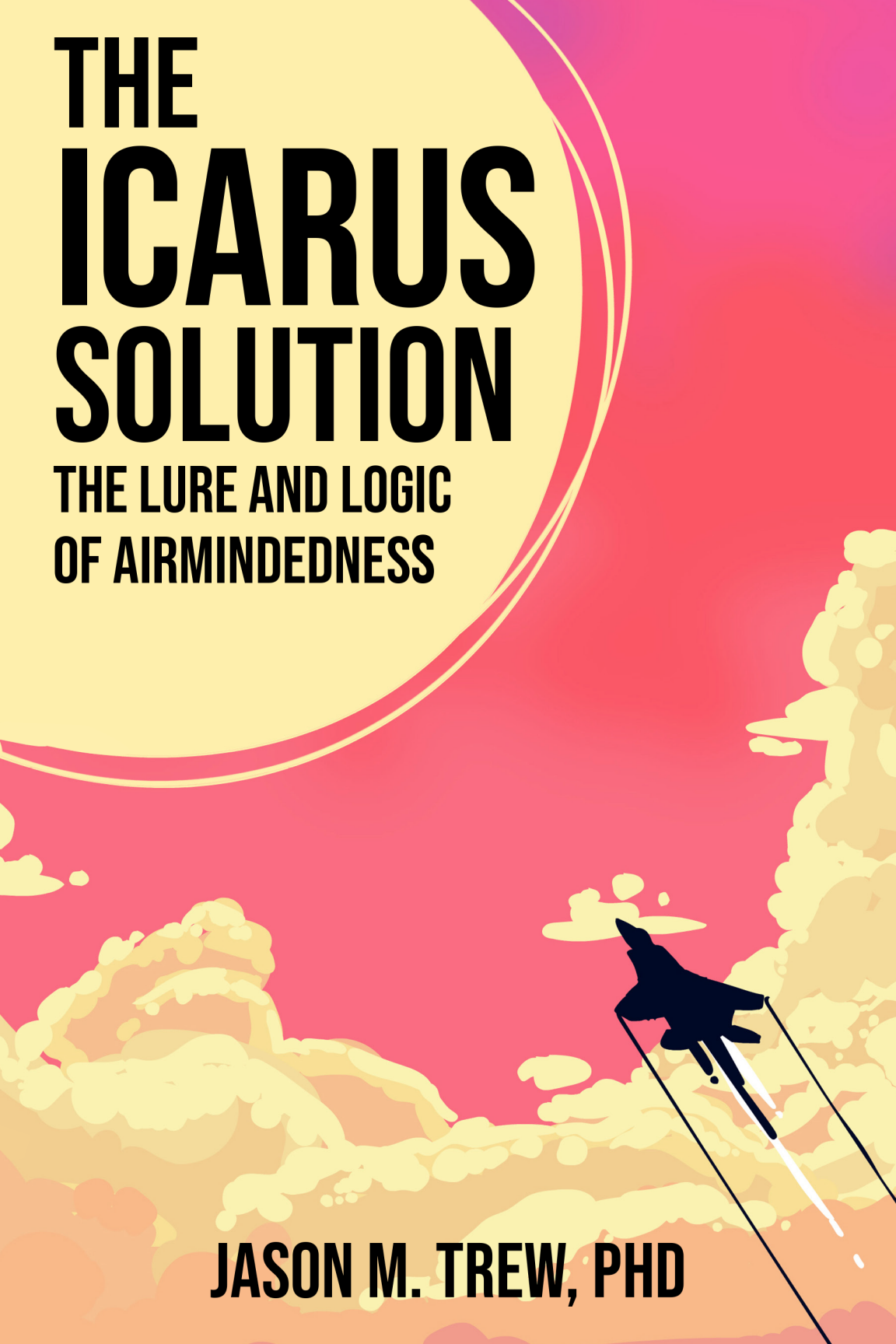
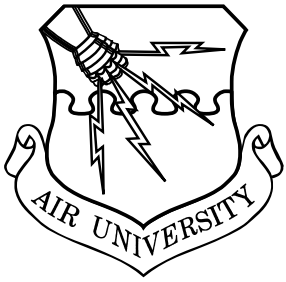
THE ICARUS SOLUTION

THE LURE AND LOGIC OF AIRMINDEDNESS



JASON M. TREW, PHD



The Icarus Solution

The Lure and Logic of Airmindedness

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Foreword

Aeschylus was the first and greatest writer of tragedy in ancient Greece and elevated drama to a high art form, building on the first literary master, the great poet Homer. Half of the plays Aeschylus submitted at the Great Dionysia theater competition, the ancient equivalent of the modern Academy Awards, won first prize there, an unparalleled record. And yet, the great playwright's tomb epitaph only mentioned the fact that he fought with valor at the Battle of Marathon. He was a warrior and an artist who knew both the strength, *bia*, required to fight in battle, and the *metis*, the imagination, to craft literature.

Like Aeschylus, Jason Trew is a warrior and an artist, who was inspired by Homer and his military experience to tell a story. Picking up from Carl Builder's 1994 *The Icarus Syndrome*, a call to return to the guiding light of air power theory as the Air Force's foundation, Trew re-examines the author's question through a carefully crafted narrative balancing the creative playful side of the warrior with the rational side of the technician. He deftly uses multiple metaphors to tell a story weaving myth and military history, narrative and nuance, theory and Theogony. This story is important; Trew's tale is about the course of discourse on air power and what it means for students and practitioners of strategy today.

Fittingly, Homeric Greek language has three numbers: a singular, a plural, and a dual. Trew uses duality to great effect thematically, drawing on two concepts, reflective of the dual-nature of air power, two themes of *metis* and *bia*, intelligence and strength, mind and matter, and sees their impact on the human ethos of flight. What makes this approach so unique is an understanding of a cultural, artistic stream within man's pursuit of flight and our nation's balance of force/*bia* and strategem/*metis* in how we envisioned and pursued force projection through the *techne* of air power as we emerged as a world power in the twentieth-century.

Readers will delight in Trew's account of the experience of World War I pilots, the first airmen to project American air power abroad. These warriors lived in two worlds, one of Dionysia, a slow time of idleness, recovery, and quite a bit of play, and another of Apollo, a fast time of violence, power, and a different form of play. Their delight in life among a time of death was and has been one of the themes of the air power story. From World War I, we travel with the author through the interwar period, an era in which the great ideas of future warfare

transformed military thinking and military planning. This advent of air power also transformed the nation, as airmindedness, both a call to arms and a call to adventure, swept America. Thinking creatively about air power required imagination, envisioned technology, and unfettered contemplation of myriad possibilities.

The central answer Trew offers to Builder and students of air power emerges from this early twentieth-century context. Air power theory arises from an era of duality, of creative play and of rational practicality, of art and technology. A path past policy-driven pedantry reveals the course of this double theme through the cauldron of the Second World War and the Cold War to the contemporary world. Trew perceives a gap in the way airmen have thought and theorized about air power in this modern era and seeks to fill it. He does this by drawing out the dichotomy of technology and imagination, of the machines and ideas, of how air power should be alongside how it could be.

I applaud Air University Press for publishing this original, creative work. It is worthy to stand with their other volumes on air power in the tradition of Frank Futrell. When Alexander the Great went off to invade Asia, he carried with him everywhere a copy of Homer's *Iliad*, annotated for him by his tutor, Aristotle. It inspired him to seek *metis* and *bia*, Odysseus and Achilles, the two muses essential for the song of strategy. Homer has also inspired Jason Trew. I urge you to read this book and be inspired in turn.

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Dedication

To Jennifer—helping me escape mazes since the 1900s

Acknowledgments

Ancient heroes play a role throughout this book. Likewise, it would be a Herculean task to acknowledge every character who was a part of the story of how this came into being. How could it be otherwise, when the narrative starts with some of the earliest memories of my life, moments such as sitting on the roof watching the airliners flying in and out of the nearby airport or weekly visits to Civil Air Patrol meetings in that airport? I thank my parents for both, as well as their love and support in the decades since. Also, critical—and too many to name—were the teachers, mentors, and leaders that encouraged me and my innumerable "flights of fantasy."

As the timeline nears the present, it is easier to recognize specific individuals for their support. Somewhere near the top of that list would be my advisor at Auburn University, and fellow pilot, Alan Meyer. Faculty and staff at Air University (AU) were also instrumental in facilitating the transition from the cockpit to the classroom, including John T. LaSaine, Robert Lass, Bridget McNamara, and Bill DeMarco. In particular, the year I spent at AU's School of Advanced Air and Space Studies (SAASS) was the most challenging and also the most rewarding year of my professional life; the world-class faculty and staff prepared me well for the academic and leadership challenges that followed. Even while facing those trials, I was afforded some time to research and write. That was only possible, however, because I had the support of successive Squadron Officer School Commandants Wayne Straw, Ricky Mills, and Lance Rosa-Miranda; fellow commanders, especially Jon Patrick Slaughter; and other members of the "Red Pants" family. Most obviously, I appreciate the team at AU Press for making this a reality. They were very patient with my countless questions and with all the peculiarities of coordinating a publication with an author who was deployed in support of combat operations.

Finally, I want to acknowledge the support of my wife and best friend, Jennifer, and our children, who have learned that the easiest way to delay bedtime is to ask me about Icarus. Well played, boys.

Author's Notes

A few notes on spelling and formatting are in order. First, a keen reader will notice the decision to use "airmindedness" without the hypen (which the author himself has used previously in writings on the subject). After an exhaustive search, the author found no discernable difference between their meanings and no obvious correct answer. This book uses the nonhypenated version throughout except for direct quotes. Second, following normal convention, non-English words used in this book are printed in italics. *Logos*, a concept fundamental to this work, is one example (though the entire phrase *technological logos* is in italics to highlight the central conceptual innovation of this research). Other examples include the Greek words *metis* and *bia*. This rule does not apply to formal names, however, so the goddesses Metis and Bia are capitalized but not italicized. Third, readers will also note capitalization differences between Airman/airman (or the plural versions, Airmen/airmen) and Air Force/air force. In the first case, airman is a generic term for an aircrew member of any nation and any service (that is, any "air force"—written without capitalization). Capitalized, Airman is slightly more problematic because it can be a specific rank but can also denote any uniformed member of the service as well as its civilians. This book exclusively uses the second, broader sense, which follows the current practice in the United States "Air Force" (capitalized). In all versions, it is gender neutral. Also, for ease of reading, unless stated otherwise, references to Airmen denote members of the United States Air Force or any of the organizations that it originated from, which include the United States Army Air Corps and the United States Army Air Force. Fourth, the difference between air power and airpower is noteworthy as well. As the United States Air Force adopted capabilities for space and cyberspace domains, it defined airpower (one word) as a singular contruct to represent all three domains. Air power (two words) refers to war-fighting activities in the air domain only. Finally, due to the times and conventions in which many of the references were written, masculine pronouns are frequently used by those quotes. Retaining their direct words accurately reflects the historical record and should not be miscontrused as an endorsement of exclusive language.

Preface

Air University (AU), Maxwell Air Force Base, Montgomery, Alabama, is the intellectual home of the US Air Force. In 1990, AU asked Carl Builder, an analyst from the think tank RAND, to write a piece to "remind incoming students of the obligations of the profession of arms, their heritage in history, and where those obligations might carry them with the future of the Air Force."[1] In his final analysis, Builder concluded that the US Air Force lacked a shared sense of identity. According to Builder, the abandonment of air power theory was the crux of the organization's problem. He labeled this institutional crisis, and titled his book, *The Icarus Syndrome.* The boy who flew too close to the sun was fitting for the context: the myth is commonly mentioned in aviation histories, references to the story can be found throughout the service, and a national organization named after his father originated at Maxwell AFB in 1934.

