining MCA proficiency at home station. MCA skills, once acquired to an adequate proficiency level, were readily perishable, and units lacked the resources and time to effectively maintain proficiency over extended periods prior to deployment. In this sense, stakeholders viewed just-in-time training as more of an MCA skill refresher. We also found it interesting that within the group of stakeholders who saw a need for just-in-time training, there was variation in terms of how this applied to Tier 1 EST versus Tier 2 CUT. Some perceived just-in-time training as most appropriate for Tier 1 while others saw

greater value with Tier 2. With Tier 2, some stakeholders even argued that the necessary CUT could be achieved on the job, after arrival in theater. Examples of stakeholder views are provided as follows:

> Assuming [the] AFFORGEN model is working, then zero [the need for just-in-time training].
>
> We can't do this just-in-time training crap anymore. By that time, it's way too late. The speed that PACAF is looking at . . . we would be extremely lucky to get 20 days [notification prior to deployment]. That training [just-in-time] . . . I don't think we could rely on that. I think it [MCA training] has to be built into our day-to-day process.
>
> I don't like it [just-in-time training]. If you want to institute a cultural shift, we need to get away from a just-in-time training mentality. Just-in-time training doesn't indicate an Air Force commitment.
>
> Some of those skill sets can be taught just in time, mostly on the expeditionary side. CUT is more difficult. It's part of your brain, your mindset. That needs to be more managed because getting repetitions is key.
>
> Probably about 25 percent of training would be just-in-time. But this mostly applies to Tier 1. For Tier 2 CUT, it would be too late.
>
> We should focus on moving the expeditionary skills forward to make room for just-in-time occupational training (CUT).
>
> There is a high requirement [for just-in-time training] . . . . Ideally, we want to train in advance but not too in advance. If you, do it too early, skills get rusty really quickly. We can and will have training in advance, but we will also have lots of just-in-time training.

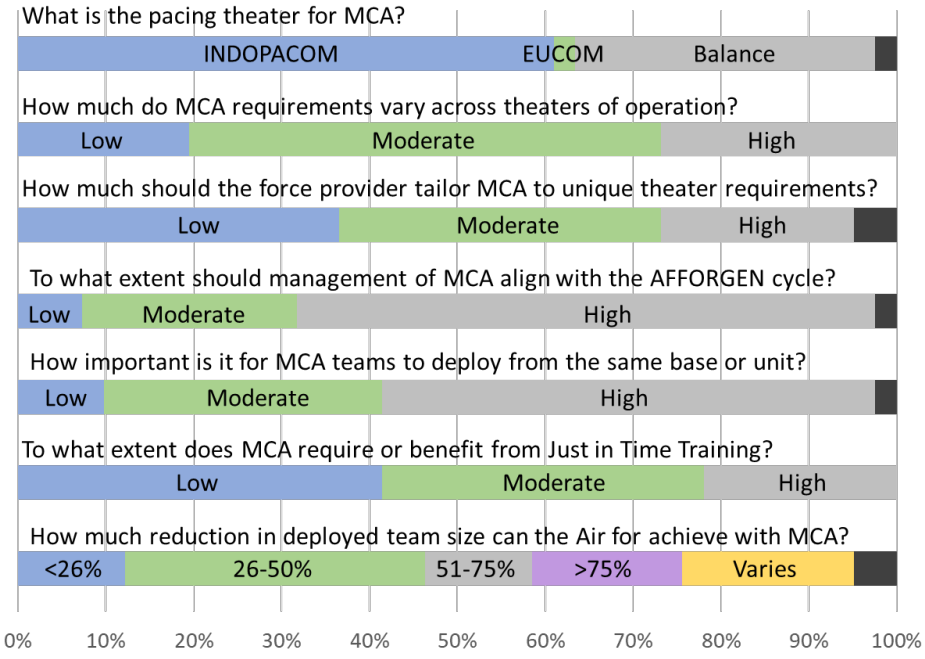
Stakeholders Differ on How Much Multi-Capable Airmen Can Reduce the Size of Deployed Teams

As noted in the section on MCA concepts, most stakeholders agreed that a main benefit of MCA is the ability to reduce the personnel footprint at forward locations without substantial loss of capability. When discussing deployments, we further queried stakeholders about the extent of team size reduction that could be achieved by using MCA. This discussion certainly relates to the conceptual benefits of MCA, but it is also relevant to the more practical matters of UTC design and logistics requirements. We heard a range of estimates, from highly conservative to highly ambitious, with the greatest number of responses falling within a moderate 26–50 percent reduction range. Many stakeholders caveated their responses with "it depends"—referring to the mission set and location—although several also noted that the Air Force will have to work this out through trial and error at exercises. Across our stakeholder subgroups, PACAF exhibited the most ambitious perspective, with 50 percent of responses proposing team reductions by more than 75 percent; USAFE-AFAFRICA was only slightly more conservative. The policy and oversight subgroup was by far the most skeptical, with a relatively high number of responses proposing team reductions of less than 25 percent by using MCA.

Summary

Figure 3.4 provides an overview of how stakeholders responded to key questions about MCA deployment. Overall, we found that stakeholders recognize that MCA requirements vary across theaters of operation but are divided on how much the force provider should tailor MCA training and MCA force presentation to specific theater needs. Stakeholders generally see the need to organize and train MCA in alignment with the AFFORGEN deployment cycle, yet they have divergent views on the requirement for just-in-time training.

Figure 3.4. Stakeholder Perspectives on Multi-Capable Airmen Deployment



NOTE: The dark shaded areas to the far right of the figure indicate missing or indeterminate data.

How Do Stakeholders Relate in Their Approaches to Multi-Capable Airmen?

The figures associated with the different MCA topic areas that we have discussed show the relative weights of individual stakeholder responses. In this section, we employ multiple correspondence analysis to assess the relationships between different stakeholder subgroups on the basis of the relative similarities or differences in their perspectives on MCA. For this analysis, we broke down our original four stakeholder groups into six subgroups. This included separating CFMs from the rest of Air Staff in the policy category (because of the unique role the CFM plays in the standardization and institutionalization of MCA) and dividing the force employer category between PACAF and USAFE-AFAFRICA to better elicit the similarities and

differences across the two theaters. For example, how similar or different are stakeholders from PACAF and USAFE-AFAFRICA in their perspectives on MCA deployment?

Multiple correspondence analysis models data as clouds of points on a biplot, with the interpretation of the data based on the spatial relationships of these clouds of points.[61] We used this approach for the figures at the end of this section. For our purposes, the positioning of a given stakeholder subgroup reveals relationships with other stakeholder subgroups and relationships with the categorical variables (responses to interview questions). The closer the subgroup plots on the chart, the greater the similarities between the subgroups in terms of their responses to interview questions.[62] Then, the distance of the plot from the center (the intersection of the two axes) indicates the level of differentiation in terms of the categorical variables; the greater the distance from the center, the greater the differentiation. For our purposes, this means that a stakeholder subgroup located near the center is relatively average in terms of its association with categorical variables (responses to interview questions). A stakeholder subgroup relatively far from the center has a uniquely strong association with one or more of the categorical variables. Outlier status is thus a function of both distance from the center and distance from other stakeholder subgroup plots.

For data, we divided our set of Likert-style interview questions into six subsets for more-refined analysis.[63] For our first four data subsets, we used the four topic areas of MCA: concepts, training, implementation, and deployment. For our fifth subset, we grouped questions from each of the four topic areas that we assessed as most relevant to Air Force–level policy decisions. Specifically, this "decision points" data subset incorporated the following questions:

- What MCA training tier should be the Air Force's highest priority (weight of effort)?
- What MCA mission pillar is most relevant to MCA or should be the focus of MCA?
- Should CUT remain within or extend across mission pillars (MG, BOS, C2)?
- Should MG MCA be trained on single or multiple aircraft?
- How much autonomy should wings have with their MCA training programs?
- Within relevant career fields, what percentage of airmen should be designated MCA?

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[61] It is important to recognize that the axes on the resultant biplots do not represent individual variables but instead capture the weighted contributions of several variables, thus allowing for the presentation of multi-dimensional relationships in a two-dimensional space.

[62] In other words, "Two individuals are similar to each other if they tend to choose the same values (i.e., categories, across a given set of variables). If they systematically choose differently across the active set of variables, they will be located in opposition to each other in the global space" (Johs. Hjellbrekke, *Multiple Correspondence Analysis for the Social Sciences*, Routledge, 2019, p. 35).

[63] The results of multiple correspondence analysis are mapped onto two axes, with each axis varying in terms of "percentage-explained inertia." Typically, the greater the number of categorical variables included in the analysis, the lower the percentage explained and the greater the possibility that we miss key relationships beyond those captured in the two core axes. Of note, the aim of multiple correspondence analysis is to exhibit the relationships of multiple (more than two) variables in a biplot; accordingly, the *x* axis (F1) and *y* axis (F2) do not represent individual variables or scales but instead represent weighted composites of multiple variables (stakeholder responses to interview questions) statistically optimized to capture the largest percentage of interrelationships. Hjellbrekke, 2019, p. 36.

- To what extent does the Air Force need to incentivize MCA?
- How much should the force provider tailor MCA to unique theater requirements?
- How important is it for MCA teams to deploy from the same base or unit?

For our sixth subset, we grouped questions from each of the four topic areas that we assessed as capturing the distinction between a conservative and aggressive approach to MCA. Specifically, this "conservative vs. aggressive" subset incorporated the following questions:

- How significant of a shift or change does MCA represent for the Air Force?
- How significant are MCA training requirements above the status quo?
- Should CUT remain within or extend across mission pillars (MG, BOS, C2)?
- Should MG MCA be trained on single or multiple aircraft?
- To what extent does MCA require new training approaches and methods?
- How much regulatory change is needed for MCA implementation?
- How much change to personnel processes is needed for MCA implementation?
- Within relevant career fields, what percentage of airmen should be MCA?
- To what extent does MCA require or benefit from just-in-time training?

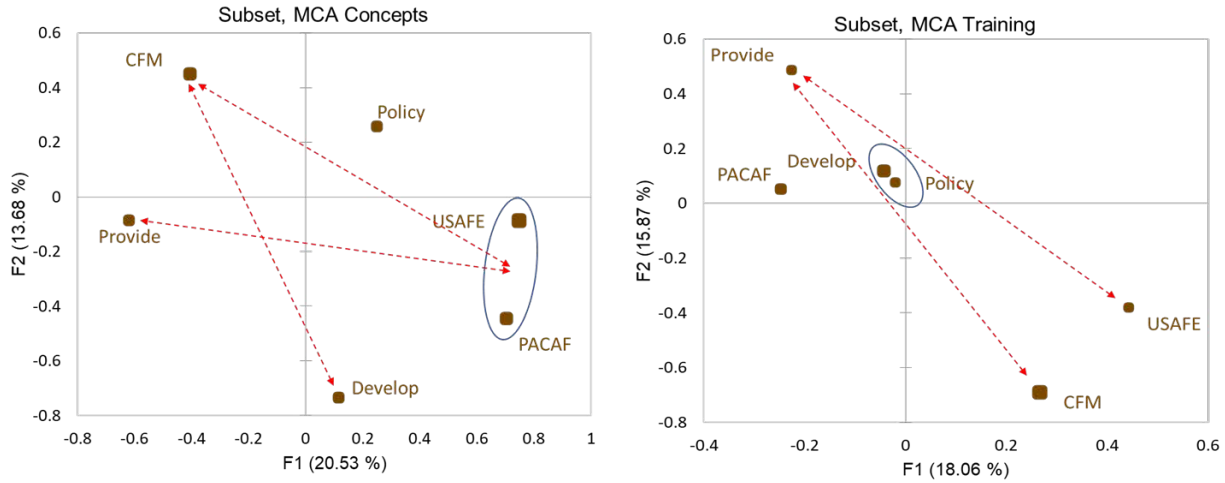
We conducted a separate test for each of the six data subsets. For each subset, we sought to identify the dominant cluster or clusters of stakeholder subgroups (based on common responses to interview questions), the stakeholder subgroup closest to the center (least differentiated in its responses), the most significant stakeholder subgroup outlier, and the stakeholder subgroups with the largest gap between each other. Table 3.1 summarizes our findings of these analyses. Figures 3.5 to 3.7 provide graphical representations of these analyses, with the dominant clusters circled and the largest gaps indicated by a dashed red line.[64]

[64] For this analysis, we used XLSTAT 2022.1.2.1258 Multiple Correspondence Analysis (Disjunctive Table). We treated categorical responses with missing or incomplete data, or that have a relative frequency of < 5 percent, as passive and assigned these responses with the response category mode to minimize the impact on the results. Hjellbrekke, 2019, p. 57.

Table 3.1. Summary of Findings from Multiple Correspondence Analysis

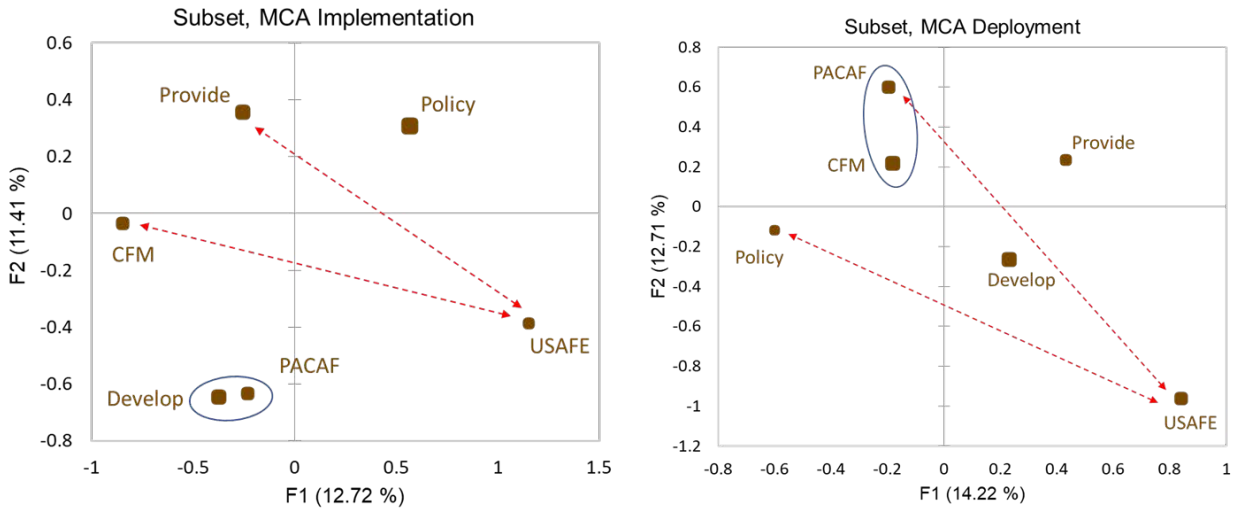
Dataset	Dominant Clusters	Center	Outliers	Largest Gaps
MCA concepts	USAFE-AFAFRICA, PACAF	Policy	None	• USAFE-AFAFRICA and PACAF versus provider • USAFE-AFAFRICA and PACAF versus CFM • Developer versus CFM
MCA training	Policy, developer	Policy	USAFE-AFAFRICA CFM	• USAFE-AFAFRICA versus provider • CFM versus provider
MCA implementation	PACAF, developer	None	USAFE-AFAFRICA	• USAFE-AFAFRICA versus CFM • USAFE-AFAFRICA versus provider
MCA deployment	CFM, PACAF	CFM	USAFE-AFAFRICA	• USAFE-AFAFRICA versus PACAF • USAFE-AFAFRICA versus policy
Decision points	PACAF, CFM, PACAF, developer	Policy	Provider	• USAFE-AFAFRICA versus provider • Provider versus PACAF and CFM
Conservative versus aggressive	CFM, PACAF, policy, provider, developer	CFM	USAFE-AFAFRICA	• USAFE-AFAFRICA versus provider and developer

Figure 3.5. Graphic Results of Multiple Correspondence Analysis, Part 1



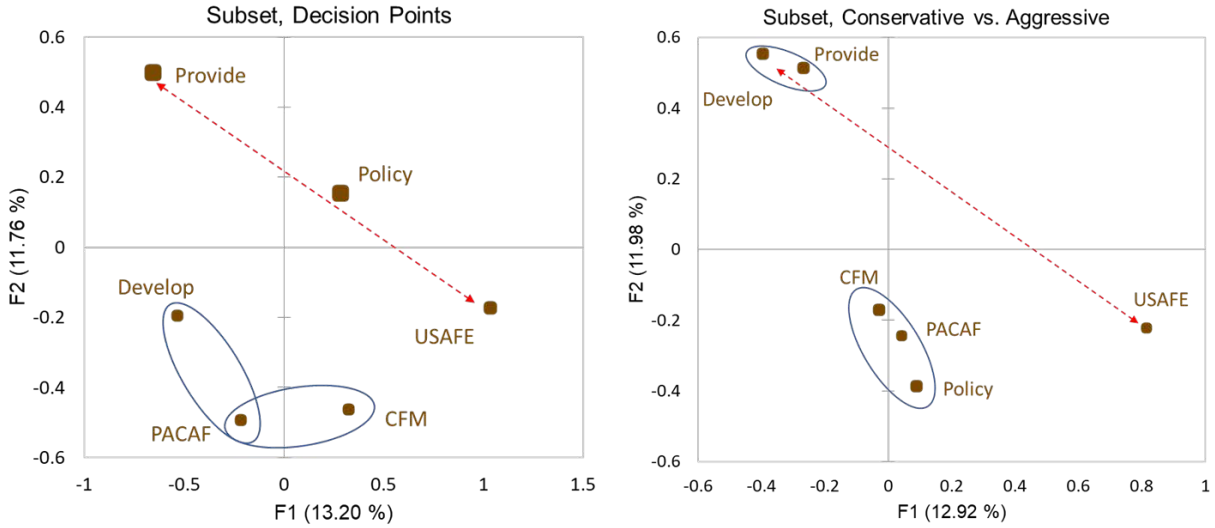
NOTE: USAFE denotes USAFE-AFAFRICA.

Figure 3.6. Graphic Results of Multiple Correspondence Analysis, Part 2



NOTE: USAFE denotes USAFE-AFAFRICA.

Figure 3.7. Graphic Results of Multiple Correspondence Analysis, Part 3



NOTE: USAFE denotes USAFE-AFAFRICA.

Four related trends stand out from this analysis. The first trend is the outlier status of USAFE-AFAFRICA. As a subgroup, USAFE-AFAFRICA stakeholders represented the most significant outlier in four of the six tests, exhibiting relatively high differentiation in relation to

the categorical variables and significant variance from the other stakeholder subgroups. Second, USAFE-AFAFRICA was part of at least one of the largest gap pairings in all six tests. Even when USAFE-AFAFRICA was not the outlier, it still exhibited a relatively large gap with at least one other stakeholder subgroup. Third, the most common of these gaps was between the USAFE-AFAFRICA and force provider stakeholder subgroups. Finally, the USAFE-AFAFRICA subgroup tended to be more conservative in its approach to MCA. This was most evident with the tailored "conservative versus aggressive" data subset but it also bled over into the other tests. Looking at the relationship between the USAFE-AFAFRICA stakeholder subgroup's positioning and the categorical variables, the group's outlier status was determined largely by the unique combination and relative weight of its responses to the questions listed in Table 3.2. In Table 3.2, we also provide the most-discriminating responses for the force provider subgroup as a comparison, given the persistently large gap between these two subgroups.