Builder's choice of metaphor was more appropriate, however, than the findings he conveyed through the myth. The relationship between the organization's culture and technology is not as simple as he portrayed. Airmen may, for example, "worship at the altar of technology," but that does not necessarily mean they pathologically "substitute technology for strategy." To understand why and return to the original question AU posed to Builder, it is useful to apply insights from the history of technology. Scholars in this field demonstrate the need to understand technology from the perspective of users, the stories they tell about their technical artifacts, and the rational and nonrational elements of those experiences. Even the word's origins reveal that, since the time of the ancient poet Homer, technology is not just material, mechanical, or measurable. Indeed, the Promethean myth Homer and others crafted to explain how humans first became "technological" reveals its subjective, social, strategic, and even spiritual connotations. This dual nature is reflected in Airmen, despite the obvious fact their profession is based on advanced weapons systems. To represent the dynamism of this balance, it is helpful to enlist contrasting pairs of mythological characters familiar to Homer's contemporaries: Bia and Metis, Apollo and Dionysius, and—like Builder—Daedalus and Icarus.

The tension within each metaphorical pair is evident in a particular period of USAF history, specifically the social life of early aviators, the cultural response to aviation between the world wars, and the

theories of air power developed by Airmen. This analysis challenges the orthodox, one-dimensional assessments of USAF culture, revealing a cyclical vacillation between political, pragmatic forces and its more inspirational—even playful—tendencies.

Reframing the organization's history, however, is not just an academic exercise. Embracing the duality in these mythological pairs—which represent the full spectrum of Airmen's technological paradigm—is a powerful, creative force for prevailing in a dangerous and disorderly world. A broader perspective that honors what Icarus and other unsung metaphorical heroes symbolize, therefore, is far from being a syndrome. On the contrary, this is how Airmen craft solutions.

Notes

1. Builder, *The Icarus Syndrome* (London: Transaction Publishers, 2002), xix. Builder's metaphorical logic is very similar to yet another author's allusion to the myth, Danny Miller's *The Icarus Paradox* (1992).

Prologue

Prologue \ˈproh-log\ *n.* - 1. an introduction [ancient Greek: *pro-* (before) + *logos* (story)]

Wilbur and Orville Wright, creators of the first heavier-than-air vehicle capable of sustained, controlled flight, were gifted technologists. Though lacking in any formal engineering education, the brothers readily replaced orthodox aeronautical theories with their own. Their insights came from their sophisticated appreciation of the aircraft as a technological system and methodical experimenting with its various parts. Biographers emphasize their genius for turning abstract ideas into mechanical realties and self-confidence in their ability to master natural forces. Contemporaries described the two as prudent and impassive. In both the creative process and the political value of their creation, the Wrights were disciplined and eminently practical. Wilbur was described as emotionless, even in the face of danger. When he demonstrated the aircraft in France, a fellow aviation pioneer wondered "Has he a heart? Has he loved? Has he suffered?"[1]

Other observers, however, eagerly converted Wilbur into a poet, ascribing mystical qualities to the reserved brother. Journalists and illustrators took creative license to depict him as a heroic artist; jovial, yet also brooding; attuned to aesthetics and spiritually gifted. This image was borne by the vision of those for whom flight was more than a matter of technical brilliance, but a majestic experience—a realization of humanity's long-standing and deep emotional connection to flight.[2]

Users of aviation technology sat at the intersection of these two opposing attitudes. The distinction made by one early pilot was *flying* could be factual and technical. At the same time, however, *flight* was "the essence of the spirit. It nurtures the soul. It is awesome, often ethereal, glorious, emotionally wondrous and all-pervading and intangible." The aviatrix goes on to state, "We knew the ecstasy of discovery. Adventure—a part of every flight—was spine-tingling, inspiring."[3]

The tension between the technical and the artistic, however, is not the only polarity in the story of human flight. Aviation history employs two opposing approaches borrowed from the history of technology. One presumes a technological imperative in which artifacts are inevitable and, once manifested, drive social changes. This deterministic view is countered by the perspective that the creation, use,

and record of all technological products, whether ideas or objects, are altogether socially constructed.

The reality is that aviation operates between both sets of opposing forces. Regarding the first pair, the intellectual history of military airmen is a story about technological users embodying both technical rationality and strategic playfulness. This "airminded" perspective is profound in the modern US Air Force as well as in its predecessor air service organizations. Specifically, it is evident in social practices of aviators, the writings of early military aviators who described the airplane's military potential as well as its psychological impact, and an institutional willingness to experiment with a variety of air power theories.[4] Secondly, this culture is neither technologically determined nor a pure social construction.

Certainly, the technological paradigm airmen operate under is shaped by the airplane's inherent advantages of range, speed, flexibility, and altitude—the *subjective* framework that guides how they think, feel, and act regarding their highly technical arsenal is imbued with the *objective* characteristics of the artifacts. Yet, at the same time, the story of how sustained, controlled, heavier-than-air flight was invented, developed, and put to human ends is inseparable from aspirations and fears as old as humanity itself. Viewed holistically as one vast technological system, flight is always subject to material realities as well as to the human psyche.

A wide body of literature describes the airplane or its users in a single dimension: the internal operations of aircraft, or its cultural impact; the heroism of its innovators and operators, or the economic and political impact of the aviation industry; Airmen as technophiles suffering from the "Icarus Syndrome," or prophets for a reformed way of war. What is missing is the multifaceted story of how military Airmen interact with their technology intellectually: not the weapon's creation or its political and economic import, but beliefs about its operational and strategic value; not the tactics of aerial warfare, but how flight continues to shape social practices outside the cockpit; not a simple narrative of technical obsession or strategic wisdom, but a technological paradigm that embraces both. This is a narrative of how Airmen occupy a space defined by the creative tension between dispassionate reason and playfulness, a space defined by *technological logos*. Embedded in the origins of these two words are the contrasting forces that define US Air Force culture.

Technology is as much about mentality as it is about materiality. Likewise, *logos* is not just logic, but stories of the subjective, sensuous, and often spiritual relationship between Airmen and their craft. Indeed, this is just one example of how all technology, to some degree, lies in the balance between the scientific and poetic, materialistic and mystical.

Notes

1. Robert Wohl, *A Passion for Wings: Aviation and the Western Imagination, 1908–1918* (New Haven, CT: Yale University Press, 1994), 11, 13, 23–27; and Leon Delagrange, "Impressions Sur L'aeroplane Wright," *L'Illustration* 132 (15 August 1908), 105. For general biographical information and records of the Wright's personal correspondence, see Marvin W. McFarland, ed., *The Papers of Wilbur and Orville Wright* (1953), Tom D. Crouch's *The Bishop's Boys* (1989), or Howard S. Wolko's *The Wright Flyer: An Engineering Perspective* (1987).

2. Wohl, *A Passion for Wings*, 25, 27, 35.

3. Louise M. Thaden and Peggy Wagstaff, *High, Wide, and Frightened*, Reprint edition (Fayetteville: University of Arkansas Press, 2004), xi–xii. Published 1938.

4. Frank P. Lahm, "Ballooning," *Journal of the Military Service Institution of the United States* 38 (May-June 1906), 510–513). Two specific examples include Frank Lahm and Benjamin D. Foulois, who both become US Army Air Corps generals (Foulois becoming the future chief). Each man helped create the earliest framework of an airminded culture within the US military (chap 1). Foulois, who flew balloons and then airplanes, made public appearances to promote aviation, encouraged the US government to increase funding for the technology, and chided the Army officer corps for its reluctance to accept the airplane. Lahm not only noted the military potential of aviation, but also remarked on the psychological thrills of flight and the national benefits aviation promised for the nation (Ronald G. Machoian, "Looking Skyward: The Emergence Of An Airminded Culture In The U.S. Army," Air Command and Staff College, Research Report, 2002), 9, 28.

Introduction

"No one comes close" was a recent United States Air Force mantra, developed as both a recruiting slogan and service motto.[1] It reflects the physical altitude of the Air Force domain and conveys a sense of operational dominance. The saying is applicable because of the distinctive way the institution is shaped by technology. When it comes to a description of this culture, the same line is still appropriate; no one has come close to fully appreciating what it means for Airmen to have a technological paradigm.

The single question guiding this project is the relationship between the organizational culture of the United States Air Force (USAF) and technology. Is it as simple as is commonly asserted, that Airmen "worship at the altar of technology" and pathologically "substitute technology for strategy"?[2] The answer, which is negative, comes by applying insights from the history of technology. While this sub-field of history may appear to be a natural resource to better understand USAF culture, the institution is rarely examined from this perspective.

The history of technology is defined by subject matter and approach. It is not just a study of tools and machinery from the past, but also about the interaction between humanity and its artifacts, the nature of technological knowledge, and the very meaning of the word technology. A history of technology approach shows that the answer to the opening question is not as simple as some claim. Yes, technology is part of what could be labeled the theology—and sometimes the dogma—of Airmen. Inherent in their culture, even if rarely explicit, is a sense of playfulness, craftiness, and wisdom. Airmen, consequently, inhabit a world at the intersection of technological artifacts and strategic art; a technologically constructed paradigm that can be described as a *technological logos*. Embedded within each of these words are a variety of connotations, which is what allows a single phrase to capture a phenomenon as complex as an organization's culture.

To understand the Greek term *logos*, and the multiple meanings implied by technological, it is first necessary to briefly describe how technology evolved from a depreciated issue to a topic worthy of serious scholarship. The following sections will also set the stage for the substance and style of the book and a full working definition of *technological logos*.

History of Technology

In the words of historian David Edgerton, "The very lowness and ubiquity of technology make it significant in history but suspect in the academy."[3] Prejudice against the scholarly treatment of technology can be traced back to the term's etymological origins.[4] The word was seldom employed in Western societies until the first half of the twentieth century. Instead, the same notion was typically referred to as the "useful," "industrial," or "mechanical" arts. This sense of technology as a field of practical knowledge had displaced earlier connotations contained in the Latin *technologia*. This seventeenth-century term included the useful arts as a field of study, the technical language of a particular art, and the language arts.[5] All of these meanings were implicit in the ancient Greek word *tekhnologia*. This ancestral version of "technology" was based on the Indo-European word *teks*, for weaving or fabricating. *Teks* became *tekne* in Greek as its meaning expanded beyond the specific task of interlacing branches to include the knowledge of carpenters, builders, and weavers.[6] The evolution of *tekne,* often transliterated as *techne,* did not stop there. The broadening of *techne* is marked by a story often referenced by historians of technology, the myth of Prometheus.[7]

The story of Prometheus starts with a war. In ancient Greek mythology there was an epic clash. On one side were the Olympian gods, led by Zeus. Opposing them were the Titans, the immortal race that preceded the Olympians. Prometheus was one of the few Titans who allied with Zeus, although he did so only after his own side refused to take advantage of his idea to win by deception. Living among the victors, he was granted the responsibility, along with his brother Epimetheus, of providing gifts to the living creatures of Earth. In one version of the story, the less intelligent sibling hastily spread all the skills among the other animals before realizing that humans were left with nothing to survive. Sympathetic to their situation, Prometheus secured fire from the gods. In another version, his sympathy for humanity manifested itself in a ruse. The ancient poet Hesiod wrote about a settlement between gods and mortal men in which Prometheus tricks Zeus into accepting the bones of sacrificial animals instead of the more valuable meat, which from then on would be available for human sustenance. As retribution, Zeus takes away their ability to cook the meat by denying them fire. Prometheus then steals fire and restores the gift, which becomes the means by which humans develop

their ability to manipulate the physical world. Furious, Zeus ordered the creation of the first human woman, Pandora, who brought with her misery, illness, and war. For Prometheus, who has forever altered the balance between mortal and god by providing humanity with immortal fire and the ability to fashion nearly immortal artifacts, the punishment is symbolically fitting: he is chained to a pillar where a bird of prey eats at his body, which grows back each night in time for another day of torture.[8]

Historians of technology use this myth for a variety of reasons and in a variety of ways. Some use it to highlight the connection between the technical and the subjective.[9] Others employ the Titan's name in their title with little to no explanation of the myth or its relevance to their work, suggesting such a familiar reference requires no further explication.[10] It is a way to ground the narrative in an ancient, but common, reference. It could also be—though rarely is—a useful way to introduce the latent dynamism inherent in the word technology.