These trends should not be interpreted as a critique of any of the subgroups, and outlier status should not be viewed in a negative light. Instead, such trends provide Air Force leadership further insight into the challenges of MCA standardization and suggest the need to weigh divergent perspectives and needs in ongoing Air Force efforts to institutionalize the MCA initiative. Again, a consistent theme from the analysis is a relatively large gap in perspectives between the USAFE-AFAFRICA subgroup and the other subgroups, especially the force provider (primarily ACC) subgroup. From the USAFE-AFAFRICA point of view, this highlights a need to clearly identify and communicate what could be unique MCA requirements and demands while not unnecessarily or unknowingly diverging from senior Air Force leadership intent. From the force provider point of view, this suggests a need to fully understand and, as feasible, take into account the unique MCA requirements of supported theater commands.

Table 3.2. Factors That Most Affect the Gap Between U.S. Air Forces in Europe–Air Forces Africa and Force Provider Subgroups

		Responses (Discriminating)	
Topic Area	Question	USAFE-AFAFRICA	Force Provider
MCA concepts	How significant of a shift or change does MCA represent for the Air Force?	Low	High
	How significant is the link between MCA and the air base squadron?	Low	High
	How significant is the link between MCA and the lead wing?	Low	High
	What MCA mission pillar is most relevant to MCA or should be the focus of MCA?	Balance	MG
MCA training	How significant are MCA training requirements above the status quo?	Low	N/A
	Should MG MCA be trained on single or multiple aircraft?	Single	Multiple

Topic Area	Question	Responses (Discriminating)	
		USAFE-AFAFRICA	Force Provider
	How much autonomy should wings have with their MCA training programs?	Low	Moderate
	To what extent does MCA require new training approaches and methods?	Low	N/A
MCA implementation	How much regulatory change is needed?	N/A	High
	How much change to personnel processes is needed?	Low	High
	What percentage of airmen should be MCA?	16–30%	N/A
	To what extent does the Air Force need to incentivize airmen to be MCA?	High	High
MCA deployment	What is the pacing theater for MCA?	Balance	N/A
	How much do MCA requirements vary across theaters of operation?	High	Low
	How much should the force provider tailor MCA to unique theater requirements?	N/A	Low
	To what extent should management of MCA align with the AFFORGEN cycle?	Low	N/A
	To what extent should MCA teams come from the same base or unit?	N/A	High
	To what extent does MCA require or benefit from just-in-time training?	Moderate	N/A

NOTE: N/A = not applicable. The N/A notation in the table does not indicate missing data but that the question did not observably discriminate the subgroup. It is also important to recognize that the responses indicated in this table might not be the most prevalent for the specified subgroup but instead represent the responses that most discriminate that subgroup.

Conclusion

With this chapter, we sought to map the viewpoints of MCA stakeholders—those with important roles in institutionalizing MCA—across the Air Force, specifically identifying important areas of convergence and divergence. We observed significant divergence of perspectives on MCA concepts, training, implementation, and deployment across individual stakeholders and across important subgroups of stakeholders. Among the important stakeholder subgroups, we assessed the most consistent gap between the force provider and USAFE-AFAFRICA subgroups. Of particular note, at both the individual stakeholder and subgroup levels, we observed significant divergence on questions with direct links to Air Force–level policy decisions. These include questions related to the appropriate balance of EST versus CUT, the extent of CUT, whether MCA should be trained to work on multiple aircraft types, the level of autonomy given to wings for their MCA training programs, the percentage of airmen to be designated and trained as MCA, the incentivization of MCA, and the tailoring of MCA force packages for deployment. These differences highlight the varied approaches and views that exist

across the Air Force, suggesting that to move the MCA initiative forward, there could be a need for more Air Force senior leadership intervention and guidance.

Chapter 4. Multi-Capable Airmen in Practice: Observations from Local Multi-Capable Airmen Programs and Exercises

As noted in the previous chapters, the Air Force has adopted a decentralized approach to the training and development of MCA, with wings taking the lead in building their own local MCA programs. To better understand variation in MCA training programs, we conducted in-depth case studies of five select wing-level efforts. In this chapter, we describe key characteristics, risks and gaps, and crosscutting lessons learned from our review of MCA training programs at the following locations: 23rd Wing (Moody AFB), 18th Wing (Kadena AB), 52nd Fighter Wing (Spangdahlem AB), 140th Wing (Buckley SFB), and 27th Special Operations Wing (Cannon AFB). In consultation with the project sponsor, we selected these wings for further study because of the relative maturity of their MCA training programs. Furthermore, as a set, these wings capture wide organizational variation with representation from ACC, PACAF, USAFE-AFAFRICA, the Air National Guard (ANG), and AFSOC.[65]

Combining a within-case and cross-case study approach, we examined each program individually and then compared programs to identify areas of commonality and difference with the aim of assessing implications for the Air Force as a whole. For these case studies, we held discussions with representatives and reviewed available documentation (e.g., training plans) from each of the selected programs. With the analysis, we sought to address five key questions:[66]

- How do approaches to MCA development and management vary across wings?
- What data are available to assess the effectiveness of different MCA models and training approaches?
- What are key gaps and risks associated with MCA employment based on experience in recent ACE exercises?
- What are crosscutting lessons learned from wing-level MCA training programs?
- What should the Air Force adopt from these wing-level programs as leadership seeks to standardize and institutionalize MCA across the force?

This chapter provides an overview of each training program and summarizes our key findings from the case study analysis. Additional details on the methodology and the interview protocol are provided in Appendix B.

[65] AFSOC does not technically train MCA, per Air Force doctrine, but has launched a separate but similar initiative to build and train Mission Sustainment Teams (MSTs) made up of Multi-Functional Airmen (MFA).

[66] We conducted site visits at Cannon AFB and Buckley SFB, which allowed for deeper discussions with program leadership and others involved with the two programs. At Cannon AFB, we also had the opportunity to visit a test range to learn about the setup for an ongoing training exercise involving the MST. (Exercise details are not described here because they are not available to general public.) For the other three locations (Moody AFB, Kadena AB, and Spangdahlem AB), we conducted one or more virtual discussions with program representatives.

Overview of Wing-Level Multi-Capable Airmen Programs Included in the Case Study Analysis

Buckley Space Force Base (140th Wing)

The 140th Wing (Air National Guard) operates and maintains F-16 fighter aircraft out of Buckley SFB, Colorado. Across the ANG, the 140th Wing is generally viewed as having the most developed MCA training program, with leadership from other ANG units pointing to the 140th Wing as the gold standard. Overseen by the wing's Weapons Standardization Section, the MCA training program is designed to provide personnel in the 140th Maintenance Group with the skills needed to be part of an MCA or ACE team. The curriculum focuses on Tier 2 CUT skills associated with F-16 MG, although the wing plans to establish a shorter, four-day Tier 1 EST course to augment Tier 2 training. One notable aspect of the wing's MCA CUT for MG is its emphasis on aircraft weapon handling. Whereas the 140th Wing has made this aspect of MG a priority for MCA, other wings have been more hesitant to pursue CUT in this area. Airmen volunteer for the MCA program as an additional duty and once selected, participation requires a two-year commitment, with the individual ideally remaining a member of a dedicated MCA team over the duration of this commitment. The training program is designed to build teams of 25–30 MCA via an initial 18-day curriculum. As a follow-up to this initial training program, the 140th Wing is working on a plan for MCA to train as a team for one week per month to sustain Tier 2 skills and to continue to develop the team dynamic. The wing currently has two MCA teams with the goal of building four total.

Moody Air Force Base (23rd Wing)

The 23rd Wing (ACC), located at Moody AFB, Georgia, operates A-10C, HC-130J, and HH-60G/W aircraft. The wing's MCA training program is managed by its A5/7 office, which was stood up specifically to support the wing's ACE and MCA efforts. Of note, ACC designated the 23rd Wing as the first to be certified as a lead wing, with a planned initial operating capability date of October 2022.[67] The wing initially focused its MCA training on Tier 2 CUT for MG. However, the wing found this training difficult to sustain over time because of resource and time constraints and subsequently shifted its emphasis to Tier 1 EST. The training program also started out as structured around the individual airman, with participants selected in an ad hoc manner by various units based on availability. After gaining experience with MCA in local exercises, the wing decided to move to team-based training. Currently, the wing's MCA training program focuses on providing advanced EST to 13-person contingency location teams, with an emphasis on small-unit skills for defending and surviving in nonpermissive environments. The two-week course is scheduled roughly four to six weeks prior to a planned exercise or

[67] River Bruce, "ACC to Certify First Lead Wing at AGILE FLAG 22-2," Moody Air Force Base, July 15, 2022.

deployment, with the intent that the 13-person team trains together and remains intact for the exercise or deployment. Beyond expeditionary skills, the two-week MCA training also covers limited C2 and air cargo–loading skills.

Kadena Air Base (18th Wing)

The 18th Wing (PACAF) at Kadena AB, Japan, is the Air Force's largest combat wing, operating a fleet of F-15C, KC-135, E-3, and HH-60G aircraft. The wing's ACE Program Office oversees the MCA training program, which is aimed at providing airmen with the necessary skills to support PACAF ACE operations.[68] The ACE Program Office conducts a one-week MCA course on a monthly basis, with 30 individual airmen attending each course. Unlike some other programs that focus on building teams, this training centers on the individual airman and individual skills, and the ACE Program Office has set the target of training roughly 300 airmen as MCA per year. The training content is highly tailored to PACAF, although the program did use the USAFEC syllabus for Tier 1 content as a starting point before modifying it for PACAF needs. Distinct from the other four cases we examined, the 18th Wing places primary emphasis on Tier 3 wing-specific skills, although wing representatives provided few details on what they consider Tier 3 versus Tier 1. Two distinct MCA training items for the 18th Wing are 10K forklift operations and manual transmission vehicle operations, both of which were added as a result of lessons learned from a PACAF ACE exercise. Other areas of emphasis, as noted by wing representatives, include basic radio use, air cargo preparation, base defense, tent set up, field generator operations, field dehumidifier operations, and basic combat medical care. To date, MCA training at the 18th Wing involves minimal Tier 2 CUT skills, but the wing is looking at expanding requirements in this area.

Spangdahlem Air Base (52nd Fighter Wing)

The 52nd Fighter Wing (USAFE-AFAFRICA) operates F-16 fighter aircraft out of Spangdahlem AB, Germany. The wing runs two ACE Academies. The first, and more established, ACE Academy falls under the Maintenance Group (Training Section) and is tailored primarily to aircraft maintenance personnel and Tier 2 skills for MG. The main aim of this MCA training for aircraft maintenance personnel is to take specialists and back shop technicians and teach them, in effect, how to be crew chiefs, with a broader set of skills required to launch, recover, inspect, and perform general maintenance on the wing's aircraft. Of note, the wing's main focus on aircraft maintenance tasks for MG MCA represents a sharp deviation from the Air Force's MG MCA TOA. The initial course consists of 25 training days in three phases, with each class consisting of roughly 18 to 20 airmen. The first two phases are ten days each, consisting of classroom academics followed by hands-on training. The final phase consists of five days of

[68] Because the PACAF ACE concept of operations is not available to the general public, we do not specify mission requirement details here.

proficiency training that is repeated every 90 days. Again, this is mostly focused on Tier 2 CUT with a minimal amount of Tier 1 EST. The Maintenance Group has recognized differences between experienced and inexperienced MCA in terms of their need for proficiency training. Accordingly, they are looking to move to a tiered sustainment model, in which MCA would require less frequent sustainment training as the airmen gain experience (similar to the Air Force's Ready Aircrew Program).[69] At present, however, there are no criteria for delineating which MCA fall into the experienced and inexperienced categories.

The wing's second, and more nascent, ACE Academy falls under the Mission Support Group and targets, as a wing representative described, "everyone who is not a maintainer, the support world," with a primary focus on Tier 1 EST. This training program is more abbreviated, lasting five days, with four days of training and a field capstone event the final day. Areas of instruction include tent setup, generator setup and sustainment, pallet buildup, and cargo handling. There is some degree of CUT, as the program also prepares MCA to serve as security force augmentees.

The 52nd Fighter Wing is thus notable for setting up distinctly separate MCA training programs for MG and mission support (or BOS) airmen. Apart from the formalization of this dual track, it is interesting that the wing has elected to emphasize Tier 2 CUT in its MG ACE Academy and Tier 1 EST in its mission support ACE Academy. We did not observe this type of distinction elsewhere.

Cannon Air Force Base (27th Special Operations Wing)

The 27th Special Operations Wing (AFSOC) does not technically have an MCA training program. Instead, its related efforts represent AFSOC's initiative to build cross-functional MSTs through training MFA.[70] However, although the terminology differs, the underlying aim of multi-skilling—to enable small teams to operate in austere forward locations—remains the same. Within the 27th Special Operations Wing, the Special Operations Mission Support Group's (SOMSG's) Detachment 1 (Det-1) oversees the wing's MST program. A 58-person MST is formed by pulling airmen from desired career fields out of other units within the 27th Special Operations Wing for a 15-month commitment aligned with the latter three phases of the four-phase, 20-month Special Operations Force Generation (SOFORGEN) cycle.[71] Of note, for the full 15 months, these airmen are attached to the MST as their primary duty, with their assigned

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[69] Matthew Walsh, William W. Taylor, and John A. Ausink, *Independent Review and Assessment of the Air Force Ready Aircrew Program: A Description of the Model Used for Sensitivity Analysis*, RAND Corporation, RR-2630/1-AF, 2019.

[70] Instead of MCA, AFSOC leadership uses the term *MFA* to emphasize the alignment of MST with joint warfighting functions.

[71] The specific AFSCs that the MST program has sourced have changed somewhat over time but have included AFSCs from the following career fields: 1D (Cyber Defense Operations), 2F (Fuels), 2S (Materiel Management), 2T (Transportation and Vehicle Management), 3E (Civil Engineering), 3F (Force Support), 3P (Security Forces), 4X (specifically, 4E0X1 [Public Health] and 4N0X1C [Aerospace Medical Service, Independent Duty Medical Technician]), 6C (Contracting), and 6F (Financial).

units on base forced to absorb the consequent manning shortfalls. At the end of a 15-month MST tour, an airman returns to his or her assigned unit. Consistent with SOFORGEN, the wing initiates a new MST every five months, so that at any given time, there are three teams, each aligned with a different SOFORGEN phase.

The MST training program encompasses six broad tasks: forward deploy the base, establish a forward operating base, sustain deployed forces, enable MG, protect the force, and establish contingency locations.[72] Together, these tasks encompass elements of the MCA MG, BOS, and C2 pillars, but the emphasis is weighted heavily toward BOS-related functions. Of note, the MST specifically excludes aircraft maintenance and weapon handling. For the first five months (the prepare phase) of the 15-month MST tenure, training is focused on Tier 1 EST and Tier 2 CUT skills. The next five months (the ready phase) includes multiple unit- and joint-level exercises and targeted training courses for specific AFSCs (e.g., small unmanned aircraft systems training). By the end of this ten-month period of formal training in the MST program, participants are designated MFA. The MST tour wraps up with another five months in the SOFORGEN commit phase. If not deployed during this phase, MST members continue to practice their skills through exercises. Another key feature of the MST program is that it explicitly associates subgroups of MFA with UTCs. The sizes of these UTCs have varied and differ by UTC type but tend to range from six to 14 personnel. For training content, the MST borrows from established training plans in various functional areas but heavily modifies these to meet MST needs; specifically, a Det-1 representative indicated that roughly 60 percent of training content is tailored to the MST. In contrast with the other wing-level programs, the 27th Special Operations Wing does not use the USAFEC syllabus as a baseline for Tier 1 training. The MST program also relies on an AFSOC-centric TOA, which a Det-1 representative indicated is more detailed than the Air Force–level MCA TOA.

What Are the Key Characteristics of Wing-Level Multi-Capable Airmen Training Programs?

As discussed, MCA training programs vary widely across locations but also exhibit some common characteristics (see Table 4.1 for a summary of key characteristics). To start, different wings tend to place varying weights of effort on Tier 1 EST versus Tier 2 CUT. PACAF is somewhat unique in this regard, with its primary focus on wing- or theater-specific Tier 3 skills.[73] The sources for training content also vary across location and training tier. Most locations— including Moody AFB, Buckley SFB, and Kadena AB—have drawn from the

[72] 27th Special Operations Wing, 27 SOMSG/Det-1 Mission Sustainment Team, *Mission Sustainment Team Validation Report*, Cannon Air Force Base, November 24, 2021, p. 6.

[73] This is not to say that Tier 2 training does not happen at Kadena AB. Tier 2 training is conducted by the units, although the Kadena Training Program Office has some interaction to provide input.

Table 4.1. Characteristics of Multi-Capable Airmen Training Programs

Characteristic	Buckley SFB (140th Wing)	Moody AFB (23rd Wing)	Kadena AB (18th Wing)	Spangdahlem AB (52nd Wing)	Cannon AFB (27th Special Operations Wing)
Tiers trained	• Tier 1 (in planning) • Tier 2	• Tier 1 (limited) • Tier 2	• Tier 1 • Tier 2 • Tier 3 (limited)	• Tier 1 (in planning) • Tier 2	• Tier 1 • Tier 2 • Tier 3
Length of training	• 4 days (Tier 1) • 18 days (Tier 2)	• 2 weeks	• 1 week	• 25 days	• 10 months
Size of team or training session	• 30 per team	• 13 per team	• 30 per session	• 18–20 per session	• 58 per team
Sustainment training	• In planning	• In planning	• Unclear	• 5 days every 90 days	• In planning and through exercises
Individual or team focus	• Team	• Team	• Individual	• Individual	• Team

USAFEC MCA training syllabus to build their Tier 1 EST curriculum but in doing so, have selected some parts of the USAFEC syllabus while dropping others. Thus, there is significant variation in Tier 1 training despite starting from a common baseline. Tier 1 training for the MST at Cannon AFB, in contrast, was developed almost exclusively in-house. Likewise, Tier 2 training content is derived from a variety of internal and external sources and among the external sources, there has been a degree of crossflow. For example, the 140th Wing at Buckley SFB looked at Spangdahlem AB's approach to CUT in building its own Tier 2 training plan.

All programs use a mix of classroom instruction and on-the-job or hands-on training, but the duration and intensity of training varies greatly. Kadena AB falls toward the lower end of the scale with a week-long MCA course. Aside from Cannon AFB's ten-month formal training program for MST as an extreme outlier, Spangdahlem AB has a relatively lengthy program with its 25-day ACE Academy for MG. For sustainment of MCA skills, only Spangdahlem AB has instituted a formal plan for recurring training, specifically with its requirement for five days of proficiency training every 90 days post initial training for those airman designated as MCA. To date, other locations are planning, but have yet to implement, similar sustainment training.

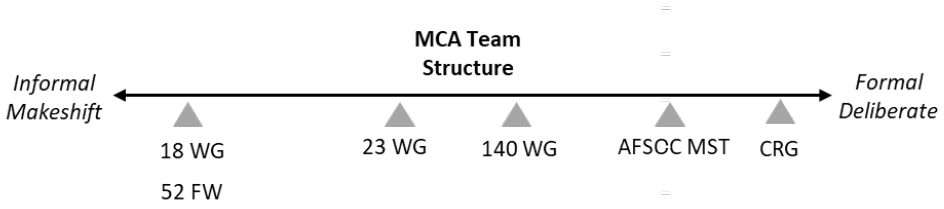
MCA instructors at most locations are 7-level SMEs drawn from relevant career fields. At Cannon AFB, the MST program employs more of a peer training model, in which one member of the MST cross-trains other members in their job specialty. Thus, there is less reliance on a dedicated instructor pool.