By the fifth century BCE, around the same time writers recorded the story of Prometheus, *techne* encompassed a wide range of skills. At one end of the spectrum lay domains we rarely associate with modern technology, including skills of piloting a ship, providing medical care, crafting persuasive arguments, writing poetry, and even performing magic.[11] Unlike our modern dichotomies, *techne* melded art and science into one endeavor that combined both the subjective and the objective, and it did not draw a strict distinction between the artist and the artifact.[12] This conception of *techne* treated technical knowledge as relatively stable, but always contextual. That is, it was static enough to be transferable while flexible enough to adapt to the circumstances. This was critical because this sense of *techne* always implied a productive knowledge, an intervention in the physical world "associated with the transgression of an existing boundary—a desire for 'more' that challenges or redefines relations of power." In the course of this technical performance the performer not only intervenes in the physical world, but—being part of that world—is also changed. In other words, the artist and the artifact co-construct human culture and, in doing so, coevolve.[13]

Many versions of the Promethean legend are clearly about this form of *techne*. First, fire is an example of knowledge that can be transmitted. In addition, fire's strategic value is its flexible nature. Fire is malleable enough to accommodate a variety of competitive or cooperative tasks with a power that is both constructive and destruc-

tive. Indeed, the ability to create fire—unimpeded by the dearth of any scientific knowledge about it—is credited as the basis of human culture. It symbolizes the inseparable nature of humanity and technological knowledge.[14] Beyond this, in his ability to persuade Zeus through speech, Prometheus demonstrates an estranged application of *techne*, the "technology" of rhetoric.[15] Last, when Prometheus crossed into the realm of the divine to steal fire, humans metaphorically earned the ability to transcend the boundaries of nature. Humans not only gained power unique among all the other living creatures of Earth—a power they would use to dominate those creatures and each other—but also gained a degree of independence from the gods. In part, this explains Zeus's rage.

This more dynamic version of *techne* is not the only insight missing from a deeper appreciation of the myth. The root of Prometheus's name is based on the noun *metis.* There is no equivalent in the English language, but it describes a strategic intelligence, making the name Prometheus literally mean "forethinker."[16] Hesiod refers to him as "Prometheus the crafty" and describes him as "changing," "nimble-minded," "of changing counsels," "crooked-minded," and "much knowing."[17] The Titan's keen and crafty intellect obviously allows him to subvert Zeus's will, but the very reason he is aligned with the god against the other Titans is that is own family had rejected his cunning stratagems.[18] Because those schemes inevitably involved technical skills, he is an image of a shrewd strategist and a skilled craftsman. This is why Prometheus becomes an even more insightful character in a history of technology. Indeed, the forgotten conceptualization of *techne* is inseparable from the equally unknown concept of *metis*.[19]

Metis, commonly translated as "cunning intelligence," spans a wide range of traits: from wisdom, expertise, and prescience to cleverness, deviousness, and craftiness. Whether employed as a reactive, adaptive strategy or as a proactive intervention, *metis* is at a premium in paradoxical or rapidly changing circumstances.[20] Given that *techne* could be the know-how to navigate and nudge the boundaries of an emergent, indeterminate system, the very conditions that called for *metis* were the same ambiguous conditions in which the transformative power of a craft could be leveraged. Recognizing when those situations arise and imagining a strategy likely to yield an advantage is a matter of *metis*. Yet, it is clear that cunning intelligence is equally reliant upon technical skills to realize a strategy in practice.[21]

Prometheus is not the only Greek character to demonstrate what classical historian Everett L. Wheeler describes as "intellectual capacity for practical knowledge, creativity, and the ability to grasp the possibilities of a given situation and to seize the right moment for action."[22] One of the central contributors to the Promethean myth is the legendary poet Homer, who offers other images that combine *techne* and *metis*.[23] The first is Hephaestus, the god of fire and metallurgy who is the Greek version of the Roman god Vulcan. A crippled blacksmith, Hephaestus was also known to ancient audiences for turning his bed into a trap for his adulterous wife, a tale that exemplifies craftiness in the sense of both *metis* and *techne*.[24] In the Promethean myth, it is his forge the fire is stolen from and he is also the one who administers Zeus's sentences: he uses his knowledge of metalworking to shackle Prometheus, and he also helps create Pandora. Hephaestus's partner in the creation of Pandora is the goddess Athena, another deity closely associated with both *techne* and *metis*, and—particularly relevant for this work—with the history of warfare.[25] Her role in the Trojan War and in the return of one of its famed warriors is described in Homer's instructive example of literary *techne*.

The most famous accounts of the Trojan War come from Homer's epics. *The Iliad* likely came first and centers around an episode in the decade-long battle between Greek city-states and Troy. *The Odyssey* begins with the end of that war and follows one of the heroes as he fights his way home through various trials. It is also one of the first known uses of the word *techne*. Indeed, Homer is an example of someone who kept the concepts of *techne* and *metis* tightly coupled. This is especially manifest in the characters of Odysseus and his wife, Penelope.[26] Furthermore, Homer's deep influence, in antiquity and today, comes from his own mastery of a skill that combines technical mastery and strategic intelligence: storytelling.

Not only does Homer meld technology and storytelling into a singular concept of *techne*—which itself melds into *metis* as both the author's explicit subject and his implicit method—but his epics also demonstrate the immense potential of stories. As possibly "one of the best tales ever told," *The Odyssey* influenced world leaders, modern strategists, and authors as famous as Shakespeare and Goethe.[27] His stories had particular resonance in the city that was famous as a center for Greek philosophy Athens.[28]

A central component of Athenian education was learning and reciting Homer's epics, and these works exemplified the "prerational

play" that pervaded Greek culture. Warfare, festivals, mythology, and cunning manipulation (*metis)* were all influenced by this style of passionate, competitive, and intuitive play.[29] *The Iliad* and *The Odyssey* also, according to historian Donald Kagan, taught aristocrats about the interplay between politics and persuasive storytelling.

Oratory prowess was a typical ambition for aristocrats in the democratic city. Since the decision-making authority had begun to shift towards the assembly of citizens, or *demos,* persuasion served as a powerful source of influence.[30] Aristocrats began employing sophists, or "wise men," to improve their rhetorical skills. The tutors never thought of themselves as a coherent group with such a narrow focus. Indeed, *sophos* initially referred to expertise in any skill or to wisdom in general, a notion that again points to the coupling of *techne* and *metis*.[31]

Modern researchers have accumulated empirical evidence for the centrality of play and storytelling in human affairs. Indeed, stories are a form of cognitive play. Whether written or spoken, stories are more motivational, more contextual, and more relevant than other forms of communication.[32] While historians of technology describe humanity as *homo faber*, "man the maker," scholars of story reference *homo narrans*, the storytelling person, and some cultural historians describe "man the player," *homo ludens*.[33] Indeed, the *techne* of early Promethean myths blurs the distinction between those labels. Furthermore, the ability to shrewdly craft, convey, and consume stories is indicative of *metis*, which itself can be described as an intellectual playfulness.[34] Despite the appreciation of these connections in ancient Greece and modern scholarship, there was a very specific point in the intellectual history of the West when stories were not valued, the ubiquity of "cunning intelligence" was dismissed, only "noble" play was acceptable, and the definition of *techne* became much less dynamic.

Plato's Prejudice

From approximately 431 to 404 BCE, the Hellenistic world was immersed in war. Eventually Sparta and its allies triumphed over the neighboring Athenian empire. After the decades-long Peloponnesian War with Sparta, the Athenian *polis* entered a period of decline while Plato was coming of age. His philosophy was a product of his time and his deep dissatisfaction with the politicians who wielded rhetorical skills to manipulate the people. In Plato's view, a democracy was

inherently unstable because the *demos* were simply too vulnerable to rhetorical influence. Emotional appeals convoluted their reason and led to unforgivable misjudgments, such as the death sentence for his mentor, Socrates.[35]

Out of this milieu, Plato constructed a philosophical system that became highly influential in Western traditions. Indeed, many claim he became the most influential philosopher in Western culture.[36] According to the classical historians Marcel Detienne and Jean-Pierre Vernant, "the concept of Platonic Truth . . . has never really ceased to haunt Western metaphysical thought."[37] Plato's themes included the promotion of abstract philosophy and political order over experience and democracy; the redefinition of *techne* and *metis;* and a scathing critique of sophists, rhetors, and poets.These elements are, in fact, all interrelated.

Consider Plato's political ideas, which had widespread impact on Western mentalities. For Plato, democratic equality did not release creative energies from the masses but only legitimized chaotic and selfish pursuits.[38] Democracy implied disorder and ineffective governance. Whereas democracy required pluralistic dialogue, only philosophers were qualified to have such discourse in Plato's image of an ideal polis.[39] Thus, states need a philosopher-king to achieve orderly rule, just as a ship needs a captain to stay on course. The proper exemplar for this ideal ruler was Plato's mentor, Socrates, and he communicated this through the allegory of the cave.

In the cave, people are restrained by chains and only able to look forward. Behind them is a fire. They can only see the shadows cast upon the wall in front of them as objects pass in front of the fire's light. The prisoner's sense of reality is limited to these representations. They assume that what they can see is all that really exists. Even if they were able to escape, the sun is another fire, behind which lie other objects that no mortal can perceive directly. These eternal, universal "forms" are the true essence of anything a human can perceive. The prisoners, however, are content with consuming the partial copies. In contrast, philosophers sense a bigger world. The best of them can even break through the bondage in order to escape the cave of illusions.[40] Outside the cave, they can begin to discern what those inside cannot fathom.

Implicit in Plato's metaphor was a critique of sophists, the purveyors of rhetoric. He mischaracterized them as a homogenous group of moral and intellectual relativists who were only interested in teaching

persuasive rhetoric for profit. Sophistry, he wrote, was "not an art, but the occupation of a shrewd and enterprising spirit."[41] To Plato, rhetoric was more like sorcery than reasonable discourse. In his words, storytelling "awakens and nourishes and strengthens the feelings and impairs the reason."[42] Reason is what future leaders need to uncover the true nature of reality and to escape the cave of illusions. Stories, on the other hand, are simply shadows of shadows that cripple the mind.[43] In Plato's assessment, this is exactly what led to the downfall of his home, Athens. This is why he famously bans the poets in the ideal *polis* he described in *The Republic*. It is, in fact, the component of the work Plato is most satisfied with.[44] This also explains why he altered the Greek sense of logic.[45]

Before Plato's attack on storytelling, *logos* meant "story, reason, rationale, conception, discourse, thought."[46] All forms of human expression and cognition were subsumed in this Greek word. Furthermore, for theologians and philosophers, it was the ultimate story: the divine and mystical force that gives meaning to all existence, the cosmos. After Plato, however, *logos* was no longer subjective, sensible, or soulful. Today the only dynamic connotation of *logos* in the West is the Christian idea of a sacred, ethereal system manifested in the physical world in the historical figure of Jesus Christ.[47]

Just as Plato divorced reason from the poetic and mystical in his redefinition of *logos,* he also stripped *techne* of its more dynamic qualities. For example, he required any specific *techne* to provide a rational account of itself (i.e., an explicable *logos)*. Technical know-how ceased to be a category of philosophical knowledge or the "means of challenging, mitigating, and even changing, one's fate." Instead, it became narrowly associated with the production of a material good: manipulative, quantitative, normative, and less sophisticated than contemplative philosophy.[48] In this new version, *techne* exists only when the entire situation can be grasped and somewhat controlled. This implies a comprehensive plan prepared in advance, ready to account for all possible contingencies and seeking objective efficiency. In *Protagoras,* for example, Plato has his title character explain the myth of Prometheus in terms that emphasize numbering and precise measurements. In addition to *techne* losing its role in constituting human culture, the story also lacks the *metis* implied in other descriptions of Promethean *techne*.[49]

If *techne* at least survives Plato's revisions—albeit in diminished form—*metis* suffers an even worse fate. According to the landmark

study by Marcel Detienne and Jean-Pierre Vernant, *Cunning Intelligence in Greek Culture and Society*, the concept is "at the heart of the Greek mental world . . .[and] its influence is sometimes all-pervasive." They offer examples ranging from technical crafts, medicine, military affairs, and politics. Indeed, Plato's denunciation of sophistry follows naturally, given that it is one of the prime examples of a *techne* showcasing *metis*.[50]

Despite the prevalence of *metis* in Greek culture, there are no tracts that directly address the idea. It has only recently been excavated by scholars of antiquity. The reason is clear. The very premise of an unstable world was anathema to Plato's ideals of clarity, reason, and universality. The philosopher could not ground his epistemology on a premise of transitory, ambiguous forces. Experiences that resist exact measurements or analytical reductions often demand intuition as well as indirect, playful strategies.[51] To the degree that this work ultimately aims to reinvigorate the USAF's organizational culture, it is vital that this concept is reintroduced to Airmen.

The Reconsideration of Platonic Objectivity

Plato offered a vision that privileged aristocracy over democracy, order over chaos, and clarity over contingency. For him, the function of play is to reduce chance and increase knowledge of the *forms*, not navigate the social messes of the lived experience. There is no Homeric *techne* that is contextual, subjective, or transformative for both material and mankind. There are no sophists and poets whose *techne* had previously offered images of metic intelligence. What philosopher John Dewey described as Western philosophy's "quest for certainty" has no room for *metis;* no account of a world that is not just a world of being, but simultaneously a world of becoming.[52] These ideas impacted the study of technology for centuries.

It was not until the sixteenth century that technology began to recover from Plato's condemnation of the useful arts. Acceptance of technology, however, truly gained momentum during the long eighteenth century, the historiographical period from approximately 1660 to 1830 that includes the later decades of the Scientific Revolution as well as the opening decades of the Industrial Revolution.[53] Still, the use of the word "technology" was rare until after World War I, a conflict defined by the industrialization of warfare.[54]

The increasingly common use of the term technology reflected the growing importance of the idea. The previous conceptualization of the useful arts was, according to historian Leo Marx, "inherently belittling." He notes: "Ever since antiquity, moreover, the habit of separating the practical and the fine arts had served to ratify a set of overlapping and invidious distinctions: between things and ideas, the physical and the mental, the mundane and the ideal . . . . This derogatory legacy was in some measure erased, or at least masked, by the more abstract, cerebral, neutral word 'technology.' " Whereas mechanical or industrial arts implied an association with a particular type of manual, sensorial labor, the generalized and idealized concept was more sophisticated and celebrated.[55] It better captured the way technical know-how and artifacts are linked organizationally and philosophically. Also reflected was the way technology was organized into systems and how those systems increasingly pervaded America's economic, political, and social realms. The more conceptual term also captured how technology became a broad, seemingly autonomous force of inevitable progress that Americans integrated as part of their national identity. The semantic shift also put what had previously been merely knowledge of a craft on par with the esteemed rationality of science. Indeed, both technology and science were becoming increasing intertwined and put into the service of corporations and governments.[56]

Techno-science, the label some scholars give to denote the growing interdependence of the two pursuits, was clearly demonstrated as states marshaled massive resources to fight the First World War.[57] Following the conflict, the American public reaped the benefits of wartime economic, scientific, and technological mobilization. While there were always dissenting opinions, historian Thomas Hughes notes "technological enthusiasm prevailed" among Americans who eagerly adopted technology as a fundamental element of their culture. Embrace of the mechanical was visible in architecture, consumer products, literature, and metaphors for both organizational management and individual character.[58] By the time the United States entered the next global conflict, techno-science had fully pervaded American military institutions.[59]

By World War II, the stage was set for a revolutionary shift in the relationship between technology, science, and war. Because of the conflict, governments around the globe increased funding for scientific research and initiated numerous institutional endeavors. Radical

innovations in military technology followed. Examples include radar, electronic computers, and the atomic bomb. Military historian, Alex Roland argues these new weapons were not decisive in the conflict but their lasting influence was attributable to two elements. The first includes principles of management and operational research that emerged to develop, test, and employ new military systems. The second was the impression that techno-science, associated most acutely with the Manhattan Project, deserved the credit for Allied victory.[60] As a result, technology and science seemed to be the key to resolving two different challenges: winning conflicts abroad and improving the quality of life at home. The first was reflected in increasingly sophisticated military systems supported by the military-industrial-university complex. Intercontinental ballistic missiles and the semi-automatic ground environment (SAGE) air defense system are two key examples.[61] The second emerged as the federal government turned to systems approaches to solve urban problems. Indeed, issues such as aging infrastructure revealed the ubiquity of technological systems in modern American life. The systems engineering approach, pioneered by organizations such as RAND, which began a think tank for the USAF, assumed that the same rational approach could work as well in civilian circumstances as it supposedly had in the war.[62] In the words of historian Carroll Pursell, postwar Americans became "technology drunk" as they enjoyed the reorientation of wartime production to mass consumption. In their inebriated state, many looked to what public intellectual Lewis Mumford derided as the "megamachine" as the means and ends of human progress.[63] Thomas P. Hughes, historian of technology, states that symbols of "order, precision, and systematic control" were diffused from the domain of technology into politics and culture writ large. However, this vision was soon challenged as a sense of technology sobriety set in. Some even question the very premise of a technological society, inaugurating what the scholar Leo Marx called "postmodern pessimism."[64]

Systems management abstracts quantitative factors from an inherently unique and multifaceted context and then subjects them to analysis. This only works in an artificially static and superficial environment, however, and the consequences of applying a systems management approach to the war in Vietnam and to weapons development are well documented.[65] Likewise, environmental pollution, industrial accidents, and political debacles lowered the public's confidence that technologists had the ability to control the systems that

now permeated every facet of modern life. Ambitious attempts to apply systems management to urban problems also faltered.

In a 1973 article, urban planners Horst Rittel and Melvin Webber developed the concepts of "tame" problems and "wicked" dilemmas to explain why technical and economic logic often failed in the face of local political and social contexts. A tame problem can be stated definitively, addressed independently—without reference to dynamic context—and solved objectively and permanently. In contrast, any problem that involves values—that is, any political problem, in the global sense of the word—is "wicked" in that it resists solution. This resistance arises from the difficulties inherent in all social predicaments: every problem is interdependent and unique; the approach depends on the how the problem is defined; there is neither consensus on the definition nor objective measures of progress; no solution is final; and every attempt to solve the problem further alters the context.[66] Attempts to find even a temporary and partial solution requires "transdisciplinary imagination" and may hinge on openness to radical changes.[67] The concept has been adopted by fields outside of urban planning, including strategists, organizational theorists, those concerned with innovation, and literary critics.[68]

In literary terms, this dichotomy of wicked and tame is represented by the contrasting settings of Homer's two epics, *The Iliad* and *The Odyssey*. The setting for *The Iliad* is the siege of Troy. This "closed world" is tame, emphasizing bounded, presumably autonomous, spaces with an acute sense of artificiality.[69] The natural world is missing. Machinery and materiel, instead, occupy the foreground, and contests are decided by reason, political power, or technical skills.[70] In contrast, "open" or "green" worlds are natural, less bounded, and more complex. Their unpredictability requires *metis* and playfulness. In *The Odyssey*, the images of the hero's dual journeys, one physical and the other psychological, exemplify engagement with mystical forces in a wondering, wandering journey home.[71] Some even began to suspect the pursuit of scientific knowledge was less the panacea envisioned by Plato and his descendants, and more of a narrow "closed world" project.

Plato conceived of human knowledge as a cumulative uncovering of universal truths. In contrast, the last half-century has seen growing awareness that all information is partial, in both senses of the word. That is, it is both irrevocably incomplete and inherently biased. As a result, some aspects of the field under investigation cannot be explained

and are, in fact, not even considered legitimate questions. A significant milestone in this appreciation of subjective and asymmetrical progress is Thomas Kuhn's 1962 work, *The Structure of Scientific Revolutions*.

Kuhn's analysis of the history of science challenged the presumption that scientific advancements transpire only through a linear accumulation of facts and theories. Such "normal science" does occur, but the questions it seeks to answer, and the mechanisms it employs to get those answers, are both provided by a dominant paradigm.[72] Although Kuhn brought that term into widespread usage, his own work lacked definitional precision. By one scholar's count, "paradigm" was used in 21 different ways throughout *The Structure of Scientific Revolutions*.[73]

In adapting Kuhn's ideas to analyze organizational culture instead of techno-scientific knowledge, Gareth Morgan offers a typology useful for understanding the intellectual history of Airmen. Morgan distinguishes between three different uses of the term paradigm. In their most narrow conception, paradigms are the "puzzle-solving activities" researchers apply to solve specific questions. The processes, tools, and concepts operationalized therein arise from principles derived from the second level of paradigms. In that sense, a paradigm is "school of thought" informed by a coherent theory. Although their perspectives may differ, these communities can still emerge from a common paradigm in the third, most expansive connotation of that term: an implicit, often tacit, philosophical system that filters and interprets experience.[74] When describing the organizational culture of the USAF, the Greek word *logos* is another term useful to describe this sense of paradigm as a worldview.