Recruitment and assignment into MCA programs also vary across locations, but all programs seek experienced airmen, generally at the 5-level or above. MCA programs at Kadena AB, Moody AFB, and Cannon AFB task squadrons to provide personnel and work with those squadrons to identify ideal candidates. The programs at Buckley SFB and Spangdahlem AB tend to solicit volunteers directly and reach out to individual airmen in relevant career fields to become MCA. At most locations, an airman's remaining time on station and deployable status are important discriminators for selection into the MCA program. Buckley SFB and Cannon AFB are distinct in that they incorporate a time commitment with their MCA training programs (two years and 15 months, respectively). At Buckley SFB, apart from initial training, this commitment constitutes an additional duty, whereas MST members at Cannon AFB are pulled from their assigned units for the duration.

Another key distinction across locations is the extent to which the development and sustainment of MCA centers on a team concept. The MST is purposefully built as a team of teams, and the team concept is baked into training from the start. As noted, airmen are pulled from their assigned units and attached to the MST full-time for a 15-month commitment. With minor exceptions, the teams within the MST stay intact over the duration, training, working, participating in exercises, and deploying together as a cohesive unit. At Buckley SFB (140th Wing), MCA go through initial training on an individual basis, but, when enough individuals are trained, they combine as a dedicated team and continue training together as a team, as an additional duty over the course of a two-year commitment window; the goal is to develop what

are called *ACE packages* or teams for deployment. Moody AFB (23rd Wing) trains MCA as teams but not as part of a deliberate, long-term plan. Again, the MCA teams are typically trained four to six weeks prior to an exercise with the intent of keeping these teams intact through the exercise but not beyond. Finally, Spangdahlem AB (52nd Fighter Wing) and Kadena AB (18th Wing) primarily train MCA as individuals. Groups of individual airmen attend training together based on class capacity and any teaming is done subsequently, as requirements for MCA employment emerge. In other words, the 52nd Fighter Wing and the 18th Wing do not develop and sustain MCA teams but train individuals as part of an MCA pool to feed into MCA teams as required down the road. Figure 4.1 illustrates this relative comparison of team-based approaches; we have also included the CRG on the scale.[74] This is a relevant comparison given that some stakeholders pointed to the CRG (during Task B interviews), with its robust team structure, as a model or even substitute for the Air Force's MCA initiative.

Figure 4.1. Multi-Capable Airmen Team Structure Comparison



NOTE: FW = fighter wing; WG = wing.

How Do Wings Track MCA and Measure MCA Training Effectiveness?

Given the importance of tracking and assessing MCA training as part of further institutionalizing MCA across the force, we also sought to understand how wings are approaching this in their local MCA programs (see Table 4.2 for a summary). We found that all five wings track airmen who have participated in MCA training programs. However, this tracking is generally limited to training completion and does not account for airman proficiency at specific tasks. This tracking is typically done via locally generated spreadsheets, although programs at Buckley SFB (140th Wing) and Kadena AB (18th Wing) also reported using Air Force Form 797, which can be maintained in an airman's formal training records.[75]

[74] Charles Rivezzo, "CRG Enables Strategic Air Operations in Qayyarah West," U.S. Air Forces Central Command Public Affairs, November 17, 2016; Anderson Air Force Base, "36th Contingency Response Group," webpage, undated; U.S. Air Force Expeditionary Center, "621st Contingency Response Wing," webpage, undated.

[75] Air Force Form 797 is called the "Job Qualification Standard Continuation Sheet" and is used to extend Career Field Education and Training Plan (CFETP) documentation regarding completion of "locally assigned duty position" tasks. Completed forms would be associated with an airman's training record. See Air Force Instruction 36-2670, *Total Force Development*, Department of the Air Force, June 25, 2020, incorporating change 4, March 31, 2023, p. 182.

The wings are generally working on how to assess MCA proficiency (timing, which skill levels, etc.) but do not yet have formalized mechanisms. Two programs, one at Buckley SFB (140th Wing) and one at Cannon AFB (27th Special Operations Wing), have published detailed training plans with proficiency targets for specific tasks. For example, the 27th Special Operations Wing MST's "Mission Qualification Training Plan" from February 2022 identifies several tasks that are expected to be performed at certain proficiency levels, with specified training frequencies.[76] However, the 27th SOMSG/Det-1 leadership indicated that the proficiency assessment is still a work in progress. For example, the land navigation task is expected to be performed at a "competent" level and trained quarterly, but how this competent level is defined and measured remains indeterminate.

None of the five wings indicated that they track MCA proficiency over time. This is partly because of a lack of proficiency targets and standards; other reasons could be that the programs are still in the development phases of program implementation and that many skills are targeted only to a "familiarization" level. For example, one Moody AFB (23rd Wing) representative indicated that many of the Tier 1 skills, such as those included in combat survival training, are taught to a familiarization level. Just being familiar is a low threshold and does not generally imply or drive a task performance standard; therefore, proficiency is less of a consideration.

Table 4.2. Summary of How Wings Track and Assess Multi-Capable Airmen

Wing Program	Track Training Completion	Training Plan with Proficiency Targets	Track Proficiency over Time	Evaluated MCA in ACE Exercises
Buckley SFB (140th Wing)	✓	✓		✓
Cannon AFB (27th Special Operations Wing)	✓	✓		✓
Kadena AB (18th Wing)	✓			
Moody AFB (23rd Wing)	✓			✓
Spangdahlem AB (52nd Fighter Wing)	✓			✓

Although individual MCA proficiency is not systematically tracked, all MCA training programs but one (Kadena AB) have used field exercises to assess MCA performance collectively. Observations and lessons learned from exercises—typically obtained via a Wing Inspection Team— are used to address gaps in training content and not necessarily to assess individual skill proficiencies or how to improve these proficiencies for specific airmen. Although

[76] 27th Special Operations Wing, Mission Sustainment Team, "Mission Qualification Training Plan," revision 5, February 10, 2022.

the 18th Wing at Kadena AB has yet to specifically employ its MCA in an ACE exercise, the wing has drawn on lessons learned from previous ACE exercises to shape its MCA training program. For example, demonstrated gaps in the ability to operate 10K forklifts and drive manual transmission vehicles led to the inclusion of these skills in subsequent MCA training courses.

None of the wings track MCA proficiency over time; however, representatives from the wing-level MCA programs indicated that airmen do receive feedback from instructors during training. Programs also leverage peer feedback mechanisms, through which participating airmen offer guidance to their teammates (a key feature of the MST model at Cannon AFB). Furthermore, several wings ask participating airmen to rate the MCA training and airmen's own level of learning; this feedback is used to adjust the training program moving forward.

What Are the Key Gaps and Risks Across Wing-Level Multi-Capable Airmen Programs?

In assessing MCA training programs at the five different wings, we looked for challenges that are unique to locations and crosscutting gaps and risks. We were particularly interested in operational gaps and risks that are exhibited while employing MCA in ACE exercises. We also looked at broader challenges related to resources, policy and authorities, and organization.

To start, wing representatives frequently noted the lack of dedicated personnel and equipment as a significant challenge. MCA offices are undermanned and MCA instructors are typically pulled from their primary jobs to teach as an additional duty, which creates gaps in their assigned units and a greater potential for burnout among the wing's most experienced airmen. Wings currently accept the risks and trade-offs associated with staffing MCA programs, but multiple representatives noted that these risks might not be acceptable or sustainable over the long term. Furthermore, most wing-level MCA programs do not have their own equipment, or at least enough equipment, and thus rely on borrowing from various units on base. Accordingly, multiple wings reported difficulties securing equipment—particularly communications equipment—for MCA training and exercises.

Beyond shortcomings in personnel and resources, wings identified gaps and risks associated with the lack of standardization and guidance across the Air Force's MCA initiative. Specifically, wing representatives observed that, in the absence of higher headquarters guidance and support, local MCA programs are heavily reliant on the prioritization, buy-in, and risk tolerance of current wing leadership. Wing commanders make tough choices about what to cut or sacrifice to resource local MCA programs; furthermore, they must determine how much risk to accept with MCA CUT. Accordingly, these programs are vulnerable to leadership turnover and shifting leadership priorities, and they face risks associated with discontinuity and instability. Given the lack of standardization and clear mission objectives, wings also struggle with formulating MCA training plans and assessing the effectiveness of their MCA training programs.

Specifically, wings are uncertain about what MCA tasks are required and MCA proficiency goals. The effects extend to MCA- or ACE-related exercises and can limit the effectiveness of these exercises. Commenting on the employment of MCA in exercises, one wing representative noted how the "inspector general doesn't have a standard to direct them against [for ACE-specific requirements]." Another representative pointed to an episode during which the wing deployed an MCA team in support of an overseas exercise; once there, however, the airmen were divided up and not allowed to employ in their full capacity as MCA because of a lack of common understanding about MCA and a lack of MCA standards.

What Are Key Lessons from Wing-Level Multi-Capable Airmen Programs?

We identified key lessons from our analysis of wing-level MCA programs. We first discuss crosscutting lessons, followed by case-specific lessons.

Crosscutting Lessons

Looking at the various wing-level approaches to the development and sustainment of MCA, there is no clear *best* approach, particularly given that all wing programs are still in a nascent development phase and all have noted gaps. Furthermore, there are no objective measures to comparatively assess the effectiveness of the programs. That said, there are important distinctions that, based on wing-level feedback, suggest positive practices for scaling.

The first is the distinction between individual- and team-based MCA training. Such programs as those at Cannon AFB, Buckley SFB, and Moody AFB emphasize the importance of small teams for ACE and incorporate a team construct into their MCA training. Moody AFB is an interesting case because, as described, the 23rd Wing started out training MCA as individuals but then shifted to a team-based approach after observing shortcomings during MCA-related exercises. Beyond enhancing the internal team dynamic, a team-based construct can help bridge the gap to force presentation. Representatives at Cannon AFB and Buckley SFB pointed to the intent of treating MCA teams as force packages to be provided on request to combatant commanders. As a Cannon AFB representative noted, commanders downrange tend to request a certain number of personnel from specific specialties instead of requesting the capabilities needed to execute the mission. Accordingly, the MST is explicitly aligned with UTCs with the goal of changing how commanders request support going forward. On the basis of our engagement with the different wing-level programs, we assess that, all else being equal, a team-based approach to the development and sustainment of MCA has distinct advantages over an individual-based approach.

Another key distinction is the extent to which wings have implemented regular continuity or proficiency training for MCA following the initial training program. All wings acknowledged the need for this proficiency training on a more formalized, routine basis; but to date, apart from the

27th Special Operations Wings, with its full-time MST model, only the 52nd Fighter Wing at Spangdahlem AB has established this type of training, associated with its MG ACE Academy.

We also view the individual MCA time commitment observed at some wings to be a positive attribute. This is probably easier for an ANG unit, such as the 140th Wing at Buckley SFB, given the stability of its workforce. The 27th Special Operations Wing at Cannon AFB requires a 15-month commitment for its MST members, but wing representatives noted challenges associated with keeping the team completely intact over the duration of the training given the active duty assignment system and the continuing demand to deploy airmen as individual augmentees. Acknowledging the administrative challenges, we assess that, all else being equal, a time commitment and the associated continuity adds value. It allows for the development of stronger team dynamics, helps to build and track proficiency, and facilitates a better return on investment associated with the initial MCA training program.

Through trial-and-error experimentation, several wings have determined the utility of delineating MCA associated with MG from those associated with mission support and training and managing the two MCA groups separately. We observed this perspective to some extent at Cannon AFB, Moody AFB, Kadena AB, and Spangdahlem AB. Such a perspective derives from both the nature of the MCA training and how the wings envision employing MCA teams in support of ACE. At places like Moody AFB and Kadena AB, the separation is less formal. A Kadena AB representative explained that they start out training all airmen together but then at some point, "We send mission gen [airmen] away and then do C2- and BOS-specific training. So, we see mission gen as its own category and the other two mix." The 27th Special Operations Wing at Cannon AFB is more explicit given that the MST is focused almost exclusively on mission support. Spangdahlem AB is the only location we observed that had separate formal training programs, with its distinct MG ACE Academy and mission support ACE Academy. Given feedback from the various wings, we recognize the benefit of distinct approaches to developing MCA for MG versus mission support tasks; we also see the value in having dedicated MCA training programs for each.

Table 4.3 summarizes our observed positive practices associated with team-based MCA development and sustainment, MCA proficiency training, MCA time commitment, and dedicated MCA training programs for MG and mission support skill sets.

Table 4.3. Wing-Level Multi-Capable Airmen Program Positive Practices

Wing-Level Positive Practice	Examples
Team-based MCA development and sustainment	Cannon AFB (27th Special Operations Wing) Buckley SFB (140th Wing) Moody AFB (23rd Wing)
Structured MCA proficiency training	Spangdahlem AB (52nd Fighter Wing)
Time commitment associated with MCA training and designation	Cannon AFB (27th Special Operations Wing) Buckley SFB (140th Wing)
Dedicated MCA programs for MG and mission support	Spangdahlem AB (52nd Fighter Wing)

Case-Specific Lessons

Apart from these broad practices that define the overall structure of a wing-level MCA program, we identified more-specific lessons learned that are common to multiple wings. For one, multiple wings emphasized the need to train airmen from nonoperational AFSCs on troop-leading procedures and basic small-unit tactics as part of Tier 1 EST. Airmen generally do not get this kind of training, which is more common in the Army and Marine Corps. Relatedly, at least two programs, Cannon AFB (27th Special Operations Wing) and Moody AFB (23rd Wing), mentioned that MCA needed additional training on mission planning skills. An additional crosscutting lesson learned is that ready access to external resources greatly enhances MCA training, but these resources are often unique to specific locations. For example, Moody AFB and Cannon AFB representatives noted being "lucky" to have easy access to excellent ranges for MCA-related training exercises (i.e., Avon Park Air Force Range near Moody AFB and Melrose Air Force Range near Cannon AFB). Moody AFB representatives also highlighted their engagement with ACC's Agile Battle Lab, particularly for developing ways to integrate radio communications data on tablets for MCA not accustomed to working with standard radio equipment. Finally, Kadena AB representatives pointed to the value of having Marine Corps units on the base; this provides the 18th Wing opportunities to learn about the Marine Corps' expeditionary advanced base operations concept and to apply useful elements to their ACE-related training and operations.[77]

What Should the Air Force Take from These Wing-Level Multi-Capable Airmen Programs?

In its push to further institutionalize the MCA initiative, the Air Force should consider adopting and scaling the wing-level positive practices that we outlined. Our analysis of wing-

[77] The Marine Corps' expeditionary advanced base operations share similarities with ACE by focusing on maintaining and sustaining naval forces in austere locations and maintaining a light footprint. Headquarters Marine Corps, "Expeditionary Advanced Base Operations (EABO)," website, United States Marine Corps, August 2, 2021.

level programs suggests three additional implications for Air Force-level consideration. The first is simply the impetus to develop Air Force standards and guidance for measuring and sustaining MCA proficiency. This goes beyond the Air Force's ongoing efforts to establish standard lists of MCA tasks for Tier 2 CUT (in the form of TOAs). As a starting point, some wings currently use Air Force Form 797 to track MCA training and qualifications, which could become the norm. The 140th Maintenance Group's (Buckley SFB) Course Training Standard for MCA and ACE provides a potential template for how to use Air Force Form 797 with MCA. The Air Force could also require wings (or MAJCOMs) to publish MCA training plans in a standard format that specifies the proficiency levels and training cycles associated with specific tasks. In this case, the 140th Maintenance Group Course Training Standard and the 27th SOMSG/Det-1 training plan provide examples of what this could look like. Such standardization would, at a minimum, aid in Air Force–level reporting and tracking, and it would help the Air Force preserve its investment in MCA training as airmen move from one wing to the next. Absent greater standardization, the Air Force will have difficulty assessing the relative effectiveness of different MCA training programs and determining the combined readiness of MCA to support ACE operations.

The second implication is an impetus for the Air Force to further refine and normalize training requirements associated with the cross-utilization TOA and to centrally manage relevant waivers, if waiver requirements cannot be eliminated. For example, wing representatives mentioned that the TOA allows a 2S0X1 (Matériel Management) airman to conduct joint inspections (JI), but there is a training prerequisite for the JI course that is limited exclusively to the AFSC that traditionally performs JI (2T2X1 Air Transportation); thus, in practice, wings cannot enroll MCA in the JI course despite the TOA. Wings also reported having to seek waivers for CUT contained within the TOA, resulting in significant time expenditure and duplication of efforts across wings. Relatedly, wing representatives expressed the need to modify existing Air Force training programs for MCA purposes while lacking the authority to do this on their own. For example, a representative from the 52nd Fighter Wing at Spangdahlem AB's program noted that the program is looking for a shorter F-16 Egress course because the full monthlong curriculum is not needed for the purpose of training MCA. Overall, wings have had to individually navigate the administrative and regulatory hurdles of MCA CUT and could benefit from more Air Force–level guidance and assistance in this regard.[78]

Finally, our analysis suggests the need for a baseline understanding of the personnel and funding requirements for wing-level MCA programs. Wings predominantly resource their MCA programs out of hide, and they vary greatly in terms of how they do this. Per wing representatives, the current lack of dedicated funding and personnel hinders MCA program

[78] We acknowledge that the Air Force has worked to address some of these challenges. In 2021, Air Force Instruction 21-101, *Aircraft and Equipment Maintenance Management*, was revised to give wing commanders the authority to have non-2W1X1 airmen certified as weapons load crew members to execute ACE missions (Air Force Instruction 21-101, *Aircraft and Equipment Maintenance Management*, Department of the Air Force, January 16, 2020, supplement March 29, 2021).

development and is unsustainable. But even if the Air Force were looking to provide additional resources to specific wings for this purpose, there is no clear picture of what *right* looks like. This is partly because of a lack of standards for proficiency training requirements. As observed in Chapter 3 and further reflected in our analysis of the five wing-level programs, there is also a wide divergence of opinion on how many airmen should be trained as MCA. To facilitate future budgeting decisions and resource allocations associated with the institutionalization of MCA, the Air Force would benefit from establishing a baseline, at least as a starting point.

Conclusion

From our review of five wing-level MCA programs across the Air Force, it is clear that wings are taking different approaches to the development and sustainment of MCA. The acute lack of standardization has negative implications for the Air Force's ability to track, evaluate, and employ MCA across the organization. This includes the risk of diminished return on MCA training investment when airmen move from one wing to the next. Furthermore, it is evident that a lack of dedicated resources and key gaps in Air Force-level guidance are impeding wing-level MCA programs. That said, experimentation and experience at the local wing level has yielded lessons learned and positive practices that can help shape Air Force–wide institutionalization, if scaled appropriately.

Chapter 5. Leveraging Training Technologies for Multi-Capable Airmen

The MCA concept presents significant training challenges in terms of developing and sustaining secondary skill sets. When asked about the primary risks and trade-offs of the MCA concept, stakeholders commonly reported concerns about achieving an acceptable level of proficiency in secondary tasks while mitigating skill decay in primary tasks (Chapter 3). Furthermore, when asked about the hurdles associated with MCA training, stakeholders commonly reported lack of resources (e.g., personnel, matériel, funding, and time) to support additional training needs. These concerns are well-founded. Experience from both DoD and private industry shows that cross-training programs can degrade and dilute employee expertise if not effectively managed (Chapter 2).[79] In this chapter, we examine how advanced training technologies could be leveraged for MCA training. Specifically, we seek to map suitable training technologies to MCA training needs.

As discussed in the earlier chapters of this report, although the training of MCA has largely been delegated to the Air Force's wing level, the Air Force has provided some overarching guidance in the form of a TOA that outlines desired MCA tasks (Tier 2 skills) for MG and AFSCs that are authorized for cross-training in each task. For our examination of training technologies and MCA training needs, we first perform a cognitive task analysis (CTA) of METs associated with the approved TOA. The CTA encompasses perceptual demands; motor demands (e.g., body movement); and remaining judgment, decisionmaking, and communication demands, which we collectively refer to as *cognitive demands*. Although limited to the current TOA, with its focus on MG, our application of CTA here is transportable to other mission areas. We then give a brief overview of select advanced training technologies and present SME assessments of the relative advantages and drawbacks of these technologies for meeting MCA training needs.[80] We end by presenting two brief vignettes to illustrate how certain advanced training technologies can contribute to the training of specific MCA tasks.