First, the intellectual history of Airmen demonstrates a certain amount of reverence towards the machinery of flight. Thus, in the theological sense, the airplane is their sacred *logos*. Also, as understood outside of Plato's philosophy, *logos* can mean a guiding narrative. This conception has the advantage of highlighting the subjective nature of theories: how they are constructed, selected, and employed—that is, how a paradigm crafts a repertoire of stories that make sense of the world. The *techne* of storytelling is more than just subjective and contextual; it also privileges *metis*. New theories emerge in times of change, when old approaches are losing their appeal. Kuhn writes, this is often through a "sudden and unstructured event" like a "flash of intuition." As his description implies, the rise of a new approach is rarely objective, instead appealing to subjective

qualities such as improved aesthetics or eloquence. Lacking evidence, he argues that the change is a decision that "can only be made on faith." The choice often hinges on what Kuhn later called a mature sensibility that holds rational and nonrational factors together in productive balance.[75] This process is also playful, holding contrasting metaphors in creative tension and "exploring constructive falsehood as a means of liberating the imagination."[76]

Contrary to Plato's incrimination of false ideas as shadows, there is wisdom in accepting each story as a partial truth. Consider Homer's epic poems, which were highly influential even though they were not objectively accurate.[77] For Plato, this demonstrated the untrustworthiness of the *demos* and the criminality of sophists: the former was liable to mistake shadows for substance, while the latter deliberately cultivated those shadows in the form of stories. Theories, however, are what Alfred North Whitehead calls a "useful fiction."[78] Kantian scholar Hans Vaihinger has a similar concept of scientific fictions: provisional, "artificial," constructs that cultivate creativity. Their utility lies not in their approximation of reality (which is what a hypothesis aspires to), but in the "almost mysterious" way they allow an "instinctive, almost cunning ingenuity" to surmount a difficult conceptual problem indirectly. He explicitly describes it as a metic, playful activity: "free creative play of psychical activity, expressing itself in arbitrary combinations and alternations of the elements existing in the world of fact." Without these fictions, the "satisfaction of understanding, the ordering of our chaotic material . . . all advances in science, and finally all higher morality would be impossible."[79] Einstein echoed these sentiments: "Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution. It is, strictly speaking, a real factor in scientific research."[80]

Finally, the idea of technical know-how is still an element of *logos* as logic—and the USAF culture is a particularly apt example of a mindset shaped by technological reasoning. It may seem absurd that this paradigm, their *logos,* could still be labeled playful while simultaneously meaning logical. The justification for this approach, however, comes from the analytical insights from the history of technology as it evolved since the mid-twentieth century.

History of Technology

The history of technology developed within the cultural, social, political, and academic milieu described above. A growing appreciation of the intricate interactions between technology and society—the same awareness that led to the very popularization of the term "technology" as a keyword—meant that some historians were no longer satisfied with detailed accounts limited to how machines worked. They increasingly critiqued the approach to technological history that focused largely on new, successful artifacts and heroic inventers and on technology as both an autonomous historical force and the principal determinant of prosperity for both individuals and empires.[81]

In 1958, a significant milestone in the field occurred with the creation of the Society for the History of Technology (SHOT). As is natural for a new endeavor, there was much ink spilled defending the field as coherent, distinct, and meaningful. Melvin Kranzberg is the man most responsible for SHOT's creation. In his words, " 'all history is relevant,' but the history of technology is the most relevant." He defended this bold statement by observing "man could not have become *homo sapiens*, 'man the thinker,' had he not at the same time been *homo faber*, 'man the maker.' "[82] These ideas are obviously contrary to Plato's diminution of *techne.* Kranzberg specifically cited the Greek philosopher as a source of the prejudice against the scholarly study of technology.[83]

Early SHOT members argued passionately for increased sophistication in the history of technology to claim its position in academia. For example, in 1975, Angus Buchanan called for a "synoptic approach" to the history of technology as an all-encompassing and creative force in historical change. His contextualist approach, or what another SHOT member called the integration of design and ambience, was even reflected in the title of SHOT's journal, *Technology and Culture*.[84]

Within three decades, contextualist approaches were more common in SHOT's journal than the previous "internalist" accounts, which merely "opened the black box" of a specific technology without situating the artifact's mechanical components within a broader context (or what John Staudenmaier memorably calls the "cultural ambience").[85] At the other end of the continuum, there are "externalist" narratives that leave the black box closed, as if the "nuts and bolts" do not matter at all. The line between these accounts and nonhistorical analyses offered by sociologists, economists, political scientists, or

philosophers is often blurred—since all eschew technical details—but externalism still retains a focus on the artifact as its main character. An example would be a work about the use of aircraft in a conflict that does not explore the links between its employment and its mechanical design.[86]

Contextualism, situated in the middle of the spectrum, mitigates the extremes of the other two. While internalism privileges the object and externalism privileges the context, contextualism blends the two, opening the box to varying degrees to show how the material, mechanical qualities of the thing are shaped by social forces and then how the thing goes on to become a social force itself.[87] This naturally leads to a focus on users, how technology can influence their paradigms and then how such paradigms influence their use of that technology. Again, USAF organizational thinking is so oriented to technology that it is fair to claim that Airmen operate within a technological paradigm. Furthermore, this way of thinking can lead to an approach to—and with—technology that can be described as playful.

Playfulness and paradigms are not unknown topics in the history of technology. Kuhn is "the one model that really dominates us all" according to one historian, and many have applied his insights into the subjective and imaginative nature of technological change.[88] One example is *Men, Machines, and Modern Times* by Elting E. Morison, in which he discusses how new technology emerges from objective data but also from "a tangle of memories, prejudices, emotional needs, aspirations, [and] common decencies." Many other historians cite the importance of imagination to foresee or break through technical problems, as well as the inherent playfulness in invention (e.g., toys often are entry points for technology).[89] Phillip Scranton, for instance, describes the process of creating aircraft jet engines amidst the anxiety of the Cold War as messy, irrational, and full of passion.[90] For some scholars, such as George Basalla, necessity is always subordinated to "fantasies, longing, wants, and desires." In *The Evolution of Technology*, Basalla argues that artificial novelty owes less to economic or biological demands and more to "technological imagination . . . [that] often exceeds the boundaries of rationality as it contemplates the improbable and the impossible."[91]

Basalla's work also starts off by acknowledging the role of cognitive play and the analytical power of metaphors.[92] Likewise, historians in the field are increasingly looking at stories for insight into technological attitudes. Perhaps the best example is David E. Nye's *Narra-*

tives and Spaces: Technology and the Construction of American Culture, which combines the social history of technology with literary theory to reveal the narrative quality of historical representations as well as the public's reactions to contemporaneous technological change.[93] Of course, history is itself a form of storytelling, using illustrative narratives and even mythological images—useful fictions such as Prometheus—to analyze and describe the subject.[94]

The story that follows in *The Icarus Solution* builds upon these precedents, while also filling in some historiographical gaps. It takes playfulness seriously, acknowledging the many forms of play that Airmen embody, from storytelling to strategy. Yet it is also playful in its approach, using contrasting pairs of mythological characters in a format like that of Paul Edwards's work on the USAF during the Cold War, "kaleidoscopic, often more collage than linear narrative." And like Edwards's work and many other recent books by the SHOT community, it employs new, often transdisciplinary, approaches to history.[95]

One such novel tactic is focusing on where most interactions occur with technology. They are not, as the weight of historiography implies, at the point of creation. Rather, as Edgerton and Svante Lindqvist argue, it is with extant artifacts. The lived experience of "technology in use" lacks sufficient study, and the recent trends towards users and consumption do not automatically correct this issue. Studies of users are pervasive in the Social Construction of Technology (SCOT) approach, but those users are those shaping artifacts' initial invention and development.[96]

Political, economic, and social constructivist perspectives tend to discount the lived experience of technology. Indeed, in *Meaning in Technology*, Arnold Pacey states that "few authors of either school get close to what seems to me the most important aspect of the practice of technology . . . how human imagination deals with practical experience of the material world."[97] The approach used throughout this book fulfills the need for more analyses of what historian Kristen Haring labeled "technical cultures," as in the specific reactions of organizations and individuals to technology.[98] In doing so, this book heeds the warnings against ignoring how mythological references are used to conceptualize human flight.[99]

Additionally, after decades of SCOT analysis seeking to demystify technology, the argument herein reclaims a place for passion as more than just a derided label.[100] In the first sense, this is similar to what Dipesh Chakrabarty claims for the historian, as described by a re-

viewer: "a right to re-enchant a world that has been disenchanted by the nihilism of modernity."[101] It comports with David Edgerton's admonition to stop ignoring popular accounts or what is often derided as "buff" literature, and Bruno Latour's plea to uncover "the passion beneath rationality" in technological practices. It matches Lewis Mumford's own version of internalism, described by Rosalind Williams as "the interplay between technology and the internal world of personality, creativity, desires, values, meaning."[102] In the words of historian Eugene Ferguson, "If we fail to note the importance of enthusiasm that is evoked by technology, we will have missed a central motivating influence in technological development."[103]

The field of aviation history, often cited for excessive displays of enthusiasm, is particularly ripe for this shift. In his 1989 article, "Aviation History in the Wider View," James Hansen critiqued the field's extant works for their narrow technical focus and silence on sociocultural issues. Unlike in the broader field of technological history, histories of aviation had not experienced the same "crowded narrative frame."[104] At the same time, excitement over flight should remain part of the historiographical toolkit, as both content for examination and the historian's own inspiration. Rosalind Williams, past president of SHOT, stated, "In the history of technology, passion serves an epistemological purpose. Strong emotion acts as a probe. It takes historians into a subject and motivates them to keep digging further."[105] A prime example of William's advice and an exemplar of the "New Aerospace History" is Bayla Singer's *Like Sex with Gods: An Unorthodox History of Flying*. Not only does the historian show the interplay of psychological aspects of flight with its technical aspects, but she also embraces the playfulness of her approach.[106]

Last, perhaps because many argue that the "essence" of the field is found in the material object, there are few works that offer a history of ideas and attitudes about technology.[107] This is particularly troublesome for the USAF, a service supposedly born as an "embodiment of an idea." If, as Singer notes, "human flight is not a simple matter of science and technology [but] a continuing epic of dreams and obsession, of yearning and striving to harness the intellect in the service of the emotions," then those ideas are not just technical speculations, but also dreams and fears.[108] Thus, this work aspires to follow Edwards's description of his own project: "a story neither of ideas alone nor of machines and their effects, but of ideas, experiences, and metaphors in the interaction with machines and material change." As

such, it follows other historians in detailing technical information only as necessary to tell the story.[109] Indeed, the very working definition of technology used herein points to such an approach.

Technology is just as difficult to define as play or politics, but a working definition is nonetheless useful. In terms of framing this project, technology is all the human mental, physical, and social activities—including research, design, production, transfer, alteration, use, repair, and discard—necessary for realizing the creative manipulation of the material world. Like fire, which itself is the manifestation of a technological system when it is deliberately used for human goals, technology:

1. emerges from a base of knowledge;
2. comes in many forms, but always involves materiality;
3. changes in ways that are sometimes predictable (often when viewed macroscopically) and sometimes not (especially when viewed microscopically);
4. can be used for many purposes (including nonrational ends);
5. shapes, and is shaped by, the surrounding environment, both physical and cultural; and
6. is fundamental to what it means to be human.[110]

This tentative explanation showcases multiple themes. First, using fire as an analogy for technology showcases the formative role of metaphor in human communication, highlighting the predominance of technology over science since the science of combustion followed the technology of fire. The metaphor also harkens to a site of play, the campfire, which includes the playful practice of storytelling. Finally, fire and technology are directly linked to the history of warfare. Projectile technology, in particular, has been described as "throwing fire," and military aviation is firmly associated with this image. Indeed, its practitioners are the exemplar recipients of Prometheus's gift of fire, a gift associated with technological knowledge and material artifacts as well as with art, inspiration, and political power.[111]

Chapter Summaries

Prometheus is obviously a useful myth for histories of technology, but there are others as well. For example, many writers invoke the

image of Apollo to represent order, control, and objective reason. In one sense, technology can only exist to the degree the material world can be manipulated in predictable ways. In contrast, the god Dionysius characterizes the realm of surrender, subjectivity, and surprise—or, in a word, play. Chapter 1 shows how World War I aviators lived at the nexus between these two contrasting images. The technical, Apollonian traits of their cutting-edge machines—specifically range and speed—afforded them the opportunity for Dionysian playfulness, at least when not flying. Not all forms of play were physical activities. These early airmen had a penchant for storytelling, a form of cognitive play with immense benefits.