[79] Carmen Abrams and Zane Berge, "Workforce Cross Training: A Re-Emerging Trend in Tough Times," *Journal of Workplace Learning*, Vol. 22, No. 8, October 2010.

[80] The distinction between primary and secondary task training is one of emphasis rather than form. MCA are not trained to the same levels of proficiency for secondary skills as they are for primary skills. Additionally, given that secondary skills are not routinely used, the MCA concept places relatively greater importance on tracking proficiency and sustaining skills during periods of disuse. Notwithstanding these differences, many of the training technologies and approaches that are applicable to primary tasks can be used for secondary task training as well.

Cognitive Task Analysis of Multi-Capable Airmen Mission-Essential Tasks

CTA catalogs and compares the knowledge and skills needed to effectively perform different tasks.[81] The results from CTA can be used for a variety of purposes, such as creating training systems or designing interfaces to enhance human performance. CTA can be performed at different levels of specificity; for our purpose of identifying suitable technologies for cross-training MCA, we employed the three task demand categories from Wickens' human factors workload model:[82]

- *Perceptual*: The extent to which a task requires orienting visual attention and encoding and making sense of visual information
- *Cognitive*: The extent to which a task draws on mental processes, such as learning, memory, judgement, decisionmaking, and planning
- *Motor*: The extent to which a task requires planning and executing coordinated physical movements.

Training system design would necessitate more-granular distinctions between perceptual, cognitive, and motor skills, along with more information about the types of knowledge and procedures that underlie MET performance. However, this basic three-category model is useful for determining the essential attributes of suitable training technologies.

Application of Cognitive Task Analysis to Multi-Capable Airmen Mission-Essential Tasks

The Air Force-approved TOA crosstabs nearly 30 officer and enlisted AFSCs to more than 40 METs and identifies primary and secondary METs for each AFSC. The average number of secondary METs across AFSCs is five, with the number ranging from one for the 2S0X (matériel management) career field to 16 for the 2A6X (aircraft engine maintenance) career field.[83]

The METs impose different perceptual, cognitive, and motor demands. For example, the objective of the spall repair task is to reduce foreign object damage to aircraft. One component of this MET is to inspect pavement surfaces for spalls and cracks, and another is to use a concrete saw and trowel to cut the surface and install a patch.[84] Thus, the spall repair task includes both perceptual (runway scanning) and motor (surface repair) demands.

To assess to relative weight of perceptual, cognitive, and motor demands, three Air Force officers with extensive experience in aircraft operations across different mission sets conducted an initial review of the METs contained in the TOA. Specifically, they individually rated each

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[81] Jan Maarten Schraagen, Susan F. Chipman, and Valerie L. Shalin, eds., *Cognitive Task Analysis*, Psychology Press, 2000.

[82] Christopher D. Wickens, "Multiple Resources and Mental Workload," *Human Factors*, Vol. 50, No. 3, June 2008.

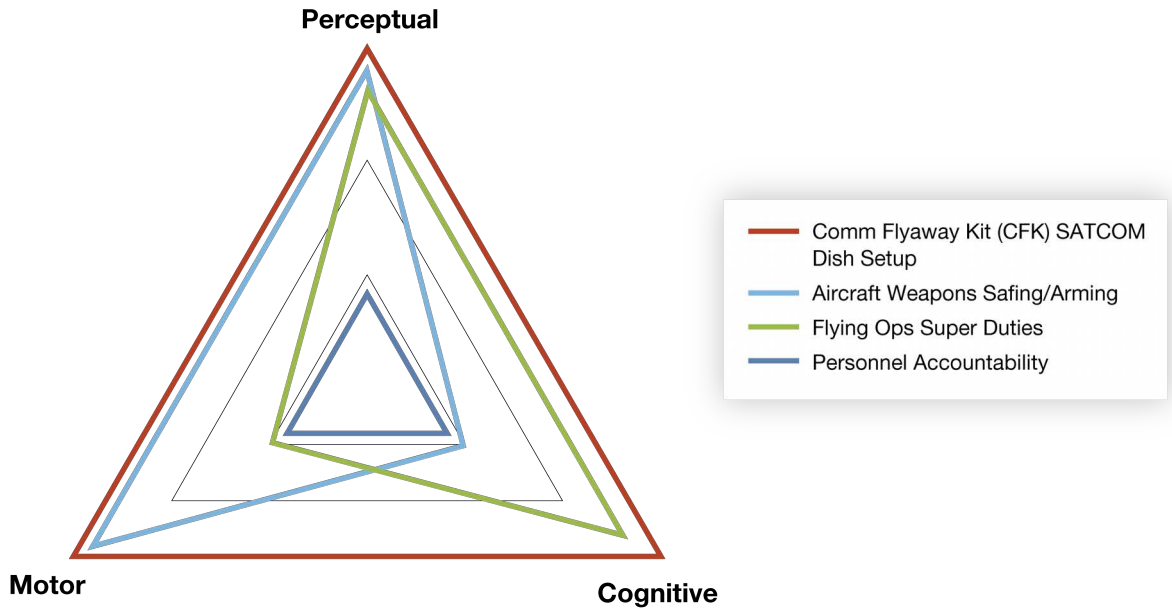
[83] Air Force Futures A5/7, "MCA Table of Authorizations_12082021," Excel file, August 12, 2021.

[84] Unified Facilities Criteria 3-270-03, *Concrete Crack and Partial-Depth Spall Repair*, U.S. Department of Defense, March 15, 2001.

MET for perceptual, cognitive, and motor demands on a 1-to-3 scale (1 = lowest demand, 3 = highest demand) and then collaborated on a consensus value. We then tasked five Air Force CFMs from relevant career fields to review these ratings and recommend changes as needed based on their experience and expertise. Overall, 73 percent of METs received a rating of 2 or higher for perceptual demand and 70 percent received the same rating level for motor demand; only 52 percent of METs received a rating of 2 or higher for cognitive demand. This suggests that MCA METs are characterized by greater perceptual and motor demand than cognitive demand.

Figure 5.1 illustrates the CTA ratings for four representative METs. The figure shows that "Personnel Accountability" does not impose heavily on any dimension of demand. In contrast, "Comm Flyaway Kit SATCOM Dish Setup" imposes heavily on all dimensions, "Aircraft Weapons Safing/Arming" imposes heavily on perceptual and motor dimensions, and "Flying Ops (Operations) Super Duties" imposes heavily on perceptual and cognitive dimensions. (See Appendix C for CTA ratings of all METs from the MG TOA.)

Figure 5.1. Perceptual, Cognitive, and Motor Ratings for Four Mission-Essential Tasks



NOTE: Comm = communications; Ops = operations; SATCOM = satellite communications.

Looking across our CTA findings, we assess that two METs impose low demand across all three dimensions (perceptual, cognitive, motor), nine impose high demand in one dimension, 22 impose high demand across two dimensions, and 11 impose high demand across all three dimensions (See Table 5.1). This variability in perceptual, cognitive, and motor demand has implications for the types of technologies that are suitable for training the different METs. It also points to differences in the optimal frequency of continuation training. Workforce studies

generally show significant loss of trained skills during periods of disuse. However, this decay is moderated by task type; specifically, physical tasks are less susceptible to skill decay than cognitive tasks.[85] The implication is that METs characterized by high cognitive demand are likely to be more susceptible to skill decay and thus require more-frequent continuation training.

Table 5.1. Types of Demands Imposed by Different Mission-Essential Tasks

Perceptual	Cognitive	Motor	Number of METs
Low	Low	Low	2
High	Low	Low	0
Low	High	Low	1
Low	Low	High	8
High	High	Low	10
High	Low	High	11
Low	High	High	1
High	High	High	11

Mapping of Mission-Essential Tasks to Training Technologies

The field of training technologies is vast. In our assessment of MCA-relevant training technologies, we limited our analysis to how training is delivered—the training medium. We do not attempt to comprehensively review all potential training technologies (e.g., gaming, networking, interoperability, artificial intelligence [AI], physiological assessment technology, learning management systems, various broad types of simulators).[86] We grouped delivery media according to their ability to provide live and/or virtual content to facilitate the training of perceptual, cognitive, and motor skills. Specifically, we categorized delivery media as live,

[85] Winfred Arthur, Jr., Winston Bennett, Jr., Pamela L. Stanush, and Theresa L. McNelly, "Factors That Influence Skill Decay and Retention: A Quantitative Review and Analysis," *Human Performance*, Vol. 11, No. 1, March 1998; Winfred Arthur, Jr., Eric Anthony Day, Winston Bennett, Jr., and Antoinette Portrey, eds., *Individual and Team Skill Decay: The Science and Implications for Practice*, Routledge, 2013.

[86] We note that other RAND research provides a framework and logic model for using live, virtual, and constructive training, also known as LVC, that could provide additional insight for the Air Force on the potential use of technology for such contexts as MCA (see Timothy Marler, Susan G. Straus, Mark Toukan, Ajay K. Kochhar, Monica Rico, Christine Kistler Lacoste, Matt Strawn, and Brian P. Donnelly, *A New Framework and Logic Model for Using Live, Virtual, and Constructive Training in the United States Air Force*, RAND Corporation, RR-A551-2, 2023). For additional examples of previous RAND reports that have explored the feasibility and potential effectiveness of some of these areas of technology for military use, see Anika Binnendijk, Timothy Marler, and Elizabeth M. Bartels, *Brain-Computer Interfaces: U.S. Military Applications and Implications, An Initial Assessment*, RAND Corporation, RR-2996-RC, 2020; Susan G. Straus, Matthew W. Lewis, Kathryn Connor, Rick Eden, Matthew E. Boyer, Timothy Marler, Christopher M. Carson, Geoffrey E. Grimm, and Heather Smigowski, *Collective Simulation-Based Training in the U.S. Army: User Interface Fidelity, Costs, and Training Effectiveness*, RAND Corporation, RR-2250-A, 2019.

computer-based training (CBT), AR, or VR, or as using haptic training simulators or integrated training devices.[87]

Live Training

Live training is the gold standard of training delivery. By closely matching the operational environment, live training minimizes transfer distance, thereby maximizing the transfer of training. Live training is well suited for training cognitive, perceptual, and motor skills. However, live training could be too costly or dangerous to rehearse certain skills, at least on a routine basis.

Computer-Based Training

CBT uses stand-alone computer programs designed for learning.[88] CBT can be self-paced, allowing learners to control how they interact with predesigned material, and it can incorporate learner responses followed by system feedback. CBT can deliver diverse content and has demonstrated efficacy in producing learning gains in different domains and learner populations.[89] CBT is particularly well suited for training cognitive skills. CBT is also well suited for training *some* perceptual skills (e.g., attentional control and image recognition) but not others (e.g., spatial information about the location of objects relative to oneself). CBT is less suitable for training motor skills.

Elements of CBT could be combined with other methods for content delivery—to guide the selection of experiences given through AR or VR. When we discuss CBT separately from integrated solutions, we are referring to the delivery of content on a computer or another electronic learning device.

Haptic Training Simulators

Hands-on training is essential to acquire motor skills. Haptic training simulators provide force and tactile feedback to allow learners to rehearse motor skills.[90] These simulators vary in terms of degrees of freedom (i.e., the number of dimensions in which the device supports movement), degrees of force feedback, and perceived realism. Studies, especially those in the

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[87] AR and VR are sometimes referred to as *extended reality* (XR), meaning they enhance or replace our view of the world. The merging of real-world and computer-generated environments and interacting with them in real time is also called *mixed reality*.

[88] Eduardo Salas, Scott I. Tannenbaum, Kurt Kraiger, and Kimberly A. Smith-Jentsch, "The Science of Training and Development in Organizations: What Matters in Practice," *Psychological Science in the Public Interest*, Vol. 13, No. 2, June 2012.

[89] Chen-Lin C. Kulik and James A. Kulik, "Effectiveness of Computer-Based Instruction: An Updated Analysis," *Computers in Human Behavior*, Vol. 7, Nos. 1–2, 1991; Andreas Gegenfurtner, Carla Quesada-Pallarès, and Maximilian Knogler, "Digital Simulation-Based Training: A Meta-Analysis," *British Journal of Educational Technology*, Vol. 45, No. 6, November 2014.

[90] Timothy R. Coles, Dwight Meglan, and Nigel W. John, "The Role of Haptics in Medical Training Simulators: A Survey of the State of the Art," *IEEE Transactions on Haptics*, Vol. 4, No. 1, January–March 2010.

medical field, have found that haptic devices increase the effectiveness of simulation-based training.[91] Overall, haptic training simulators are well suited for training motor skills. They can be included in integrated designs to train perceptual and cognitive skills; however, haptic training simulators alone are not geared toward cognitive or perceptual skills.

Augmented Reality

AR overlays virtual information on real-world scenes and objects.[92] This virtual overlay can include instructional information, images, and perceptual cues. AR is relatively inexpensive and can be delivered using such devices as cell phones, tablets, and helmet-mounted displays. In several recent analyses, AR was found to be as or more effective than training in nonsimulated control environments.[93] The use of information overlays makes AR well suited for training cognitive and perceptual skills. Furthermore, because AR allows trainees to interact with physical objects in the real world, it is well suited for training motor skills.

Of note, AR solutions could allow trainees to interact with objects and physical environments. However, some AR solutions primarily involve visualization. Thus, not all AR solutions are intended to support the acquisition of motor skills.

Virtual Reality

VR provides an immersive environment that allows individuals to interact with three-dimensional virtual scenes.[94] VR can be used to rehearse skills that are too costly or dangerous to perform in the real world, such as responding to fires or hazardous material spills.[95] Like AR,

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[91] Xuesong Zhai, Yulian Sun, Minjuan Wang, Fahad Asmi, Wenjing Cai, and Xiaoyan Chu, "Exploring the Effect of Virtual Reality with Haptics on Educational Research: A Meta-Analysis from 2010 to 2020," *2022 8th International Conference of the Immersive Learning Research Network (iLRN)*, Institute of Electrical and Electronics Engineers, 2022.

[92] Alexandra D. Kaplan, Jessica Cruit, Mica Endsley, Suzanne M. Beers, Ben D. Sawyer, and P. A. Hancock, "The Effects of Virtual Reality, Augmented Reality, and Mixed Reality as Training Enhancement Methods: A Meta-Analysis," *Human Factors*, Vol. 63, No. 4, June 2021.

[93] Medhat Alaker, Greg R. Wynn, and Tan Arulampalam, "Virtual Reality Training in Laparoscopic Surgery: A Systematic Review and Meta-Analysis," *International Journal of Surgery*, Vol. 29, May 2016; Kaplan et al., 2021; J. D. Fletcher, James Belanich, Frank Moses, Ashley Fehr, and Jason Moss, "Effectiveness of Augmented Reality and Augmented Virtuality," paper presented at MODSIM World Conference and Expo, Virginia Beach, Va., April 25–27, 2017.

[94] Kaplan et al., 2021.

[95] Rory M. S. Clifford, Sungchul Jung, Simon Hoermann, Mark Billinghurst, and Robert W. Lindeman, "Creating a Stressful Decision Making Environment for Aerial Firefighter Training in Virtual Reality," *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Institute of Electrical and Electronics Engineers, 2019; Frederik Winther, Linoj Ravindran, Kasper Paabøl Svendsen, and Tiare Feuchtner, "Design and Evaluation of a VR Training Simulation for Pump Maintenance Based on a Use Case at Grundfos," *2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Institute of Electrical and Electronics Engineers, 2020; Kadir Lofca, Jason Haskins, Jason Jerald, and Regis Kopper, "Studying the Effect of Physical Realism on Time Perception in a HAZMAT VR Simulation," *2022 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Institute of Electrical and Electronics Engineers, 2022.

VR training has been found to be as or more effective than traditional training methods in several cases.[96] VR is well suited for training cognitive and perceptual skills, particularly for high-risk, low-frequency events. Importantly, VR's effectiveness is moderated by task-technology fit, such that training gains for tasks with a motor component are greatest when VR is combined with realistic manual devices; for example, a VR surgical simulation with realistic tools as inputs is more effective than a similar simulation that is limited to using a keyboard and mouse.[97] Overall, VR by itself is ill-suited for training motor skills but can be augmented with haptic devices to make up for this shortcoming.

Integrated Training Devices

Integrated training devices combine AR or VR with haptic devices to generate realistic perceptual and motor experiences. The AR or VR components provide perceptual inputs, and the haptic components support manual outputs. Integrated training devices have been used to train tasks that require cognitive and perceptual skills, in addition to fine and gross motor skills (e.g., medical procedures and athletic routines).[98] Because integrated training devices include AR or VR, they are well suited for training cognitive and perceptual skills. Because they incorporate haptic devices, they are well suited for training motor skills.

Synthesis

Table 5.2 summarizes the strengths and weaknesses of different classes of training technologies. Across classes of technology, AR, integrated training devices, and live training are well suited for training perceptual, cognitive, and motor skills; VR can be effectively applied to perceptual and cognitive skills; haptic training simulators are best suited to training motor skills; and the value of CBT is generally limited to cognitive skills.

Building on our previous CTA of individual METs, we computed the percentage of METs that each class of training technologies can support. AR, integrated training devices, and live training can address all METs, VR can address METs without significant motor demands (30 percent), haptic training simulators can address METs without significant perceptual or cognitive demands (23 percent), and CBT can address METs without significant perceptual or motor

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[96] Kaplan et al., 2021; Alaker, Wynn, and Arulampalam, 2016; Fletcher et al., 2017.

[97] Matt C. Howard, Melissa B. Gutworth, and Rick R. Jacobs, "A Meta-Analysis of Virtual Reality Training Programs," *Computers in Human Behavior*, Vol. 121, August 2021.

[98] Pavithra Rajeswaran, Priti Jani, Praveen Kumar, and Thenkurussi Kesavadas, "AirwayVR: Virtual Reality Trainer for Endotracheal Intubation-Design Considerations and Challenges," *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Institute of Electrical and Electronics Engineers, 2019; Samali U. Liyanage, Lakshman Jayaratne, Manjusri Wickramasinghe, and Aruna Munasinghe, "Towards an Affordable Virtual Reality Solution for Cardiopulmonary Resuscitation Training," *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Institute of Electrical and Electronics Engineers, 2019; Takayuki Nozawa, Erwin Wu, and Hideki Koike, "VR Ski Coach: Indoor Ski Training System Visualizing Difference from Leading Skier," *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Institute of Electrical and Electronics Engineers, 2019.

demands (7 percent). Ultimately, the choice of a training medium depends on additional factors, such as cost, safety, and technology availability. AR and integrated training devices offer attractive alternatives to live training because of safety and cost considerations.

Table 5.2. Alignment Between Classes of Training Technologies and Mission-Essential Tasks

Cognitive Affordance	Computer-Based Training	Haptic Training Simulator	Augmented Reality	Virtual Reality	Integrated Training Device	Live Training
Perceptual	+	—	++	++	++	++
Cognitive	++	—	++	++	++	++
Motor	—	++	++	+	++	++
Percentage of METs supported	7	23	100	30	100	100

NOTE: ++ denotes high alignment, + denotes moderate alignment, and — denotes low alignment.

The life-cycle costs of training technologies are difficult to quantify, and the strength of a business case depends on multiple factors, such as the size of training audience, cost relative to live training, and additional infrastructure needed to support the technology. However, there are some general considerations that help frame discussions around cost. First, when live training is costly—such as flight or medical training—technology solutions could reduce matériel costs. Likewise, when instructors and peers are needed to support training, technology solutions could reduce personnel costs. Finally, existing commercial off-the-shelf (COTS) or government off-the-shelf technologies, relative to bespoke technology solutions, have lower research, development, test, and evaluation costs. Thus, technologies that are built to train specialized skills, such as many VR and integrated training solutions, tend to be more costly. In general, AR technologies cost less than VR, haptic, and integrated training devices.

State of Training Technology

To understand the state of training technologies, how they are being applied, and the operational benefits and risks they entail, we interviewed 36 SMEs from 20 defense science and technology organizations (see Appendix C, Table C.2). The technologies discussed did not specifically or uniquely pertain to MCA tasks (e.g., some of the SMEs we spoke with are primarily concerned with pilot or medical training), but each had potential applications for MCA training. In these discussions, we sought to understand the existing landscape of advanced training technologies and methods—what is available, how it is currently used, and how it could conceivably be used to meet MCA training needs. We also sought to capture any lessons learned that might inform how the DAF should approach the training of MCA.

To draw out trends from these interviews, we employed *thematic analysis* methodology, as is commonly used in the social sciences, to systematically identify, organize, and report patterns within a large body of data.[99] Table 5.3 lists the eight key themes that emerged from this analysis.[100]

Table 5.3. Overview of Interview Themes

Major Category		Theme
Technology enablers	1.	XR technologies can be used to train perceptual, motor, and cognitive skills.
	2.	XR can be used to augment—not replace—live training.
	3.	Tools exist to create educational and training content at the point of need.
	4.	Tools exist to capture and assess trainee performance.
MCA risks	5.	Proficiency is a zero-sum game.
	6.	Notwithstanding its potential, XR technologies have significant drawbacks.
	7.	Tasks and environments could be structured in new ways to support MCA.
Technology innovation	8.	Innovation examples highlight factors to enable technology transition.

Technology Enablers

The first set of interview themes was related to the potential for advanced training technologies to mitigate risk and reduce training time for MCA.

Extended Reality Technologies Can Be Used to Train Perceptual, Motor, and Cognitive Skills

XR is a term that encompasses AR, VR, and mixed reality. Many interviewees described how XR can be used for training and which XR technologies are best suited for different types of skills.

AR can be used in various ways for perceptual and cognitive training. One interviewee described how AR can reduce cognitive demands during training by displaying checklists as individuals rehearse procedural, judgment, and decisionmaking skills. For example, an AR system can retrieve content from "QR codes printed on equipment and panels."[101] Another interviewee explained that AR can provide perceptual cues to teach individuals what to attend to in complex visual scenes. Relatedly, AR can be used to train perceptual discrimination; for example, we learned about an AR system that allows utility workers to "call up images from a

[99] Jennifer Attride-Stirling, "Thematic Networks: An Analytic Tool for Qualitative Research," *Qualitative Research*, Vol. 1, No. 3, December 2001.

[100] To encourage frank discussions, all interviews were conducted with the promise of complete confidentially, so no quotations or findings will be attributed to any specific organizations or interviewees.

[101] SME, interview with the authors, April 26, 2022.

library to decide whether an electrical component is sufficiently worn to replace or whether it can go for another couple years."[102] Finally, AR can allow an individual to share visual information with an instructor at a remote location. As these examples demonstrate, AR can be used for training and for real-time performance support.

VR is also useful in the right circumstances; it adds value for training high-risk, low-frequency scenarios. However, one interviewee cautioned that, in some scenarios, VR might be prohibitively expensive:

> If you need to train a large number of people to operate a very specific device, it makes sense to invest the money to create an elaborate [VR] simulator . . . but if you're talking about a larger number of maintenance tasks, creating a simulator that covers all of these things is going to be very expensive.[103]

Some interviewees described combining elements of AR or VR with physical props to create integrated systems.[104] For example, one interviewee created a rudimentary aircraft tactical trainer by constructing a wooden cockpit with a plunger for the stick and pairing it with COTS VR goggles to render an immersive environment. In this way, trainees could rehearse perceptual, cognitive, and motor components of basic flight maneuvers at relatively low cost. 3D printing has made it easier to create props to use with XR. This approach is a viable alternative when it would be unsafe for MCA to interact with an actual physical system during training (e.g., the arming mechanism on a weapon) or when the physical system is not available for training.

Extended Reality Can Be Used to Augment—Not Replace—Live Training

Many interviewees expressed that the best use of XR is to augment, not replace, live training. For example, XR can be used to rehearse basic skills prior to live training. Reflecting on the effects of using XR to introduce new pilots to flying fundamentals, one interviewee remarked, "They're doing better in their dollar ride and their first ten sorties. . . . We've seen a huge improvement in preparation and ability to process info and learn and retain information early in the program."[105] As this example illustrates, XR does not obviate the need for live training; it maximizes the benefits of live training when it is delivered. In addition, XR can be used to rehearse advanced skills that cannot currently be performed in live training. One interviewee commented, "Some of the [VR] simulators are more high speed than the flights because of the limitations of real life—you can't get shot at in real plane, but you can get shot at in sim[ulation]. . . . VR can supplement, and in some cases go beyond, what we do in live training."[106]

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[102] SME, interview with the authors, April 26, 2022.

[103] SME, interview with the authors, May 20, 2022.

[104] Kaplan et al., 2021, p. 13.

[105] SME, interview with the authors, May 9, 2022.

[106] SME, interview with the authors, May 9, 2022.

Tools Exist to Create Educational and Training Content at the Point of Need

The XR medium for delivering training is one link in a chain that includes generating content, delivering it to warfighters, and assessing their performance. Themes 1 and 2 pertain to delivering content, as listed in Table 5.1. Themes 3 and 4 pertain to requirements to flexibly generate content and assess performance.

MCA training needs differ across Air Force wings and might be hard to anticipate. To enable the MCA concept, trainers must be able to develop instructional content at the point of need. During the interviews, we learned about COTS tools that allow individuals with little background in instructional design to quickly generate tailored training material that is reflective of scientific learning principles. For example, one interviewee described a software application that "get[s] instructors to think beyond a PowerPoint or lecture and identify different modalities that could be appropriate in different situations."[107] Additionally, we heard about COTS tools for AR content authoring.

Tools Exist to Capture and Assess Trainee Performance

Interviewees also highlighted technologies to capture and automatically score performance. Once captured, performance data can allow a human instructor to provide feedback, one of the most powerful influencers of learning. As one interviewee noted,

> Every time we do the sim[ulation] and a flight, we watch the playback of the videos from the displays and the helmet. . . . That's where most of the learning happens because they're no longer in that high-stress environment and they can see things they didn't see before because they were task saturated.[108]

AI systems also exist for scoring the performance of basic skills. These systems can reduce the burden on human instructors to provide feedback. However, many interviewees acknowledged that AI systems do not yet scale to complex skills and environments. One interviewee also described how objective performance measures can be used for computational cognitive models of skill acquisition and retention. These models take as inputs information about how frequently and recently an individual performed a task along with their level of performance. The models then predict the amount of skill decay that occurs during periods of disuse. These models could be used to monitor and mitigate skill decay during periods of disuse for MCA.

Multi-Capable Airmen Risks

The second set of themes relate to technology limitations along with human-centered risks that are inherent to the MCA construct.

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[107] SME, interview with the authors, May 26, 2022.

[108] SME, interview with the authors, May 9, 2022.

Proficiency Can Be a Zero-Sum Game

One theme that came up during many interviews is that the time spent training on secondary skills takes time away from training on primary skills. Thus, proficiency gains in one area are offset by losses in another regardless of the application of the advanced training technologies. As one interviewee remarked: "It's a zero-sum game. If you're training something new, that means you're not training something on your primary role. No amount of tech is going to change that."[109] To mitigate this risk, the Air Force must determine the level of proficiency that MCA need for secondary skills and deliver only enough training to meet that goal. In addition, by performing more in-depth CTA, the Air Force can identify deep similarities between seemingly disparate tasks. As another interviewee commented, "There may be [tasks] that don't *look* similar, but actually do impact each other."[110] This creates opportunities for positive transfer—the transfer of training and experience from primary to secondary tasks, or vice versa. Alternatively, failure to understand how primary and secondary tasks relate could produce negative transfer—knowledge from one task interfering with the performance of another.

Besides thinking in terms of tasks that airmen perform regularly, the Air Force can track and leverage the knowledge, skills, abilities, and other attributes that airmen developed during previous duty assignments. In thinking about MCA, one interviewee recommended that the Air Force "look at the assignments that a person has had in the past to say that they possess skills that lend themselves to transfer on these secondary tasks."[111]

Notwithstanding Potential, Extended Reality Technologies Have Significant Drawbacks

Besides acknowledging the benefits of XR, several interviewees discussed its limitations. One set of concerns involves the suitability of XR for operational environments. As an interviewee explained, "If your AR relies on spatialization, then consistent lighting is really important."[112] This came up during several interviews. State-of-the-art haptic training simulators might also be difficult to support in operational environments. When asked about the feasibility of deploying haptic training simulators, one interviewee candidly remarked, "This is a very expensive and precise device. . . . If you give it to a group of young airmen, they're going to break it."[113] Likewise, multiple engineering challenges must be overcome to use VR for highly interactive tasks; for example, as one interviewee described, besides creating a controlled

[109] SME, interview with the authors, May 9, 2022.

[110] SME, interview with the authors, May 16, 2022.

[111] SME, interview with the authors, May 27, 2022.

[112] SME, interview with the authors, May 12, 2022.

[113] SME, interview with the authors, May 20, 2022.

environment with blackout curtains, VR requires networking computers, headsets, power sources, and sensors, any of which can break.[114]

Aside from the difficulty of supporting XR in operational environments, some interviewees questioned whether XR could adequately replicate the physiological responses produced by live training. One interviewee described it this way:

> The simulator is not going to re-create the effects of sitting in a 100-degree cockpit with 50 pounds of gear on in the middle of July. . . . You can practice perceptual, cognitive, and motor skills, but task performance can change in high-stress environments.[115]

This is a significant concern given that MCA will be required to perform tasks in demanding conditions. As one interviewee observed, the adverse effects of such moderators as stress on task performance will be greatest for MCA because of their lower proficiency.[116]

Finally, some individuals noted that the physiological and cognitive effects of time spent in XR are not yet fully understood. Some of these effects are acute, such as motion sickness. Others are cumulative, such as fatigue. As one interviewee pointed out,

> We're giving them great technology, but we haven't limited how and when they're allowed to use it. . . . I'm not too concerned if people want to read when they're at home, but how does that compare to using a VR device to fly outside duty hours?[117]

Tasks and Environments Could be Structured in New Ways to Support Multi-Capable Airmen

Given that MCA are not trained to the same level of proficiency for secondary tasks as for primary tasks, the aspects of tasks and context might need to be modified to support MCA performance. As one interviewee remarked, "Because they [MCA] have less knowledge in their heads, we need to provide more knowledge in the world."[118] This could include providing checklists or placing distinguishing markings on mechanical components, such as fuel panels. In this sense, the technology is not only useful in the training environment but can also potentially assist with post-training, real-world operations. Besides modifying the task environment, it might be necessary to alter teammates' roles. Most of the tasks that MCA perform are part of a team effort. Other team members must be aware of the capabilities and limitations of MCA. As one interviewee pointed out, although MCA are the primary training audience, others working

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[114] SME, interview with the authors, May 13, 2022.

[115] SME, interview with the authors, May 9, 2022.

[116] SME, interview with the authors, May 12, 2022.

[117] SME, interview with the authors, May 9, 2022.

[118] SME, interview with the authors, May 12, 2022.

alongside them are the secondary training audience.[119] This secondary audience must be trained to monitor MCA actions and to back them up.

Technology Innovation

The final theme to emerge from the interviews was unexpected and unsolicited. Many interviewees drew attention to the nuances of developing and transitioning training technologies.

Innovation Examples Highlight Factors to Enable Technology Transition

As compared with major acquisition programs, all the training initiatives we learned of were low cost, started out at the wing level or below, and leveraged mature COTS products. These training initiative characteristics have implications for innovation and transition.

First, the Air Force does not need to take on significant risk to adopt new training technologies. As one interviewee observed, "We don't need to do anything cosmic. Academia and industry have been doing this for years."[120] Simply digitizing training materials, making them available anytime and anywhere, introducing elements of interactivity, and tracking student performance would constitute meaningful change. The primary challenge, as one interviewee described it, is to "modernize the 1950s instructional approaches that persist."[121]

Second, rather than developing new technologies, the Air Force can adapt existing commercial solutions. This shifts emphasis from research and development to experimentation and operational testing. As one interviewee explained, "We take companies out to demo and use their training technologies in operational environments."[122] Another said, "We pull it [a training technology] into our ecosystem, we prototype with it, and then we'll either spend money making it better or we'll discard it."[123] Thus, the Air Force can afford to conduct multiple small-scale experiments and fail quickly to identify meaningful training offsets.

Third, training technologies are more likely to be adopted if a return on investment can be clearly demonstrated. For example, describing a successful technology transition, one interviewee explained, "Our biggest win was demonstrating the huge waste of time [of the existing training method]."[124] A training technology that produces equivalent learning outcomes in less time is extremely valuable. As the Air Force pursues new training technologies, it must consider how to demonstrate a return on investment.

Finally, given the organic and distributed nature of wing-level MCA efforts, it is important for the Air Force to maintain a centrally managed innovation dashboard. This dashboard could

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[119] SME, interview with the authors, May 10, 2022.

[120] SME, interview with the authors, June 1, 2022.

[121] SME, interview with the authors, May 19, 2022.

[122] SME, interview with the authors, June 24, 2022.

[123] SME, interview with the authors, July 7, 2022.

[124] SME, interview with the authors, May 24, 2022.

include descriptions of the training methods and technologies that are being used in different wing-level MCA efforts; associated costs, barriers, and enablers; and considerations for use, such as in which environments and settings the training technologies are most effective. As one interviewee stated, the Air Force "needs a clearinghouse to get the information out there—to connect airmen and innovators."[125] The interviewee went on to say, "It's a two-way street to find out who's doing what and to reach out to them." A centrally managed innovation dashboard could reduce the potential for duplication of effort, create opportunities for reuse, and share lessons learned.

None of these considerations are unique to MCA. Yet, given the importance of effective and economical training solutions for MCA, these considerations are highly relevant.

Multi-Capable Airmen Mission-Essential Task Training Vignettes

To illustrate the potential use of new training technologies, we considered two METs from the TOA: hot pit refueling and schedule build and distribution.[126] We chose these METs because they cover several perceptual, cognitive, and motor abilities; also, on the basis of feedback from our interviews across DoD, industry, and academia, these METs represent compelling use cases for a variety of training technologies.

Hot Pit Refueling

Figure 5.2 summarizes the key components of hot pit refueling. The following vignette describes how advanced training technologies, particularly AR, can be used to deliver MCA training for this MET.

[125] SME, interview with the authors, June 1, 2022.

[126] Hot pit refueling is identified as a secondary task for two AFSCs (11F Pilot and 2W0 Munitions) and schedule build and distribution is identified as a secondary task for four AFSCs (14N Intelligence Officer, 1C3 Command Post, 1N0 Intelligence Analysts, and 1W0 Weather).

Figure 5.2. Augmented Reality for Training Hot Pit Refueling

Hot Pit Refueling

Subtasks

- Set up refueling area[a]
- Drive fuel truck to hot pit area
- Guide aircraft into hot pit
- Walk wing
- Uncover fuel port
- Attach receptacle to fuel port
- Set aircraft to accept fuel
- Set and monitor flow from fuel truck
- Reverse procedures

Enabling Training Technologies

- **CBT:** Deliver static training and present multimedia assets.
- **Haptic training simulator:** Provide 3D print, low fidelity, and static props to allow airmen to handle the equipment in advance.
- **Augmented Reality:** Display checklists and instructions, provide attention cues, and highlight hazards.

Perceptual: Identify fuel port, scan area for debris or hazards.

Motor: Remove fuel panel, attach fuel receptacle.

Cognitive: Execute procedures, communicate with team members.

SOURCE: Adobe Stock.
NOTE: The boxes in the lower right corner indicate level of difficulty on a scale of 1 to 3 filled boxes, with 1 filled box indicating the easiest and 3 filled boxes indicating the most difficult. The colors further emphasize this scale: green = easy, orange = medium, and red = difficult.
[a] Most suitable for MCA.

Air Force Chief Master Sergeant Smith (CMSgt)—a senior enlisted leader for the Logistics Readiness Squadron at Seymour Johnson Air Force Base—is tasked with training a large number of MCA on hot pit refueling as a secondary skill set shortly before these MCA deploy overseas. He recognizes that the traditional training plan is too time- and resource-intensive. Looking for other options, the CMSgt employs a software application to help design a training plan. Once the CMSgt has inputted information about the desired knowledge, skills, and abilities and proficiency levels, the software application provides a basic curriculum and outlines training events.

The CMSgt then works to build a local CBT module to teach hot pit refueling basics. Using a head-mounted camera, he collects video recordings of airmen conducting key hot pit refueling tasks. He also records audio communications and commands that are essential for acting as part of a hot pit refueling crew. With the help of a production specialist on base, the CMSgt adds these multimedia elements to a PowerPoint presentation for airmen to review before progressing to hands-on training.

The CMSgt is unable to get enough access to actual aircraft for initial hands-on training. So, with the help of his local Spark Cell, he uses a 3D printer to fabricate static props that resemble a

fuel nozzle and hookup.[127] These props allow MCA to "feel" the equipment before going on the flight line.

Moving to the flight line, the CMSgt considers how to enhance training and support performance for MCA who have minimal experience and reduced training time. He decides to employ wearable AR-enabled smart glasses. After consulting with the Maintenance Group, he affixes QR codes to parts of the aircraft. When the glasses scan the QR codes, relevant instructions are automatically displayed. The glasses also overlay perceptual cues on relevant parts of the aircraft, such as the fuel panel, and highlight hazardous areas around the aircraft to be avoided.

Given the demonstrated utility of this system for training, the CMSgt submits a proposal to his local Spark Cell for the development of a deployable version to be used for performance support during live hot pit refueling at a contingency location.

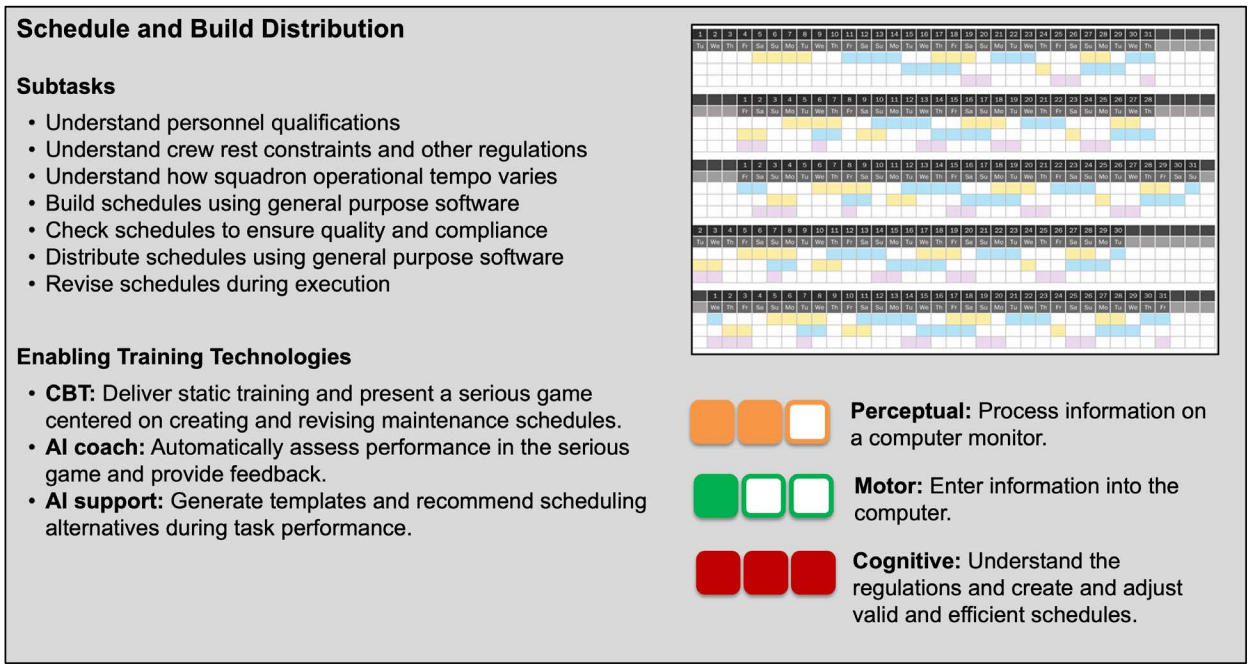
Schedule Build and Distribution

Figure 5.3 summarizes the key components of building and distributing a schedule. Although this could include creating flight schedules, the SMEs we spoke with expressed doubt about whether an MCA could learn to perform such a complex task. They suggested that other scheduling tasks involving logistics or maintenance were more feasible.