Even though World War I demonstrated the destructive potential of aviation, its overall effect was to enhance its reputation. In contrast to the image of savage and primordial hand-to-hand combat taking place in cramped, muddy trenches, genteel chivalry and storybook gallantry characterized the aerial combats fought overhead. Fights were depicted as aerial duels, and the most successful pilots became national icons. These technological heroes portended a new age for humanity, one that, in the period after the war, increasingly embraced both the political and psychological benefits of aviation. The former could be represented by Daedalus, described by Homer as the greatest craftsman among mortals, and a reliable creator of military weapons. In contrast, a common image for the aspirational aspects of flight was his son, Icarus, who perished after becoming too enthralled with the experience of flight. Chapter 2 describes how, in the interwar period, attitudes towards aviation embraced the values of both characters: flight was both technical and playful. This airmindedness was a function of the multidimensional *perspectives* afforded by flight; new altitudes conferred new attitudes that shaped Western society. As part of that society, it shaped how airmen believed this new technology would change the character of war.

Leading up to the Second World War, airminded thinkers produced a variety of theories to guide the use of air power.[112] The most famous (or infamous) of these concerned high altitude, daylight strategic bombardment. While the historiographical record is heavily weighted towards this particular use, the reality is that World War II exhibited a variety of aerial operations, including close air support to land and naval forces. Even before the conflict, Airmen debated a variety of ideas regarding air power. The same can be said of the next time Airmen produced their own air power theory, which was not

until decades later. In histories of Operation Desert Storm (ODS), the concept of strategic paralysis gets most of the scholarly attention, despite a multifaceted air campaign. Both cases demonstrate the innate *flexibility* of air power. And in both cases, the historical narrative is skewed by the way Airmen themselves selectively framed air operations in a way that hyped operational flexibility while ignoring strategic adaptability. Instead of celebrating a moment of strategic playfulness, the institution coalesced around a single, seemingly validated model. Chapter 3 examines this process in terms of the Kuhnian evolution of knowledge, as scholars have adopted and adapted it to the study of technology.

Air power theories are a species of technological knowledge, subject to what renowned scholar Sir Lawrence Freedman labels the "most powerful dichotomy in all strategic thought": the contrasting images of destruction or intellect embodied in the Greek gods Bia and Metis.[113] Before their names became associated with the impersonal qualities of brute force and cunning intelligence, these two gods were part of the fabric of Greek mythology. Though not as familiar as other mythological characters used metaphorically thus far, they each have a central role in the ancient pantheon—as well as in the paradigm of modern Airmen. Bia is an agent of Zeus; "the goddess or personified spirit of force, power, might, bodily strength and compulsion."[114] She is the one, in fact, that delivers Prometheus to Hephaestus to carry out the punishment Zeus ordered.[115] Metis is the first wife of Zeus, who swallows her in an attempt to avert the prophecy that her children will challenge his rule.[116] In the process, he symbolically subsumes her considerable powers of metamorphosis, wisdom, and guile. Still, she is able to perform one more feat, emblematic of what her name will come to represent: within Zeus she births a daughter, Athena, and manufactures armor that will not only protect the new goddess, but also cause such pain that Zeus demands Hephaestus relieve him by striking him upon the skull with one of the blacksmith's metal instruments.[117] As a result of the blow, Athena emerges, geared for war and imbued with the same craftiness as her mother.

Airmen do not fit wholesale into one category or the other. Their technological paradigm has overt references to violence (*bia*), as well as appeals to *metis*. There is a latent power in this duality. Like the earlier chapters, choosing between images is a false dilemma. The question should not be Dionysius or Apollo, Daedalus or Icarus, Bia or Metis.[118] Instead, following the examples of Prometheus, Hephaestus, and

Athena, Airmen can embody the creative tension within all of these contrasting pairs. Indeed, when it comes to strategy, they have, at times, wisely selected a variety of ways to apply force—at least until, in retrospect, a particular approach hardened into dogma. This decline in intellectual playfulness occurred after World War II and again after Operation Desert Storm.

The historical moment following air operations over Iraq corresponds with another organizational shift in the USAF. For the first time since the US Air Force gained organizational independence in 1947, Airmen incorporated airmindedness into their doctrine. Yet, just as *metis* waned in the aftermath of the Gulf War, the term airminded no longer incorporated the playfulness it had in the interwar period. Chapter 4 returns to the intellectual history of airmindedness, using the discourse among Airmen in the years since Desert Storm. Even though a body of airminded scholarship exists, none of it addresses this use of the term in the USAF.

In summary, this book proceeds via a set of case stories. They flow into each other in a chronological sense, but the selection emerged organically as a result of trying to answer the initial intellectual problem: what does it mean for the USAF to have a technological culture? The answer, as should be expected for something so elusive, revealed itself in not only different time slices, but also in different guises for each of those periods. It was only after those narratives were digested and filtered through the theoretical framework offered by—and projected from, or appended to—the history of technology that the *technological logos* concept materialized as the answer. So, while chapter 1 describes some of the tangible practices of early airmen, chapter 2 delves into aviation's more intangible cultural influences in the interwar period. Flight shaped the feelings and thoughts of Western culture, including those of airmen. Out of this social milieu, they applied this style of thinking and sense of transformation to the character of war. Chapter 3 describes the results: prewar debates of various strategic theories, diverse use of air power in World War II, and finally, how they in the following decades became content with a simplified narrative of air power. The chapter also demonstrates how this cycle repeated itself at the other end of the Cold War era, in Operation Desert Storm. The results of that dogmatic approach to air power—with only traces of its earlier sense of aspiration and revolutionary change—is reflected in the way Airmen discuss airmindedness in the

decades since the first Gulf War. In this discourse, the ideas of play, wicked dilemmas, and *metis* are as important as they are unknown.

The conclusion speculates on why the USAF should revitalize this more dynamic side of its intellectual history; why it should embrace the playful side latent in its century-old *technological logos*. The theoretical foundations laid out in this introduction and the historical case studies that make up each chapter all furnish the multiple compartments captured in that expressive phrase, which is fully unpacked in the final chapter. A somewhat unwieldy working definition must suffice until then: *technological logos* is a paradigmatic story that intertwines the rational, the irrational, and the nonrational elements of ideas, attitudes, and actions regarding technology, which itself contains a host of common and forgotten meanings ranging from the artifactual to the artistic, from proto-scientific precision to rhetorical playfulness, from the explicable to the tacit, and from the tactical to the strategic. Next, the conclusion reveals the author's rationale for the use of mythological metaphors and Homeric images throughout this work, which may have appeared as arbitrary or ornamental. Last, it divulges this project's own *logos*.

The *raison d'etre* of the project—or, to use the Greek equivalent of that well known French phrase, the *lógos ýparxis* (story of existence)—has two elements. First, it reflects an attempt to push the scholarly boundaries of the discipline of history and the study of technology while analyzing the intellectual history of a technological organization. It is grounded in analytical perspectives and subjects familiar to historians, such as exploring technological experiences, the interplay between machines and mentalities, or the nature of technical know-how. Yet, it also stretches the styles and subjects considered by historians of technology. Some of these innovations, such as taking allusions to mythological metaphors and the etymology of some keywords more seriously, appear as natural evolutions of extant practices. More radical novelties arise from importing approaches from other fields (a trend scholars of technology have demonstrated in kind, though not in these specific categories).[119] Examples include links between technology and rhetoric, military theory as technological knowledge, and the need for playful, "crafty" strategies heralded by urban designers, psychologists, and philosophers. Another animating purpose, however, grew out of this initial scholarly agenda.

Highlighting the psychological consequences of the physical characteristics of air power—its revolutionary capacity for range, speed,

and altitude—is not merely a chance to explore the invitation by some members of SHOT to consider "the forbidden fruit of technological determinism."[120] Reframing the narrative of USAF culture also evolved into a pragmatic objective for the author: to give Airmen a deeper understanding of their own culture. A more coherent and credible story of what being an Airman has meant in the past, and should mean today, may be able to catalyze the organization toward truly fulfilling its short-lived motto: "no one comes close."

In sum, this reformulation is not a critique of technical logic or the piety towards the airplane; after all, these elements are implicit within the origins of "technology." Instead, it is a plea for balance, for preserving the service's theology while avoiding dogmatism and for nurturing a culture of strategic wisdom for a wicked world that is disorderly and dangerous.

Notes

1. Matthew J. Lloyd, "From Recruiting Slogan to Air Force Motto: The Evolution of 'Aim High…Fly, Fight, Win!' " (Air War College, Research Report, 2011), 1, 4–5.

2. Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore, MD: Johns Hopkins University Press, 1989), 19; and Brice Harris, *America, Technology and Strategic Culture: A Clausewitzian Assessment* (New York, NY: Routledge, 2015), 2.

3. David Edgerton, "Innovation, Technology, or History: What Is the Historiography of Technology About?," *Technology and Culture* 51, no. 3 (July 2010), 680–97.

4. Peter Caws, "Praxis and Techno," in *The History and Philosophy of Technology*, edited by G. Bugliarello and D. Doner (New York: Harper and Row, 1978), 228. Likewise, Carl Mitcham, a philosopher of technology, suggests this is a "good place to begin the history of ideas" specifically in relation to this topic. Carl Mitcham, *Thinking through Technology: The Path between Engineering and Philosophy* (Chicago: The University of Chicago Press, 1994), 117.

5. Eric Schatzberg, "Technik Comes to America: Changing Meanings of Technology before 1930," *Technology and Culture* 47, no. 3 (7 August 2006): 489.

6. David Roochnik, *Of Art and Wisdom: Plato's Understanding of Techne* (University Park, PA: Penn State University Press, 2007), 19. This is explained in John Staudenmier's *Technology's Storytellers* (May 1985), appropriately subtitled "*Reweaving the Human Fabric*." For more discussion on the evolution of technology, see Leo Marx, "Technology: The Emergence of a Hazardous Concept," *Technology and Culture* 51, no. 3 (15 August 2010): 561–577.

7. Janet M. Atwill, *Rhetoric Reclaimed: Aristotle and the Liberal Arts Tradition* (Ithaca, NY: Cornell University Press, 2009), 49. According to the English professor Atwill, "the most significant mythic tradition of *techne* is found in various Prometheus accounts."

8. Wm. Blake Tyrrell, Hesiod, *Theogony*, trans. msu.edu/~tyrrell, msu.edu/~tyrrell/theogon.pdf, accessed 3 October 2017, 535–70. Mark Cartwright, "Prometheus," *Ancient History Encyclopedia*, www.ancient.eu/Prometheus, accessed 22 November 2017.

9. Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge, MA: The MIT Press, 1978), 334–335). Winner uses the image of Prometheus's punishment to highlight the vulnerabilities of technological dependence. In Oswald Spengler's *The Decline of the West,* Prometheus represents a specific cause of Western decay, the ambition to achieve godlike powers through machines (Oswald Spengler and H. Stuart Hughes, *The Decline of the West*, ed. Helmut Werner, trans. Arthur Helps and Charles Francis Atkinson (New York: Oxford University Press, 1991), 164, 168, 340). Leo Marx, Carroll Pursell, and Arnold Pacey all examine references to the Titan to uncover attitudes towards technology (Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America*, 35th Anniversary edition (New York: Oxford University Press, 2000), 202, 205-6, 297, 299; Carroll Pursell, *Technology in Postwar America: A History* (New York: Columbia University Press, 2007), 64; and Arnold Pacey, *The Culture of Technology* (Cambridge, MA: The MIT Press, 1985), 88, 96–97, 172).