The following vignette describes how advanced training technologies, particularly CBT, can be used to deliver training to MCA for this MET.

[127] AFWERX, "Spark," webpage, undated.

Figure 5.3. Computer-Based Training for Schedule Build and Distribution



NOTE: The boxes in the lower right corner indicate level of difficulty on a scale of 1 to 3 filled boxes, with 1 filled box indicating the easiest and 3 filled boxes indicating the most difficult. The colors further emphasize this scale: green = easy, orange = medium, and red = difficult.

Air Force Captain Abler—a flight commander in the Civil Engineering Squadron at Nellis Air Force Base—is responsible for vehicle and equipment maintenance. She employs a single, dedicated scheduler at her home base to help track and execute the required maintenance, including the replenishment of petroleum, oil, and lubricants and spare parts. With increasing demand to operate from multiple dispersed locations that have potentially limited connectivity, she is concerned about relying on a centralized scheduling office and determines the need to train MCA on the schedule build and distribution task.

To start, the captain accesses the Air Force's Digital Innovation Dashboard and searches for *adaptive training* and *maintenance scheduling*. The dashboard returns an abstract for a Phase II Small Business Innovation Research (SBIR) on a software application to train logistics personnel to build transportation schedules. The captain contacts the company associated with the SBIR; after some discussion, she sees the potential use of the tool for training personnel to build and distribute maintenance schedules. She coordinates with her chain of command to grant a sole source Phase III award to extend the tool.

The captain meets with a group of experienced schedulers from various units across base and, using a knowledge elicitation tool, she leads this group in building a list of scheduling processes, rules, and decision heuristics. The captain then engages with the small company to produce instructional material. Specifically, she has the company create a CBT module that not only teaches the material but also simulates the spreadsheets used for maintenance scheduling

and presents the student with multiple scheduling problems to solve. The program is designed to increase the complexity of these problems as the student demonstrates greater proficiency. At the end of a two-hour training session, the program provides the student a proficiency rating. Squadron leadership also receives a report of these proficiency ratings to help determine which airmen are authorized to perform schedule build and distribution as a secondary task.

Looking forward, the captain engages with the company to consider how the tool could be hosted on a cloud. This would allow other units to access the tool and to create additional content. They also discuss whether an AI-enabled system could be used to construct a complex schedule from basic inputs. This would allow less-skilled airmen to check and refine the machine-generated solutions as opposed to building a schedule from scratch.

Conclusion

An essential part of the MCA initiative is to develop and sustain secondary skill sets. For the initiative to succeed, the Air Force must find ways to efficiently and economically train airmen in these secondary skill sets to an adequate level of proficiency while mitigating against the degradation of primary skill sets. Advanced training technologies might not fully address this challenge, but they can help.

Our analysis of the METs contained in the MG MCA TOA showed that although most impose a mix of perceptual, cognitive, and motor demands, the METs disproportionately emphasize perceptual and motor dimensions. This has implications for the types of technologies that are best suited to train MCA. Of the training modes considered, AR, integrated training devices, and live training were suitable for all METs, whereas VR, haptic simulators, and CBT were suitable for only a subset. Besides assessing task-technology fit, the Air Force must consider such additional factors as cost, safety, technological readiness level, and transfer of training when choosing among training devices for MCA. Our interviews with relevant SMEs supported these findings while also highlighting the additional value of certain training technologies for providing continuous performance support. Finally, SMEs emphasized the importance of the surrounding technology ecosystem for developing training content and assessing performance. Overall, a thoughtful blend of advanced training technologies shows significant promise for enhancing MCA training, from the development of training plans to content creation to delivery, and wrapping up with performance assessment and feedback. Although these same technologies offer an advantage for the training of primary skills apart from the MCA initiative, they offer a distinct value for MCA training, given the greater impetus to achieve the right amount of proficiency (and not overtrain) within the least amount of time and with the fewest resources.

Chapter 6. Findings and Recommendations

The Air Force's MCA initiative is still in a formative stage, with most efforts to develop and sustain MCA taking place in an experimental, ad hoc manner at the wing level. As such, Air Force leadership has been wrestling with how to best standardize and institutionalize MCA across the force. The Air Force Directorate for Integration and Innovation within Air Force Futures (A5I) asked RAND Project AIR FORCE to help refine the emergent MCA concept and provide recommendations on how the Air Force can effectively develop and sustain MCA. This final chapter summarizes our key findings from across the project's four main tasks and presents relevant recommendations.

Overview of Key Findings

What Is the Origin and Construct of the Air Force's Multi-Capable Airmen Initiative, and What Can the Air Force Learn from Previous Multi-Skilling Efforts?

In Chapter 2, we described the origin, evolution, and basic construct of the Air Force's MCA initiative while also briefly examining previous multi-skilling efforts. The intent with Chapter 2 was to provide background for the rest of the analysis. We highlight some of our key background observations below.

The impetus for the current MCA initiative is for it to be a workforce enabler for ACE; the Air Force will absorb the full costs and risks associated with multi-skilling efforts but will gain the full benefits only in the event of an armed conflict versus a peer adversary. The current MCA initiative is explicitly linked to ACE and although there could be some crossover benefits associated with in-garrison use, the MCA efforts we observed at the wing levels are largely aimed at optimizing the workforce for deployed combat operations. This has important implications for any cost-versus-benefit analysis. The Air Force has a long history of experimenting with and implementing workforce multi-skilling, but most of these efforts have centered on in-garrison use. Caution must be used when assessing MCA through the lens of these previous, seemingly related, multi-skilling efforts.

The value of MCA for ACE derives from team employment, but the Air Force's current organizational construct for building and designating MCA centers on the individual. ACE drives a demand not just for MCA but for efficient and resilient MCA teams. The Air Force's current approach to building MCA, however, emphasizes the individual airman and the skills required of the individual airman. Looking across the main organizing tenets of the MCA initiative, notably the training tiers and mission set pillars, there is no clear team concept baked in. The Air Force's proposal to delineate MCA by levels appears to be a further extension of the

focus on the individual, distinguishing airmen by their individual skill sets as opposed to contribution to a team.

There is tension between the idea of MCA as a broad shift in Air Force culture and the idea of MCA as narrowly focused on ACE operations. Statements by Air Force senior leadership have expressed the MCA initiative as a vehicle to spur a broad cultural shift that is aligned with the ideal that every airman is an MCA. However, there is tension between this vision and the recognition that the Air Force has the resources and need to develop only a relatively small number of MCA with the skills to effectively operate from dispersed forward sites in support of ACE. As an early MCA document states, a key takeaway from the MCA concept is that "not every Airman will be part of a cross-functional team conducting agility operations . . . only those assigned to UTCs with specific tasks to execute dispersed operations."[128] This tension has significant implications for the implementation of the MCA initiative and stakeholder buy-in. As one stakeholder commented,

> The obstacle is convincing the MAJCOMs and wings that MCA is needed in support of ACE. MCA is not the kitchen sink; it's only about supporting ACE. We need that education piece of what MCA truly is. Without that understanding across the force, we will struggle with this.

The proposal to delineate levels of MCA is an attempt to ease this tension, relaying the message that all airmen are MCA, but some are more multi-capable than others. Only a select number of MCA will receive the advanced training required to deploy in support of ACE.

Multi-skilling can degrade workforce effectiveness if overdone. Furthermore, the benefits of multi-skilling are highly contingent on the effective design, management, and utilization of a multi-skilled team. Our review of the literature on previous workforce multi-skilling initiatives in private industry and DoD suggests that although multi-skilling is costly, the benefits can significantly outweigh the costs in terms of enhancing workforce efficiency and resiliency. That said, the payoffs do not increase proportionally with the scope of cross-training. Rather, the benefits are likely to trail off as cross-training broadens. But even if an organization determines the right level of cross-training at the individual level, the full benefits of multi-skilling are still not guaranteed. Instead, optimizing the benefits of multi-skilling versus the costs requires the careful teaming of multi-skilled workers and effective management of these teams. For the Air Force, building a pool of individual MCA is important, but, absent a well-defined and well-practiced MCA team structure, the return on investment will likely decline.

There are parallels between MCA and the Army's defunct MSS initiative; the Air Force should take note of the Army experience. As noted, there is tension between the idea of MCA as a cultural shift and the idea of MCA as limited to support of ACE via selective CUT. Literature on the Army's MSS initiative points to a similar tension. In the developmental stage of MSS, there was a gap between stakeholders who mainly thought of the initiative as a way to

[128] ACC, 2019, p. 3.

enhance workforce efficiency and resiliency through CUT, specifically to enable distributed combat operations, and those who saw the primary value of MSS as more broadly "developing soldiers with significantly enhanced capacities for adaptability, versatility, and mental flexibility."[129] In the end, the Army concept remained broad and ill defined and was never effectively tied to anything substantially new and concrete that the average soldier could identify with the concept. In addition, the Army failed to dedicate the resources necessary to move the initiative from ad hoc experimentation to a more institutionalized effort and failed to address key training challenges. There are many parallels between the current state of the Air Force's MCA initiative and the Army's now defunct MSS initiative in its developmental stage; accordingly, the Air Force should take note of the shortcomings of the Army initiative.

How do Stakeholders Perceive Multi-Capable Airmen Concepts, Training, Implementation, and Deployment?

In Chapter 3, we sought to understand the perspectives of key Air Force stakeholders on MCA, particularly where these perspectives converge and diverge. Toward this end, we targeted individuals across the Air Force who are directly involved in the development and implementation of the MCA initiative. We assess that even minor differences in perspectives across this group can have a significant effect on the future direction and efficacy of the MCA initiative. We describe the key findings from our analysis of stakeholder perspectives in the following paragraphs.

Stakeholders understand the conceptual link of MCA to ACE but are unclear about what is new with the MCA initiative and are skeptical about its benefits. Even among stakeholders who are closely involved in the development of the MCA initiative, there is a lack of clarity about what is new or significant about the initiative and skepticism about its benefits versus the costs and risks.

Stakeholders have widely disparate views about how many airmen should be designated and trained as MCA and the level of proficiency that is needed. When asked about the percentage of airmen who should be designated and trained as MCA, stakeholder responses ranged from below 10 percent to more than 80 percent within relevant career fields. This has important implications for how various organizations approach and allocate resources to MCA training. As a related observation, stakeholders generally concur on the need to track MCA via an SEI (or something similar) but are concerned about a lack of clear, objective standards to designate MCA. Specifically, if most airmen are MCA, how does the Air Force determine which MCA qualify for the SEI? As already described, the proposal to delineate levels of MCA is intended to help address these issues, but there will still need to be clear boundaries between the levels, and what an individual MCA looks like at the different levels will likely vary significantly from one career field to the next. Based on our engagement with stakeholders, we assess that the

[129] Nelsen and Akman, 2002, p. 6.

message that all airmen are MCA but not to the same level could exacerbate the confusion and even cynicism that surrounds the MCA initiative.

Stakeholders see value in training MCA as teams and in deploying these teams from the same base or unit; they also perceive a need to align the development and sustainment of MCA with AFFORGEN. Stakeholders recognize that the Air Force needs the flexibility to combine MCA from across bases to support ACE, but they also see great benefit to developing, sustaining, and then deploying MCA as dedicated teams to the maximum extent possible. Furthermore, they perceive the need to more explicitly tie MCA to AFFORGEN, with some stakeholders noting that the Air Force was developing the MCA and AFFORGEN concepts simultaneously but separately and without a clear link.

Stakeholders are divided on the need to incentivize individual MCA but generally see the opportunity to be a part of an elite team as strong motivator. Looking at the MCA initiative from an individual perspective, many stakeholders proposed the need to provide monetary or other individual incentives to encourage airmen to participate. However, when focused on the team dynamic, this perspective changed, with stakeholders observing that airmen are motivated by the opportunity to be part of an elite team. Commenting on a team-based MCA construct, one stakeholder observed, "Our airmen jump up and down at the opportunity to do this. . . . Just tell them they can be part of any elite team. The real problem is that too many people will volunteer, and we have to make the hard choices." Our discussions with airmen assigned to an AFSOC MST during a site visit revealed similar sentiments.

Stakeholders are divided on the extent to which the force provider should tailor MCA to unique theater requirements. Stakeholders generally noted that MCA requirements vary substantially across theaters (mainly EUCOM and INDOPACOM) but were mixed on how much the force provider should be involved in MCA requirements tailoring. More than one-third of interviewed stakeholders expressed that the force provider should do little to no MCA tailoring. It is perhaps unsurprising that representatives from the force provider subgroup (primarily ACC) had the least favorable view of force provider tailoring, with 75 percent of this subgroup recommending little to no MCA tailoring. Interestingly, the subgroup most in favor of tailoring was not force employment (USAFE-AFAFRICA and PACAF) but policy and oversight, with less than 25 percent of this latter subgroup proposing little to no tailoring. The force employment subgroup fell somewhere in the middle, with approximately 50 percent proposing little to no tailoring, and USAFE-AFAFRICA exhibiting a slightly higher preference for tailoring than PACAF.

Wings generally desire more guidance on MCA than higher headquarters provides. Stakeholders concur that wings currently have a great deal of autonomy in their MCA training programs but disagree on the right amount of autonomy moving forward. Looking at different breakdowns of stakeholder groups, wing representatives proposed a lesser degree of wing autonomy than proposed by their MAJCOM staffs, and stakeholders at Air Force headquarters recommended a higher degree of wing autonomy than the MAJCOM staffs. In essence, as one

moves up the chain, the impetus to push responsibility down the chain appears to grow. The apparent result is a gap between the level of guidance that wings want and the level of guidance that higher headquarters appears to be willing or able to provide.

Stakeholders view the degradation of airmen primary skills and inadequate proficiency in secondary skills as the main risks associated with the MCA initiative; they also assess Air Force culture as a major hurdle to widespread implementation. Stakeholders expressed concerns that the time spent training MCA in secondary skills will negatively affect the ability to maintain proficiency in primary skills. Similarly, they voiced concerns that MCA will not be proficient enough in secondary skill sets to safely and effectively perform those secondary tasks in a demanding deployed environment. Solving the proficiency as a zero-sum game dilemma is thus critical to the success of the MCA initiative. When asked about implementation hurdles, stakeholders also consistently pointed to a lack of dedicated resources but generally saw Air Force culture as the most difficult hurdle. In their discussions about Air Force culture, several stakeholders suggested something akin to a generational gap, noting that younger airmen might be more amenable to the MCA concept than more senior airmen who are accustomed to the old way of doing business in stovepiped career fields.

What Are the Key Trends and Lessons Learned from Wing-Level Multi-Capable Airmen Training Programs?

The Air Force is leaning heavily on airmen at the wing level to figure out how best to develop and sustain MCA in support of ACE. Chapter 4 documents our observations from an in-depth study of five wing-level MCA programs with the intent of identifying crosscutting characteristics and trends that are relevant to Air Force efforts to further expand and institutionalize the MCA initiative. We describe our main observations in the following paragraphs.

Wing-level MCA training programs vary greatly. What stands out the most from our engagement with various wing-level MCA programs is simply the level of variation across wings. There are major differences in almost every aspect of these programs, including the office or organization that manages the program, the focus and content of the training, the duration of the training, and the number of airmen trained. This lack of standardization persists despite the publication of a formal Tier 1 EST syllabus, the release of the TOA for Tier 2 CUT, and at least some sharing of information across wings. Multiple wing representatives pointed to the lack of standardization and central guidance as impeding their local efforts and affecting decisionmaking related to resource allocation, program evaluation, and force presentation, among other issues. At the Air Force level, this lack of standardization hinders the overall assessment of progress and the effectiveness of the MCA initiative. As a local measure of performance, wings report how many MCA they have trained in a given period, but at the Air Force level, such metrics have limited use because MCA at one wing could look completely different from MCA at another wing.

Wings have solidified initial MCA training but do not conduct routine sustainment training. Furthermore, wings lack the means to evaluate and track MCA proficiency. Although there is a great deal of variation across wings, each wing we engaged with had solidified a version of initial MCA training. There was a gap, however, in the development of MCA continuity or proficiency training. To start, there are no standards or measures for proficiency. Wings reported that they do not have a good idea of what MCA proficiency should look like and do not know how to effectively assess proficiency. All wings we engaged with expressed the desire to establish routine sustainment training for MCA, but only one wing had done so. Furthermore, wings have not yet determined how to evaluate the effectiveness of MCA training programs, individually or comparatively, apart from tracking the number of airmen trained.

Wings are constrained by a lack of resources and their MCA training programs rely on the buy-in of local leadership. Every wing we engaged with expressed concern about the lack of resources dedicated to the development and sustainment of MCA at the wing level. The Air Force is leaning heavily on the various wings to establish MCA training programs. Wings are working to do this but are largely doing it out of hide with few additional resources. In effect, wing leadership must decide what other programs to sacrifice or cut back to support local MCA efforts. Several stakeholders noted that their MCA programs, as result, will be difficult to sustain or will not reach full potential. Wing representatives also observed that the viability of wing-level programs hinges significantly on the preferences, interests, and risk tolerance of individual wing leaders; without further higher headquarters guidance, there is not only the strong potential for variation across wings but also from one leader to the next at a given wing.

Some wings recognize the value of MCA and are trying to implement a team-based approach for developing and sustaining the initiative, but these efforts remain local and ad hoc. Wings currently have a great deal of autonomy over their MCA training programs, and some, of their own accord, are working to align their MCA training around a team concept as opposed to training pools of individual MCA. This includes wings that started out training MCA as individuals and then purposely shifted to a team model after the former approach underperformed. However, these efforts remain local and there is a great deal of variation. Of note, the 27th Special Operations Wing's MST provides a blueprint for how to build and sustain a dedicated MCA team at the wing level and how to align these efforts with a deployment cycle. However, the MST manning approach might be unsustainable at scale. In our discussions with MST and associated wing leadership, it was clear they were wrestling with the personnel implications and questioning the long-term sustainability of pulling airmen out of their assigned units (without backfill) for full-time MST duty over an extended 15-month commitment. Scaling such a model across the Air Force would likely be even more challenging.

Across wings, there is no *best* MCA program, but different wings exhibit positive practices with potential for scaling. Among wing-level MCA programs, we observed positive practices related to team-based MCA development and sustainment, formalized MCA

proficiency training, an identified time commitment associated with training and designation as an MCA, and dedicated MCA training programs tailored to MG and mission support skill sets. All else being equal, such characteristics are likely to enhance the effectiveness of a wing-level MCA training program and should thus be considered as the Air Force institutionalizes the MCA initiative across the force.

How Can New Training Technologies Enhance Multi-Capable Airmen Training?

As noted, when asked about the primary risks and trade-offs of the MCA concept, stakeholders commonly reported concerns about achieving an acceptable level of proficiency in secondary tasks while mitigating skill decay in primary tasks. For Chapter 5, we examined how advanced training technologies could be leveraged to help overcome the challenges associated with MCA training. We describe the key findings from this analysis in the following paragraphs.

Across a variety of technologies, AR is particularly well suited for training MCA cross-utilization skills; in contrast, CBT and pure VR solutions offer marginal benefit. On the basis of our CTAs, we found that most MCA cross-utilization METs in the current TOA rely predominantly on perceptional and motor skills and less on cognitive skills. This has implications for the delivery methods that are best suited for MCA CUT. For example, across the assessed methods, CBT is valuable for tasks that require cognitive skills but is the least suited for tasks that require perceptual and motor skills. The Air Force should be wary of relying too much on CBT for the development and sustainment of MCA. In contrast, we found that AR, integrated training devices, and live training are suitable for all MCA METs included in the MG TOA. Of the training technologies we considered, AR stands out in terms of task-technology fit, safety, and affordability. Although many stakeholders suggested the potential value of VR for training MCA during our interviews, we assess that a pure VR solution is suboptimal and not worth the relatively high cost, in some cases, compared with other viable training technologies.

Beyond training delivery, new technologies can aid in the development of training content at the point of need, the assessment of MCA proficiency, and the performance of MCA tasks in day-to-day operations. Although we were primarily focused on the delivery of training material, SMEs from DoD and private industry proposed ways that various training technologies could enhance MCA training by assisting the development of tailored training content at the point of need and by providing an assessment of the trainee's proficiency. Some training technologies, particularly those with high durability and portability, can also help guide MCA when performing tasks in a live operational environment, thus reducing proficiency demands whether in garrison or at a deployed location.

Training technologies, although not uniquely applicable to MCA, can add distinct value for MCA, given the added impetus to avoid overtraining in secondary skills. None of the training technologies highlighted for MCA training are uniquely applicable to MCA. With secondary skills, there is a minimal level of desired proficiency, which is a primary concern of most stakeholders. However, there is also a downside to overtraining that does not attain primary

skills given that proficiency tends to be a zero-sum game. Training technologies that can readily tailor content to an individual airman's needs and that can assess and adjust to an airman's level of proficiency thus add distinct value for MCA secondary skill sets.

Recommendations

Based on findings from across our project tasks, we recommend the Air Force consider the following actions to further refine and institutionalize the MCA initiative.

Establish a single office of primary responsibility to lead, coordinate, and manage communication regarding the MCA initiative. The MCA initiative involves a wide variety of organizations across the Air Force. Accordingly, the Air Force is managing the initiative as a "cross-functional collaboration across the MAJCOMs and Air Staff," with different organizations tasked by the Air Force Chief of Staff to manage distinct MCA lines of effort.[130] Although a collaborative approach is valid and necessary, the Air Force should designate a single office as the primary owner with the responsibility and authority to oversee and coordinate the MCA initiative. Absent such a move, the initiative will likely continue experiencing the types of standardization and prioritization challenges seen to date. In addition, this can help ensure that there is consistent and clear communication regarding MCA and its implementation. As we note throughout this report, there are significant differences in how MCA is being interpreted and implemented across the Air Force.

Build baseline workforce and funding requirements for wing-level MCA programs. Per wing-level representatives, the current approach of resourcing MCA programs out of hide hinders development and is unsustainable. To further institutionalize the MCA initiative, the Air Force must allocate adequate personnel and funding to wing-level programs. However, given the wide disparities across wings, there is not a clear baseline for workforce and funding requirements. Developing this baseline with wing inputs would facilitate more-effective planning, budgeting, and resource allocation at the Air Force level.

Continue to standardize MCA CUT tasks, as per the ACE tasking order, but also establish training standards, proficiency measures, and tracking mechanisms. The Air Force is working to standardize MCA CUT tasks beyond the initial TOA. However, as evidenced by our observations across multiple wing-level MCA programs, having a standard list of training tasks does not result in training standardization. To get at the standardization issue, the Air Force must go further and provide guidance on training standards and proficiency measures. Furthermore, the Air Force must put in place a system for tracking proficiency.

Formalize a team-based approach to the development and sustainment of MCA at the wing level. As described in our findings, some wings have implemented a team-based approach to developing and sustaining MCA, but these efforts remain local and ad hoc. We propose that

[130] DAF official, correspondence with the authors, June 27, 2022.

the Air Force expand and formalize a team-based approach at the wing level as a main organizing construct of the MCA initiative. There are many ways to do this, but we see utility in building on the MST model, a main exception being participation for most members as an additional versus full-time duty. Reflective of promising practices developed by wing-level MCA programs, such a model could be tailored as follows:

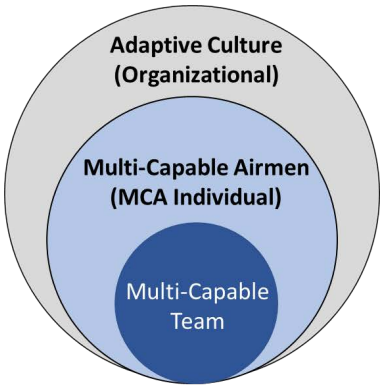
- Establish two different types of dedicated multi-capable teams at the wing level, with one focused on MG and the other focused on mission support or BOS. Dedicate personnel for small, full-time cadres to organize and manage these teams.
- When designing the teams, draw from CRG and MST models and their multi-capable team-of-teams structures.
- Create a highly trained, combat-ready team culture that is enabled by, but distinct from, individual MCA.
- Make participation voluntary and selective, targeting airmen who are not only experts in their primary specialties but who have also progressed as individual MCA.
- Require that team members commit, as an additional duty, for an 18-month period aligned with the last three phases of AFFORGEN (prepare, ready, commit). After an initial training program, members return to their in-garrison units but continue to train together on a regular basis.
- Revise UTCs to integrate and leverage wing-level MCA teams.

Our proposal for a team-based approach derives from and addresses multiple project findings. Specifically, this proposal can help affect the following considerations:

- Reduce the cognitive gap between the idea of MCA as a broad shift in Air Force culture (i.e., every airman is an MCA) and the idea of MCA as a narrow and selective focus for ACE operations.
- Add clarity on what is new and significant about the MCA initiative, reducing the perception of MCA as more of the same but with a different name.
- Avoid the path of the Army's MSS initiative, which failed to link the MSS concept to concrete, readily identifiable organizational measures.
- Respond to stakeholders who perceive a significant benefit in training MCA as teams and in deploying these teams from the same base or unit.
- Respond to stakeholders who perceive a need to align the development and sustainment of MCA with AFFORGEN.
- Provide an objective basis for assessing how many airmen should be designated and trained as MCA.
- Incentivize MCA by leveraging the motivation to be part of a specialized, elite team.
- Establish a framework for routine, consistent, and measurable MCA sustainment training.

Of note, our proposed team-based approach is distinct from and could supplant the existing model that emphasizes different levels of individual MCA. In our proposal, the primary delineation is not between less capable and more capable individual MCA, but between individual MCA (as developed within specific career fields) and MCA who are selected and trained as part of a multi-capable team in support of ACE (see Figure 6.1).

Figure 6.1. Proposed Approach to Structuring the Multi-Capable Airmen Initiative



Award an SEI for training and experience as part of a dedicated MCA team. If the Air Force elects to award an SEI for MCA, we recommend linking the SEI to training and experience as part of a dedicated MCA team. Individual MCA training and qualifications, which necessarily vary across Air Force career fields, would be tracked in the airman's individual training record. Aligned with our recommendation for a team-based approach to the development and sustainment of MCA at the wing level, we propose that the SEI be awarded after the completion of the first 12 months (the prepare and ready phases of AFFORGEN) of an 18-month time commitment. This would be consistent with many other SEIs that require 12 months of experience after initial training.[131] The Air Force is considering awarding an SEI to airmen classified as either ACE MCA or Level 2 MCA, with both exclusively focused on individual training. We assess that a team-based SEI reflects a cleaner, more objective distinction, thus mitigating some of the concern among stakeholders about distinguishing which MCA deserve an SEI. Furthermore, a team-based SEI potentially does more to emphasize the significance of the MCA team dynamic for ACE.

Incorporate and normalize progressive goals for MCA within the CFETP. Correspondingly, consider de-emphasizing MCA levels as an organizing construct. A shift to a team-based approach to MCA training and the adoption of a team-based SEI would reduce the impetus to designate different levels of individual MCA (e.g., Agile MCA versus ACE MCA). We recommend the Air Force de-emphasize, or even drop, individual MCA levels as a main organizing construct. We assess that MCA levels could be a source of further confusion and friction with the MCA initiative. That said, we recognize that some airmen will be more multi-capable than others on the basis of experience level, career field, and billet. To account for this, the Air Force can prescribe the progressive development of individuals as MCA in the relevant CFETPs and then track this development via the airman's training record.

[131] Air Force Personnel Center, *Air Force Enlisted Classification Directory (AFECD): The Official Guide to the Air Force Enlisted Classification Codes*, U.S. Air Force, October 31, 2021.

Integrate crosscutting lessons learned from wing-level MCA exercises into standard training plans. On the basis of experience in MCA-related exercises, wings have added elements to local MCA training. Under the current construct, such add-ons fall under Tier 3, or wing-specific, training. However, there should be an established process for incorporating these elements into standard training plans, even if they do not readily align with Tier 1 or Tier 2 training. For example, on the basis of common wing-level experience in MCA-related exercises, there is a need for MCA training in small-unit leadership and mission planning. Neither of these areas relates directly to an individual MCA task, but they enhance the effectiveness of MCA team employment. Both areas should be emphasized in standardized MCA training plans and purposefully integrated into future MCA-related exercises.

Conduct refined CTA of MCA skill sets and develop a model of direct and indirect skill set links. The strategic pairing of skill sets is critical to the efficacy of any multi-skilling initiative. The Air Force does not have data to effectively map the links across MCA tasks and assess the potential for positive or negative transfer in training and execution. Our cursory CTA associated with the assessment of training technologies revealed important, but basic, distinctions and similarities across a subset of MCA skill sets. A more robust CTA of MCA skill sets that feeds into a model of direct and indirect links could aid Air Force efforts to optimize individual MCA training and build effective MCA teams.

Invest in and develop AR training systems with dual use for performance support. Prioritize training technologies that can measure and automatically assess proficiency with a high degree of granularity. Across a variety of training technology options, we assess that AR training systems are best suited for most MCA cross-utilization tasks in the current TOA. Thus, we recommend that the Air Force leverage such systems for MCA training, particularly in contrast to stand-alone VR solutions. To the extent that AR systems can also be employed for performance support in day-to-day or deployed operations, they offer more potential return on investment and open doors to new and creative approaches to develop, sustain, and employ MCA. Stakeholders generally think of training technologies as useful for getting MCA to *at least* the minimum level of proficiency required to perform a task. With MCA however, the risk of undertraining in secondary skill sets is balanced by the drawbacks of overtraining in these skill sets. Accordingly, the Air Force should prioritize training technologies that not only teach MCA skills but can also measure and automatically assess proficiency with a high degree of granularity.[132]

[132] We note that any specific training program and training technology should be validated for effectiveness before broader implementation.

Conclusion

The MCA initiative is still very much in a formative stage. Although there are benefits to experimentation at the local wing level, effective institutionalization of the MCA initiative will require more guidance and intervention by Air Force senior leadership. Our project findings documented in this report provide insights on how key stakeholders converge and diverge in their perspectives of MCA, lessons learned and scalable practices from wing-level MCA programs, and the potential of advanced technologies to enhance MCA training and performance. Reflective of these findings, our recommendations provide Air Force senior leadership with steps to further refine and institutionalize the MCA initiative.

Appendix A. Stakeholder Interviews

In Chapter 3, we described findings from our interviews with key stakeholders across the Air Force regarding their perspectives on MCA concepts, training, implementation, and deployment. This appendix provides additional detail on the participants, the interview and analysis approach, and the interview protocol.

Participants

We conducted a total of 41 interviews with key stakeholders from across the Air Force. To ensure we had representation from key stakeholders, we divided our interviewees into four categories: (1) policy and oversight, (2) force development, (3) force provider, and (4) force employer. For the policy category, we targeted key individuals at Air Force headquarters in A1 (Manpower, Personnel, and Services), A3 (Operations), A4 (Logistics and Engineering), and A5 (Plans and Integration), and we purposely included a relatively large sample of CFMs given the important role these individuals play in determining the bounds of cross-training within the relevant career fields. For the force development category, we focused on including representatives from AETC and the USAFEC, with the latter being tasked to develop a standardized curriculum for Tier 1 EST. Turning to force providers, we looked primarily at ACC—at the staff and wing level—while also sampling from AMC and AFSOC. With ACC, we targeted organizations designated by the MAJCOM as lead wings in support of the ACE concept of operations. Finally, for force employers, we looked at USAFE-AFAFRICA and PACAF at the staff and wing levels. Table A.1 provides an overview of the number of participants in each category.

Table A.1. Interview Participants

Category	Subcategory	Number of Participants
Policy and oversight	A1	3
	A3	3
	A4	2
	A5	3
	CFM	7
Force development	AETC	2
	USAFEC-AFAFRICA	2
Force provider	ACC staff	3
	ACC wing	5
	AMC	2
	AFSOC	1
Force employer	PACAF staff	2
	PACAF wing	2
	USAFE-AFAFRICA staff	2
	USAFE-AFAFRICA wing	2
Total		41

Interview and Analysis Approach

For each of the interview sessions, a senior project team member facilitated the interview while another team member took as verbatim notes as possible. The protocol was structured to include open-ended response questions and more-structured questions for which participants were asked to provide a specific rating on a five-point Likert scale. The rating scale was used to help anchor the response of the interviewee and serve as a starting point for discussion, with the facilitator asking the participant to explain their rating. These structured-response questions were also used to facilitate a more structured comparison between the answers of different stakeholder groups.

Qualitative Coding

Following completion of the interviews, we uploaded all transcripts into the Dedoose qualitative coding software program to help identify key themes from the open-ended interview questions. The qualitive coding of the open-ended answers went through two phases. In the first phase, three team members coded each transcript into broad categories of answers on the basis of the interview protocol (i.e., all responses to question one were coded under “MCA definition”). During the second phase of coding, a senior project member coded the responses to each of these broader categories into subthemes. A second senior project member independently coded the answers to see if they identified similar subthemes for each question. In some cases, additional

subthemes were broken out; in other cases, subthemes were grouped together into a higher-level theme. We highlight relevant themes in response to each question in the Chapter 3 discussion.

Comparisons Across Stakeholders

In addition to identifying key themes from the more open-ended responses, we also sought to provide a more structured comparison to identify where there was convergence and divergence among stakeholders on how MCA was being defined and approached across the Air Force. For these structured questions, we provided interview participants with a general five-point Likert scale to help anchor their responses. Responses to these types of questions varied from participants providing a specific number to others providing a general range; others discussed their overall response and did not provide a specific number. Our intent with these comparisons was not to provide a statistical estimate, as might be derived from a formal survey, but to provide a general sense of convergence and divergence. On the basis of the numerical or categorical responses to the structured questions and participants' explanation of their responses, we had two senior researchers independently code the responses into a smaller set of categories (e.g., we often coded responses down to a three-point scale of low, medium, high). For any coding discrepancies, the two researchers collaboratively reassessed the text from the interview transcript to determine a consensus. If a response did not fit within a designated category, it was coded as "other."

Interview Protocol

The interview protocol used for the discussion with stakeholders is provided in the following paragraphs. Note that for questions that provide a scale, we followed up with a question asking stakeholders to explain their rating if they did not do that as part of their initial response. This protocol is presented without revision.

Participant Background

Could you start by giving us a brief description of your current position and responsibilities, particularly as related to MCA?

MCA Core Concepts

5. In your own words, how would you define MCA?
6. What is the main goal or benefit of the MCA initiative?
7. What is the primary risk or trade-off for the Air Force associated with developing and/or employing MCA?

    a. (*If at the wing level*) For your organization?

8. The Air Force has always had airmen that perform duties and possess skills outside of their primary career fields. On a scale of 1 to 5, how significant of a shift is MCA for the Air Force? (1 = minor shift, 5 = major shift)

9. We know that MCA is related to ACE. On a scale of 1 to 5, how critical is MCA to the successful implementation of ACE? (1 = low importance, 5 = critical to success)
10. Parallel to MCA, the Air Force is developing the concept of expeditionary air base squadrons. Are you familiar with the air base squadron initiative? On a scale of 1 to 5, how closely is MCA linked to the air base squadron initiative? (1 = minor linkage, 5 = highly significant linkage)
11. Parallel to MCA, the Air Force is also developing the concept of lead wings. Are you familiar with the lead wing initiative? On a scale of 1 to 5, how closely is MCA linked to the lead wing concept? (1 = minor linkage, 5 = highly significant linkage)
12. The Air Force has designated different tiers of training associated with MCA—Tier 1 being expeditionary skills and Tier 2 being occupational cross-utilization. What do you see as the roles of each within the MCA initiative? If we had to choose how to focus MCA training efforts, should they be weighted more toward expeditionary skills or cross utilization?
13. The Air Force has designated three different clusters of capabilities associated with MCA: mission generation, base support, and C2. What do you see as the roles of the three clusters within the MCA initiative? Which of these clusters is most important or relevant to MCA?
14. For MCA, the Air Force has established the guidance to train down but not up. How does the Air Force define or measure what is up and what is down?

MCA Training

1. How does the Air Force train MCA and who does this training?
    a. How does this vary for expeditionary skills vs. cross utilization training?
2. What do you see as the primary training challenges associated with MCA?
3. On a scale of 1 to 5, how significant will additional training requirements and costs associated with MCA be compared to the status quo? (1 = little additional cost, 5 = very high additional cost)
4. Are the costs and challenges of MCA training different with expeditionary skills and cross-utilization? Where are the costs and challenges greatest?
5. We previously discussed mission generation, base support, and C2 as three distinct capability clusters. Should MCA cross-utilization training remain within these clusters or migrate across clusters?
    a. Are there differences in the extent and type of MCA training needed within the three MCA clusters?
6. Should mission generation MCA be trained on a single aircraft or multiple aircraft?
7. From what we heard, there seems to be a lot of work being done on MCA at the wing level. On a scale of 1 to 5, how much autonomy do wings currently have in their MCA training programs? (1 = low autonomy, 5 = high autonomy)
8. On a scale of 1 to 5, how much autonomy should wings have in their MCA training programs? (1 = low autonomy, 5 = high autonomy) Why?
9. On a scale of 1 to 5, to what extent would MCA benefit from new training approaches and methods? (1 = low benefit, 5 = high benefit)
    a. What new training approaches or methods do you think are needed for MCA?