10. David S. Landes, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present* (London: Cambridge University Press, 1969); and Thomas P. Hughes, *Rescuing Prometheus: Four Monumental Projects that Changed the Modern World* (New York: Random House Inc., 2000). In addition, other examples include Richard Hallion's edited volume *The Wright Brothers: Heirs of Prometheus* (Washington, DC: Smithsonian Institute Press, 1978), James MacLachlan's *Children of Prometheus: A History of Science and Technology* (St. Louis: Wall & Emerson, 1989), and Robert A. Wauzzinski's *Discerning Prometheus: The Cry for Wisdom in Our Technological Society* (Vancouver: Fairleigh Dickinson University Press, 2001). Authors making use of the myth within their text, if just in passing reference, occurs in George Basalla's *The Evolution of Technology* (Cambridge, England: Cambridge University Press, 1988) as well as Lewis Mumford's *Technics and Civilization* (Chicago, IL: The University of Chicago Press, 1934).

11. Martha C. Nussbaum, *The Fragility of Goodness: Luck and Ethics in Greek Tragedy and Philosophy*, 2nd edition (New York: Cambridge University Press, 2001), 94. On poetry as *techne*, see Gregory Nagy, *The Best of the Achaeans: Concepts of the Hero in Archaic Greek Poetry* (Baltimore: Johns Hopkins University Press, 1998), 297, 300; or Everett Wheeler, *Stratagem and the Vocabulary of Military Trickery* (New York: Brill, 1997), 28.

12. Andrew Feenberg, *Between Reason and Experience: Essays in Technology and Modernity* (Cambridge, MA: The MIT Press, 2010), 121.

13. Atwill, *Rhetoric Reclaimed*, 48, 53–54, 67, 68.

14. Roochnik, *Of Art and Wisdom*, 23. Atwill concurs, writing, "As future versions of the myth attest, fire signifies more than the potential for craft and invention. *Techne* marks the transition from a nomadic gathering culture to one of cultivation and specialized labor, a transition that created the new forms of social identity that constituted the bonds of the city" (Atwill, *Rhetoric Reclaimed*, 7, 104). Also, see Prometheus's speech after he is chained down by Hephaestus (Aeschylus, *Prometheus Bound* [New York: Dover Publications, 1996], 444–64).

15. Mitcham, *Thinking through Technology*, 129. According to Mitcham, " 'technologist' used to refer to. . . rhetorician."

16. Atwill, *Rhetoric Reclaimed*, 103–4, 114.

17. Hugh G. Evelyn-White, *Hesiod, the Homeric Hymns, and Homerica*, trans., revised edition (Cambridge, MA: Loeb Classical Library, 1914), 14 and Hesiod, *Theogony* quoted in Alexander C. Loney, "Hesiod's Incorporative Poetics in the Theogony and the Contradictions of Prometheus," *American Journal of Philology* 135, no. 4 (2 December 2014), 511, 521, 546, 616. According to the classicist Alexan-

der C. Loney, "In the conventional language of heroic epithets, Hesiod thus acknowledges Prometheus' multiple, shifting, sometimes contradictory meanings. The complexities of his character are profoundly traditional, extending back into prehistorical Indo-European myth and the archetypal universals of the trickster figure" (Loney, 504).

18. Atwill, *Rhetoric Reclaimed*, 125–26; Loney, "Hesiod's Incorporative Poetics in the Theogony and the Contradictions of Prometheus," 505; "Prometheus," *Ancient History Encyclopedia*. Two other authors note that "Hesiod and Aeschylus are at one in recognizing in Prometheus that very type of wiley intelligence, that same power of deception which the Greeks called *metis*." Marcel Detienne and Jean-Pierre Vernant, *Cunning Intelligence in Greek Culture and Society*, trans. Janet Lloyd (Chicago: University of Chicago Press, 1991), 58.

19. Atwill, *Rhetoric Reclaimed*, 56. Lowell Edmunds, *Chance and Intelligence in Thucydides* (Cambridge, MA: Harvard University Press, 1975), 106; and Mitcham, *Thinking through Technology*, 118.

20. Lisa Raphals, *Knowing Words: Wisdom and Cunning in the Classical Traditions of China and Greece* (Ithaca, NY: Cornell University Press, 1992), xii; and Detienne and Vernant, *Cunning Intelligence*, 18.

21. Cheryl De Ciantis, "The Gait of Hephaistos: Crooked Perceptions into Consilience," *Icono* 14, vol. 15, no. 1 (1º semestre [enero-junio], Publicado, 2017), 136. As one scholar puts it, "foremost, to be *effective metis* assumes the possession and mastery of a *techne*."

22. Wheeler, *Stratagem and the Vocabulary of Military Trickery*, 30; and Roochnik, *Of Art and Wisdom*, 23.

23. Detienne and Vernant, *Cunning Intelligence*, 280; and Roochnik, *Of Art and Wisdom*, 22–23.

24. Ciantis, "The Gait of Hephaistos," 129; and Roochnik, *Of Art and Wisdom*, 23.

25. Detienne and Vernant, *Cunning Intelligence* 177–85; and Raphals, *Knowing Words*, 217.

26. Atwill, *Rhetoric Reclaimed*, 47, 52–54; Nussbaum, *The Fragility of Goodness*, 94; Edmunds, *Chance and Intelligence in Thucydides*, 106; and Detienne and Vernant, *Cunning Intelligence*, 54, 281.

27. Charles Hill, *Grand Strategies: Literature, Statecraft, and World Order* (New Haven, CT: Yale University Press, 2011), 9, 254–55. The *Odyssey* was used by leaders such as Frederick the Great and T. E. Lawrence, who kept his copy in his camel's saddlebags during World War I. Stephen V. Tracy, *The Story of The Odyssey* (Princeton, NJ: Princeton University Press, 1990), xi. The ancient historian Plutarch wrote that Alexander the Great carried *The Iliad* on his eastern campaign, "declaring that he esteemed it a perfect portable treasure of all military virtue and knowledge" (quoted in Hill, 2). According to Brian Boyd, professor of comparative literature, Homer was "a writer gifted enough to last three millennia—and to inspire authors as major as Virgil, Shakespeare, Goethe, and Joyce." Boyd, *On the Origin of Stories: Evolution, Cognition, and Fiction* (Cambridge, MA: Belknap Press, 2010), 256.

28. Athenians also worshipped Athena, Hephaestus, and—unique among all other Greek cities—Prometheus. Carol Dougherty, *Prometheus* (New York: Routledge, 2006), 46; Lewis Richard Farnell, *The Cults of the Greek States*: vol. 1 (United Kingdom Adamant Media Corporation, 2002), 277; Robert Parker, *Polytheism and Society at Athens* (London: Oxford University Press, 2007), 409; and Loney, "Hesiod's Incorporative Poetics," 504, 514.

29. Mihai I. Spariosu, *Dionysus Reborn: Play and the Aesthetic Dimension in Modern Philosophical and Scientific Discourse* (Ithaca, NY: Cornell University Press, 1989), x, 5, 12–13, 144.

30. Donald Kagan, *Pericles Of Athens and The Birth of Democracy* (New York: Free Press, 1998), 21; and John Thorley, *Athenian Democracy*, 2nd ed. (London: Routledge, 2004), 10. "Consider one man who was nicknamed Odysseus, described by Thucydides as reflective, prescient, adaptable, intuitive, and a persuasive speaker." Thucydides, *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War* (New York: Free Press, 2008), 1.14.3, 1.91–93, 1.138.3.

31. Samuel E. Stumpf, *Philosophy: History and Problems*, 5th ed. (New York: McGraw-Hill, 1995), 30. Aeschylus describes Prometheus as a sophist before the term came to mean a tutor available for hire. Johan Huizinga, *Homo Ludens: A Study of the Play-Element in Culture* (Eastford, CT: Martino Fine Books, 2014), 146.

32. Kendall Haven, *Story Proof: The Science Behind the Startling Power of Story* (Westport, CT: Libraries Unlimited, 2007), 100, 108–109.

33. Walter R. Fisher, *Human Communication as Narration: Toward a Philosophy of Reason, Value, and Action* (Columbia: University of South Carolina Press, 1989), 62.

34. Atwill, *Rhetoric Reclaimed*, 55; Loney, "Hesiod's Incorporative Poetics," 517; and Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 307.

35. Robert B. Strassler, *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War*, trans. Richard Crawley (New York: Free Press, 1998), 3.36–49. In another example, the rhetorical skills they taught could be used one day to convince the assembly to slaughter the entire male population of a rebellious state and then to convince them to reverse that decision the very next day.

36. Stumpf, *Philosophy*, 46. Consider Alfred North Whitehead's illustrative quote: "The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato." Alfred North Whitehead, *Process and Reality*, 2nd ed. (New York: Free Press, 1979), 39. In classicist Eric A. Havelock's conclusion to *Preface to Plato*, he writes, "Europe still lives in the shadow [of Socrates and Plato] using their language [and] accepting their dichotomies." Eric Havelock, *Preface to Plato* (Cambridge, MA: Belknap Press, 1982), 305.

37. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 318.

38. Stumpf, *Philosophy*, 75.

39. Lawrence Freedman, *Strategy: A History* (New York: Oxford University Press, 2013), 38–39. Plato's criticism of democracy, for instance, persisted as a dominant image in Western philosophy through the Enlightenment. Kagan, *Pericles of Athens and The Birth of Democracy*, 268. Even America's founders were reluctant to use the term. Hill, *Grand Strategies*, 147.

40. Henry Frowde, Plato, *The Republic*, trans. Benjamin Jowett (Heritage Press, 1944), 514a–520a.

41. Keith Crome, "Socrates and Sophistry," *Richmond Journal of Philosophy* 9 (Spring 2005): 1. Quote, Plato, Gorgias, 463a.

42. Plato, *The Republic*, 10.605b-c.

43. Havelock, *Preface to Plato*, (Cambridge: Belknap Press of Harvard Univ., 1982), 4–5. Admittedly, Plato offers to entertain an argument in defense of stories and concedes they can be charming. Havelock argues in his *Preface to Plato*, however, that the burden of proof is so high and the charges are so damning that to think that his offer "amounts to a recantation profoundly mistakes his intention." Furthermore, none of this precluded Plato from employing storytelling himself (such as the myth of Prometheus) or advocating it for the philosopher-king (who should employ

"noble lies" to keep the politic content with illusions of reality). Freedman, Strategy, 40.

44. Havelock, *Preface to Plato*, 4–15. "Of the many excellences which I perceive in the order of our State, there is none which upon reflection pleases me better than the rule about poetry." Plato, *The Republic,* 10.595a. According to Eric Havelock, roughly half of *The Republic* is devoted to disparaging the art of storytelling.

45. Benjamin Jowett, trans. Plato, *The Republic*. "Introduction Analyses and Summary" (New York: Heritage Press, 1944), 10.595a.

46. Fisher, *Human Communication*, 5.

47. I am indebted to Dr. Patrick Quinn, author and friend, for bringing this theological dimension of *logos* to my attention, somewhat serendipitously, during a multi-hour cycling adventure in July 2018.

48. Atwill, *Rhetoric Reclaimed*, 6, 161; John Wild, "Plato's Theory of τέχνη: A Phenomenological Interpretation," *Philosophy and Phenomenological Research* 1, no. 3 (1941): 260-61; Nussbaum, *The Fragility of Goodness*, 104, 108–9; and Mitcham, *Thinking through Technology*, 119. For more, see Robert P. Multhauf, "Some Observations on the Historiography of the Industrial Revolution," in *In Context: History and the History of Technology: Essays in Honor of Melvin Kranzberg*, edited by Stephen Cutcliffe and Robert Post (London: Lehigh University Press, 1989); and Leo Marx, "The Invention of 'Technology,' " in *Major Problems in the History of American Technology*, edited by Merritt Roe Smith and Gregory Clancey (Boston: Houghton Mifflin, 1997).