MCA Institutionalization

1. What office or organization in the Air Force should be responsible for the long-term development and oversight of MCA?
2. On a scale of 1 to 5, how much regulatory change is needed to implement MCA? (1 = no change, 5 = major change)
    a. What regulatory change is most important?
3. On a scale of 1 to 5, how much change to Air Force personnel processes (e.g., promotions, evaluations, assignments, recruiting, AFSCs) is needed to implement MCA? (1 = no change, 5 = major change)
    a. What personnel process change is most important?
4. What are the most significant hurdles or challenges to implementing MCA long term?
    a. How would you rate the following as potential hurdles to long-term MCA implementation? (1 = no hurdle, 5 = major hurdle)
        i. Resources (1 to 5)
        ii. Air Force culture (1 to 5)
        iii. Organizational structure of Air Force (1 to 5)
        iv. Perceived lack of operational demand (1 to 5)
5. How are airmen be selected to be MCA? How should they be selected?
    a. What is the most important attribute?
6. How do you think MCA will or should be identified and tracked in the Air Force?
7. Within relevant career fields, what percentage of airmen should be designated as MCA?
8. On a scale of 1 to 5, to what extent does the Air Force need to incentivize airmen to be MCA? How should the Air Force incentivize? (1 = no need for incentives, 5 = high need for incentives)
9. The Air Force's current approach to MCA seems to be scaled back from the initial vision. What do you see as the cause? Is the current, limited approach an end state or an incremental step to more-ambitious plans?

MCA Deployment/Employment

1. What is the pacing theater for MCA—CENTCOM, INDOPACOM, or EUCOM (i.e., where is most of the demand coming from)?
2. On a scale of 1 to 5, how *much* do MCA requirements vary across theaters of operations? (1 = low variation, 5 = high variation)
    a. How do MCA requirements vary across theaters of operation?
3. On a scale of 1 to 5, to what extent should a force provider (e.g., ACC) tailor MCA to unique theater requirements? (1 = no tailoring, 5 = significant tailoring)
4. On a scale of 1 to 5, to what extent should MCA management align with the four-phase AFFORGEN deployment model? (1 = low alignment, 5 = high alignment)
5. On a scale of 1 to 5, how important is it for a deployed MCA team to come from the same base or unit? (1 = low importance, 5 = high importance)

6. On a scale of 1 to 5, to what extent does MCA require "just-in-time" training prior to deployment? (1 = no requirement, 5 = high requirement)
7. We've heard that a primary aim of MCA is to reduce the size of deployed teams. As an estimated percentage, how much of a reduction in team size can the Air Force achieve with MCA?
8. Given a smaller deployed team, how does MCA most enhance agile combat employment? (Select out of three potential options):
    a. Efficiency = minimal footprint to reduce logistical demand and increase agility
    b. Flexibility = respond to diverse and rapidly changing requirements without increasing size of footprint
    c. Resiliency = continue operations despite the loss of individual team members

Closing Questions

1. What haven't we asked about that would be helpful for us to know regarding current Air Force efforts around MCA?
2. Are there MCA-related briefings or reports you can share with us?
3. Are there other stakeholders you suggest we speak with for our study?
4. Would you be open to follow-up discussion at a later date?

Appendix B. Case Study Methodology and Protocol

In Chapter 4, we described findings from five case studies of MCA training programs across the DAF. This appendix provides additional detail on our methodology and the interview protocol we used to collect information on the MCA training programs.

Methodology

For our case studies, we used qualitative data collection methods (interviews and documentation review). Between May and June 2022, we conducted site visits or held virtual discussions (via Microsoft Teams) with MCA program representatives from the five case study locations: 23rd Wing (Moody SFB), 18th Wing (Kadena AB), 52nd Wing (Spangdahlem AB), 140th Wing (Buckley AFB), and 27th Special Operations Wing (Cannon AFB). Site visits were conducted in May 2022 at Cannon AFB and Buckley SFB and virtual discussions with the other three sites were conducted in May or June 2022.[133]

For each discussion, at least one team member facilitated the discussion while another team member took notes. The Cannon site visit also afforded the opportunity to visit training facilities (e.g., training exercise at a nearby range). Some programs also provided additional documentation (e.g., training plans and schedules), which were used to supplement the notes.

Following each discussion, a team member (usually the facilitator or the notetaker) summarized key descriptive information and themes from the case. This information was put into a table in a document that was then shared over email with the primary contact at the site. The contact was asked to review the summarized information to ensure it accurately reflected their program. Specifically, we provided summarized information on the following: program objective and structure, training length, target audience (type and number of airmen), key skill areas targeted for training, MCA tiers focused on in-training program, feedback and evaluation of airmen in the program, key gaps and risks for the program and/or wing operations, and key lessons learned associated with MCA training and ACE exercises.

In addition to the summarized information provided to program representatives for review, we categorized information for each site in an Excel file to ensure we captured the relevant descriptive elements of each case (e.g., types of instructors), as well as what the MCA program representatives identified as key gaps and risks and lessons learned. One team member, who was part of the data collection effort for the site, entered the site's information into the spreadsheet while another team member, who was also part of the data collection effort, independently

[133] We originally sought to conduct site visits with all three continental U.S. locations—Buckley, Cannon, and Moody—but Moody representatives were not available for site visits during the data collection period.

reviewed what was entered to correct any inaccuracies or fill in any gaps. After this review was complete, the four team members met to discuss key themes across locations to identify crosscutting issues and relevant differences that could influence how the DAF implements MCA across the force.

Discussion Protocol for Case Studies

We used a semistructured interview approach to collect information for the case studies. Note that the final set of questions on operational effectiveness were not fully captured for all sites; we determined as we began data collection that these questions were not fully relevant, as none of the programs indicated employing MCA to conduct ACE in an operational environment (yet).

Characteristics of Different Training Approaches for MCA Development and Employment

[*Note to facilitator(s): For each type of training identified, ask the following types of questions. If prompts are needed, types of training may include initial skills training, continuation training, and training exercises.*]

1. What kinds of training (both formal and informal) do you conduct in support of MCA and ACE?
2. What are the goals and objectives for this training?
    a. Probe: What training needs are you trying to address (i.e., how does the training help in terms of ACE and the goals of ACE)?
3. What skills and attributes does the training program target?
    a. Probe: What level(s) of skill proficiency are being targeted by the training? Does the targeted level of proficiency differ by skill set?
    b. Probe: How do you assess when someone has reached the desired level of proficiency? Are there plans to track this and what is needed to maintain that level of proficiency?
    c. Prompt if needed: Is training targeting Tier 1 (expeditionary skills), Tier 2 (cross-utilization skills), or a combination of the two tiers?
4. Are MCA expected to use new skills in garrison and if so, in what ways?
    a. Probe: How do you know whether those skills are being used?
5. What is the basis for the content of the training program?
    a. Who "owns" the content?
    b. How often is content updated?
    c. How do you determine when content should be updated?
    d. Probe: Does the program draw on the Expeditionary Center's syllabus (for tier 1 skills)?
6. Does the training adapt existing training content and methods or create new ones?
7. Can you briefly describe the training environment?

a. Prompt about setting: Is it classroom based? Online? Involve on-the-job training?
b. Who are the instructors?
c. Prompt about material needs: What kinds of material (equipment, comms) are needed for training?

8. Who is the training audience?
    a. Are MCA trained as units or as individuals?
        i. [If training as units or teams]: Is unit-based training by design (intentional) or based on other factors (availability)?
    b. How do you identify and select them?
    c. What numbers?
9. How is student performance evaluated during and immediately following training?
    a. What methods are used (e.g., exams)?
    b. How often are they [students] evaluated?
    c. How is feedback delivered to students about their performance?
10. Who manages the training program?
    a. How do you manage (e.g., track) those who receive MCA training?
    b. How do you manage inbound personnel who have already received MCA training?
11. How often is training done and how long does it last? *[Note: Ensure to prompt if training is initial vs. continuation training.]*
    a. How do you determine how often training is needed?
    b. When is training done relative to the deployment cycle?
    c. Is additional training optional or mandatory?
12. Is your training tailored to an AOR [area of responsibility]?
13. Is the training tailored to a mission set (OCA/AI [offensive counterair/air interdiction], CAS [close air support], HADR [humanitarian and disaster relief], deep strike, etc.) and/or type of conflict (MCO [major combat operation])?
14. Are there plans to change the training? If so, can you describe the kinds of changes that are being planned?
    a. Probe: Why are these changes being made?
    b. Probe: What was the basis of making the changes? For example, were there observations or data collected from exercises?

Data Availability to Assess the Effectiveness of Different MCA Models and Training Approaches in Training Exercises and Programs

1. What data are available on personnel involved in training (i.e., inputs)?
    a. What data are available on performance in training? In exercises? How do you assess adequacy of training for ACE operations? Probe: Have you done any evaluations or have reports on the effectiveness of MCA training and employment from ACE exercises?
    b. Do you collect information on any of the following or have plans to do so? Training outputs:
        i. Number of safety incidents prior to and after training (or exercises)?
        ii. Time to complete a task that has been part of training?
        iii. Time to prep/launch jets during exercises/operations involving MCA?
        iv. Sortie rates?
        v. Aircraft MC [mission-capable] rates?
        vi. Number of MCA tactical-level mistakes?
    c. Other indicators:
        i. Number of MCA leaving the service compared to non-MCA?
        ii. Ability of units to meet deployment timelines?
        iii. Feedback from airmen who take MCA training or participate in ACE exercises?

Lessons Learned from ACE Exercises

1. What airmen skills were employed during ACE exercises?
    a. Were the skills needed for the exercise considered those associated with MCA? If so, did the skills vary by Tier 1 (expeditionary) and Tier 2 (cross-utilization) MCA categories?
2. Were certain skill sets or competencies missing that were needed for the exercise? If so, what skill sets?
    a. Were these MCA-related skills? If so, did the skills vary by Tier 1 (expeditionary) and Tier 2 (cross-utilization) MCA categories?
3. Did you assess whether MCA are effectively utilized during exercises? If so, what kind of data were collected?
4. Were you able to reduce the number of personnel needed to be effective in the ACE exercise?
5. Are there other lessons learned from ACE exercises as they relate to personnel-related issues?

Gaps and Risk Areas

1. What were key gaps and risk areas in the ability to employ MCA effectively in recent ACE exercises?
    a. Was training sufficient to develop proficiency in MCA skills? To maintain proficiency (e.g., via continuation training)?
    b. What are the primary operational risks that training assumes?
    c. What level of risk does the training entail to airmen's primary AFSC duties?
    d. Does the training approach create risk in overutilization?
    e. What trade-offs are made to focus on MCA training vice other command priorities?
    f. What are the greatest challenges/barriers you face toward delivering MCA training?
2. What steps would need to be taken to address any identified gaps and to institutionalize MCA?
    a. What resources are required to sustain and scale the training approach?
        i. What is needed to address gaps identified in the training? In terms of resources?
        ii. Policy and authorities?
        iii. Organization?
        iv. Technology?
    b. If you could be king/queen for a day, what would you change to address the gaps in MCA training?

Operational Effects of MCA Training and ACE Exercises

1. Does your training approach enhance operational efficiency; e.g., reduce personnel requirements for ACE operations? How, and how much?
    a. We are interested in attributes needed for ACE operational effectiveness. What attributes are needed for each of these ACE capabilities? Ability to operate in a contested environment?
    b. Rapid response?
    c. Agile operations?
    d. Execution across the full spectrum of operating locations?
    e. Joint and coalition integration?
    f. Transportation and movement?
    g. How does MCA training and development offer benefits to ACE operational effectiveness? Does it offer benefits in terms of any of the following?
    h. Flexibility?
    i. Resiliency?
    j. Speed?
    k. Agility?

Appendix C. Mission-Essential Task Analysis and Interview Protocol

MET Training Survey Results

Table C.1 contains SME ratings for the perceptual, motor, and cognitive demands for all METs listed in the TOA.

Table C.1. Subject-Matter Expert Ratings of Mission-Essential Task Demands

MET	Perceptual	Motor	Cognitive
AFE equipment maintenance	2	3	1
AFE preflight and postflight	2	2	1
AGE familiarization and pre-use inspections	2	2	1
Air traffic radio set up and use	2	3	1
Aircraft launch and recovery	2	1	2
Aircraft mission management	3	1	2
Aircraft pre- and postflight inspection	2	2	2
Aircraft servicing	2	2	3
Aircraft tow member duties	1	2	1
Aircraft weapon loading and unloading	3	3	1
Aircraft weapon safing and arming	3	3	1
Airfield kit setup	2	2	2
Airfield status reporting	2	1	2
Basic postflight inspection	2	2	2
Cargo tie down and loading (airlift)	1	2	1
Cargo tie down and loading (ground)	1	2	1
Certify HAZMAT for transport	2	1	2
Combat survivor evader locator radio program and GPS fixes	1	2	1
Comm flyaway kit SATCOM dish setup	3	3	3
Emergency action procedures	1	1	1
Create and/or distribute OPREPs and SITREPs	1	1	2
Personnel accountability	1	1	1

MET	Perceptual	Motor	Cognitive
Conduct LZC and LZSO duties	2	2	2
Develop aircraft plan and MOG management	2	1	2
Flying ops super duties	3	1	3
Install MAAS	2	2	2
Integrated combat turnaround	2	2	2
Limited local weather observer	3	1	2
Load aircraft using forklift	1	2	1
Man-portable TACAN setup and use	1	2	1
Minimum operating strip selection	2	1	2
Munitions assembly and transport	3	3	2
Operate Bobtail with load	1	2	1
Operate and set up hydrant system	1	2	2
Perform cargo joint inspection	2	1	2
Receive, store, transfer fuel	2	2	1
Refuel and defuel operations	2	2	1
Defuel aircraft	2	2	1
SFO aircraft refuel	2	2	1
Hot pit refuel	2	2	2
Schedule build and distribute	2	1	3
Set up and use comm flyaway kit	2	2	3
Spall repair	2	2	1
Vehicles and equipment refuel	1	2	1

NOTE: AFE = aircrew flight equipment; AGE = aerospace ground equipment; GPS = global positioning system; HAZMAT = hazardous materials; LZC = landing zone controller; LZSO = landing zone safety officer; MAAS = Mobile Aircraft Arresting System; MOG = maximum on the ground; OPREP = operations report; SFO = specialized fueling operations; SITREP = situation report; TACAN = tactical air navigation system.

Interview Protocol

Technology-focused discussions with SMEs were conducted as semistructured interviews using a main protocol and an optional case study protocol. Each topic in the main protocol was covered during the interviews, although the conversation content and flow did not necessarily follow the protocol verbatim. The case study protocol was used when there was sufficient time following the main protocol or when the study team felt an organization could lend particularly useful insights to the case studies on the basis of their expertise and experience. This protocol is presented without revision.

Main Interview Protocol

Participant Background

1. Could you start by giving us a brief description of your organization?
2. Could you give a brief description of your position and responsibilities?

Technology Overview

3. What are the key training technologies that your organization is developing?
    a. Does the technology have specific application domains, such as medical or pilot training, or classroom education?
4. What training challenges or objectives is the technology intended to address?
5. What is the technical readiness level (TRL)? For example:
    a. Have the principles of the technology been demonstrated in laboratory studies?
    b. Has a prototype system been demonstrated in an operationally relevant setting?
    c. Has the system been deployed?
6. How scalable and deployable is the technology? For example:
    a. Is it very costly?
    b. Does it require extensive infrastructure?
    c. Does it require a skilled instructor cadre?

Applications to MCA

7. Through our discussions with Air Force SMEs, we have learned about some of the key needs for training and sustaining skills in MCA. To what extent is the technology applicable to each of the following? And how so?
    a. Accelerate learning?
    b. Sustain skills or track proficiency during periods of disuse?
    c. Deliver just-in-time training?
    d. Objectively assess performance?
    e. Determine suitability of individual for position?
    f. Enhance skill transfer?
8. The METs that MCA are cross-trained on draw on multiple cognitive abilities. Which of the following has the technology been used to train? And how so?
    a. Perceptual skills?
    b. Motor skills?
    c. Cognitive skills (memory, judgement and decision making, attention, etc.)?

Case Study Protocol

Case Study

9. During the remaining time, we would like to think about potential applications of your technology to one of three mission-essential tasks (METs) that MCA are trained on. As we describe the METs, please think about which is most applicable given your technology.
    a. Hot pit refueling—This task involves a team of airmen refueling an aircraft. An airman who is cross-trained in this task is responsible for removing the fuel panel from the aircraft, attaching the receptacle to the fuel port, and reversing the steps when fueling is complete. The airmen must also maintain situational awareness and communicate with other members of the refueling team. The task demands are primarily perceptual (identifying fuel port) and motor (attaching receptacle to fuel port).
    b. Schedule build and distro—This task involves scheduling shifts for maintenance or logistic personnel. An airman who is cross-trained in this task must understand the different certifications that maintainers and logistics personnel may hold. The airman must use software programs like Excel to create shift schedules that take personnel certifications, operations, and other constraints like crew rest into account. The task demands are primar[ily] cognitive.
    c. Setup and use communications flyaway kit—This task involves setting up a modular system to establish internet and communications at a location. An airman who is cross-trained in this task must be knowledge[able] about the steps involved in setting up a power source, positioning a satellite dish to establish a reliable connection, and troubleshooting computer and communication software. The task demands are perceptual (inspecting system components), motor (assembling components), and cognitive (applying configuration instructions and troubleshooting).

Organizations Included in Interviews

Table C.2 lists the organizations and the number of participants who were included in the technology-focused interviews.

Table C.2. Organizations Included in Interviews

Category	Subcategory	Interviewees
Government	AETC Detachment 23	1
	AETC Linguist Training Next	1
	AETC Pilot Training Next	1
	AETC Studies, Analysis, and Assessments (AETC/A9)	2
	AETC Undergraduate Pilot Training 2.5	1
	Air Force Agency for Modeling and Simulation (AFAMS)	1
	The Air Force Research Laboratory, 711th Human Performance Wing (AFRL/711th)	1
	The Army Research Laboratory, Human and Complex Systems Division (ARL/RSG)	1
	F-35 Academic Training Center	1
	59th Medical Wing	6
	Naval Postgraduate School (NPS)	5
	USAFE-AFAFRICA Staff	1
Industry and academia	Aptima, Inc.	2
	Cognitive Performance Group	2
	Design Interactive	3
	George Washington University	1
	Lockheed Martin	1
	Next Gen	1
	SAIC	2
	Tier1 Performance Solutions	2

Abbreviations

AB	Air Base
ACC	Air Combat Command
ACE	Agile Combat Employment
AETC	Air Education and Training Command
AFB	Air Force Base
AFFORGEN	Air Force Force Generation
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
AI	artificial intelligence
AMC	Air Mobility Command
ANG	Air National Guard
AR	augmented reality
ASVAB	Armed Services Vocational Aptitude Battery
BOLT	Blended Operational Lightning Technician
BOS	base operating support
C2	command and control
CBT	computer-based training
CFETP	Career Field Education and Training Plan
CFM	career field manager
Comm	communications
COTS	commercial off-the-shelf
CRG	Contingency Response Group
CTA	cognitive task analysis
CUT	cross-utilization training
DAF	Department of the Air Force
Det-1	Detachment 1
DoD	Department of Defense
EST	expeditionary skills training
EUCOM	European Command
GOSG	General Officer Steering Group
INDOPACOM	Indo-Pacific Command
LIT	Lightning Integrated Technician
MAJCOM	major command
MCA	Multi-Capable Airmen
MDS	mission design series

MET	mission-essential task
MFA	Multi-Functional Airmen
MG	mission generation
MOS	Military Occupational Specialty
MSS	Multi-Skilled Soldier
MST	Mission Sustainment Team
Ops	operations
PACAF	Pacific Air Forces
SATCOM	satellite communications
SEI	Special Experience Identifier
SME	subject-matter expert
SOFORGEN	Special Operations Force Generation
SOMSG	Special Operations Mission Support Group
SFB	Space Force Base
TOA	Table of Authorizations
USAFE-AFAFRICA	U.S. Air Forces in Europe–Air Forces Africa
USAFEC	U.S. Air Force Expeditionary Center
UTC	unit type code
VR	virtual reality
XR	extended reality

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