49. Atwill, *Rhetoric Reclaimed*, 151–152; and Roochnik, *Of Art and Wisdom*, 45, 52–53.

50. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 307.

51. Detienne and Vernant, 3–5, 317–318. Roochnik describes Plato's view of the more dynamic version of *techne* (what Roochnik labels *techne2*) as "epistemically unsatisfying." Roochnik, *Of Art and Wisdom*, 228.

52. John Dewey quoted in Timothy V. Kaufman-Osborn, *Creatures of Prometheus Gender and The Politics of Technology* (Lanham, MD: Rowman & Littlefield Publishers, 2000), viii.

53. Multhauf, "Some Observations on the Historiography of the Industrial Revolution," 42–49.

54. Marx, "The Invention of 'Technology,' " 3–4.

55. Marx, "The Invention of 'Technology,' " 2, 5.

56. Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca, NY: Cornell University Press, 1990).

57. Also written without a hyphen, techno-science means that scientists are increasingly reliant upon technologies (e.g., computers, lasers, measuring apparatuses), that technology itself cannot be a body of knowledge independent of science, or both. This is an area of much debate and has been extensively developed by scholars in the Science and Technology Studies (STS) field. For more, see Rachel Laudan, ed., *The Nature of Technological Knowledge. Are Models of Scientific Change Relevant?* (Boston: Springer, 1984); and Wybo Houkes, "The Nature of Technological Knowledge." *Philosophy of Technology and Engineering Sciences*, ed. Anthonie W. M. Meijers, vol. 9 (Amsterdam: North Holland, 2009), 343–44.

58. Thomas P. Hughes, *Human-Built World: How to Think about Technology and Culture* (Chicago: University of Chicago Press, 2005), 13, 39, 53, 72, 120.

59. Alex Roland, "Science and War," *Osiris* 1 (1985): 263.

60. Roland, 265–266.

61. Both are addressed in Pursell, *Technology in Postwar America;* and Hughes, *Human-Built World*.

62. Hughes, *Human-Built World*, 77–85 and Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm*, 1870–1970, 2nd ed. (Chicago: University of Chicago Press, 2004), 6, 10, 12, 316.

63. Pursell, *Technology in Postwar America*, 134; and Lewis Mumford, *Pentagon of Power: The Myth of The Machine, vol. 2* (San Diego, CA: Harcour Brace Jovanovich, 1974), 241. Examples include the interstate highway program and the rapid growth of suburbia.

64. Hughes, *Human-Built World*, 84–85, 87–96. Examples include oil spills, Three Mile Island, smog, acid rain, global warming, the Vietnam War, Watergate, and the Challenger shuttle accident.

65. Eliot Cohen dismantles this argument in "Systems Paralysis: Social Scientists Make Bad Generals," *The American Spectator* (November 1980), 23–29. Charles Hitch, head of the Economics Division of RAND, even admitted that "operations research is the art of sub-optimizing, i.e., of solving some lower-level problems, and that difficulties increase and our special competence diminishes by an order of magnitude with every level of decision making we attempt to ascend . . . the proportion of the relevant reality which we can represent by any such models in studying a major foreign-policy decisions, appears to be almost trivial." Quoted in Charles E. Lindblom, "The Science of 'Muddling Through,'" *Public Administration Review* 19, no. 2 (Spring 1959): 79. Even deterrence strategy, built upon mutual nuclear destruction, seemed vulnerable to similar fallibilities. False alarms in US missile warning systems did nothing to ease the image of technological cynicism.

66. Horst W. J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences* 4 (1973): 155–69.

67. Valerie A. Brown, John A. Harris, and Jacqueline Russell, *Tackling Wicked Problems: Through the Transdisciplinary Imagination* (Washington, DC: Routledge, 2010), 4.

68. For examples, see, respectively, US Army Training and Doctrine Command Pamphlet 525–5–500; Jeff Conklin, *Dialogue Mapping: Building Shared Understanding of Wicked Problems* (Hoboken, NJ: Wiley, 2005); and Oswald A. J. Mascarenhas, "Innovation as Defining and Resolving Wicked Problems," 11 May 2009, accessed 28 April 2015, weaverjm.faculty.udmercy.edu/.../ MascarenhasWickedproblems.doc.

69. Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: The MIT Press, 1997), 12–13.

70. Edwards, 307–11.

71. Edwards, 13, 309–312. As in *The Odyssey*, the focus is on finding or restoring community and a sense of flow, often related to a quest: "The protagonist's role is to remain open to this dizzying flux, riding the moment rather than trying to impose control, accepting and returning gifts of aid rather than trying to force a way alone . . . . Quest is integrative: comprehending complexity, transforming Others into mere others, and gathering forces for an eventual reunification." See Eberle for descriptions of play that match "open worlds." Scott G. Eberle, "The Elements of Play: Toward a Philosophy and a Definition of Play," *American Journal of Play* 6, no. 2 (January 2014): 220. David Bergen notes that play fulfills the criteria for nonlinear dynamic systems: it can be self-organizing; exhibits punctuated and variable stability, emergence, fractal qualities; [and is] sensitive to starting conditions, openness, interdependence. David Bergen, "Psychological Approaches to the Study of Play," in *The Handbook of the Study of Play*, edited by James E. Johnson, et al. (Lanham, MD: Rowman & Littlefield Publishers, 2015), 62–63.

72. Thomas S. Kuhn, *The Structure of Scientific Revolutions: A Guide to Method*, 4th ed. (Chicago: University of Chicago Press, 2012), xi–5.

73. Kuhn, *The Structure of Scientific Revolutions*, xix; and Gareth Morgan, "Paradigms, Metaphors, and Puzzle Solving in Organization Theory," *Administrative Science Quarterly* 25, no. 4 (December 1980): 606.

74. Morgan, "Paradigms, Metaphors, and Puzzle Solving," 605. "Paradigm," in its most expansive sense, is "metatheoretical or philosophical . . . denot[ing] an implicit or explicit view of reality. Any adequate analysis of the role of paradigms in social theory must uncover the core assumptions that characterize and define any given world view, to make it possible to grasp what is common to the perspectives of theorists whose work may otherwise, at a more superficial level, appear diverse and wide ranging" (Morgan, 606–607).

75. Kuhn, *The Structure of Scientific Revolutions*, 122, 154–155, 157; Marc and Trachtenberg, *The Craft of International History: A Guide to Method* (Trenton, NJ: Princeton University Press, 2009), 21–22. For example, some physicists claim that physics is only five percent observation and "ninety-five percent speculation," and a philosopher of science concludes "our chances of progress may be obstructed by our desire to be rational." Jerome Bruner, *The Culture of Education* (Cambridge, MA: Harvard University Press, 1997), 123–24; quoted in Paul Feyerabend's *Reborn*, 296.

76. Morgan, "Paradigms, Metaphors, and Puzzle Solving in Organization Theory," 611; Peter M. Senge, *The Fifth Discipline: The Art & Practice of the Learning Organization* (New York: Doubleday Business, 1994), 142; Marty Neumeier, *The Designful Company: How to Build a Culture of Nonstop Innovation* (Berkeley, CA: New Riders, 2008), 40; and Frans P. B. Osinga, *Science, Strategy and War: The Strategic Theory of John Boyd*, *Strategy and History* (New York: Routledge, 2007), 103. Morgan encourages a mental promiscuity that engages in a variety of metaphors. "The ultimate challenge," he writes, "is not to be seduced by the power or attractiveness of a single metaphor—old or new—so much as to develop an ability to integrate the contributions of different points of view" (Morgan, xii).

77. Jerome Bruner, *Making Stories: Law, Literature, Life* (Cambridge, MA: Harvard University Press, 2003), 98. While stories themselves, approximately half of both *The Iliad* and *The Odyssey* feature speeches or stories told by characters (Jasper Griffin, "The Speeches." *Cambridge Companion to Homer*, ed. Robert Fowler, Cambridge, UK: Cambridge University Press, 2004, 156.)

78. Paul Bate, *Strategies for Cultural Change* (Boston: Butterworth-Heinemann, 1994), 269.

79. Mihai I. Spariosu, *Dionysus Reborn* quote by Hans Vaihinger. (Ithaca, NY: Cornell University Press 1989), 248–256.

80. Albert Einstein, *Einstein on Cosmic Religion and Other Opinions and Aphorisms* (Mineola, NY: Dover Publications, 2009), 97.

81. John M. Staudenmaier, *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge, MA: The MIT Press, 1989); Wiebe E. Bijker, Thomas Parke Hughes, and T. J. Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: The MIT Press, 2012); Svante Lindqvist, *Changes in the Technological Landscape: Essays in the History of Science and Technology* (Sagamore Beach, MA: Watson Publishing International, 2011); and John McDermott, "*Technology: The Opiate of the Intellectuals*," New York Review of Books, 31 July 1969, 24.

82. Melvin Kranzberg, "One Last Word—Technology and History: 'Kranzberg's Laws,' " in *In Context: History and the History of Technology: Essays in Honor of Melvin Kranzberg*, edited by Stephen Cutcliffe and Robert Post (London: Lehigh University

Press, 1989), 251, 255. Elsewhere, Kranzberg wrote that "every thinking man" should be "concerned with the development of technology and its relation with society and culture" (Melvin Kranzberg, "At the Start," *Technology and Culture* 1, no. 1 (Winter 1959), 2). Carroll Pursell, a former SHOT president, wrote that a better understanding of technology, offers "a better understanding of ourselves" (Pursell, *Technology in Postwar America*, xvi). In the same spirit, in his *Prometheus Bound*, "Aeschylus reflects a broadened conception of *techne* . . . one which implies an essential relationship between humanity itself and *techne*" (Roochnik, *Of Art and Wisdom*, 42).

83. Kranzberg, "At the Start," 3.

84. Angus Buchanan, "Technology and History," *Social Studies of Science* 5, no. 4 (1975): 49; and. Staudenmaier, *Technology's Storytellers*, xiv. The journal's title, explained Kranzberg, "reveals the breadth of our definition of culture and indicates our awareness of the complex and intricate interrelationship of all aspects of technology" (Kranzberg, "At the Start," 1). Some critics worried that "culture" would be equated with fine arts and harken back to Plato's prejudice.

85. Staudenmaier, *Technology's Storytellers*, 21.

86. For one example, see David Edgerton, *England and the Aeroplane: Militarism, Modernity and Machines,* revised ed. (New York: Penguin Random House, 2013).

87. Staudenmaier, *Technology's Storytellers*, xxiv.

88. Alex Roland, "Theories and Models of Technological Change: Semantics and Substance," *Science, Technology, & Human Values* 17, no. 1 (1992): 95. Examples include Krohn, et al, *Dynamics of Science and Technology* ((New York: Springer Publishing, 1978); David Wojick's chapter "The Structure of Technological Revolutions" in *The History and Philosophy of Technology* (1979); Giovanni Dosi, "Technological Paradigms and Technological Trajectories," *Research Policy* 11 (1982): 147–162; Richard Nelson and Sidney Winter, "In Search of Useful Theory of Innovation," *Research Policy 6* (1977): 6–76); and Edward W. Constant, *The Origins of the Turbojet Revolution* (Baltimore: Johns Hopkins University Press, 1980). Arguments against applying Kuhn's model of scientific knowledge to technological knowledge—and the more persuasive counterarguments—can be found in Laudan's edited volume, *The Nature of Technological Knowledge*.

89. Elting E. Morison, *Men, Machines, and Modern Times* (Cambridge, MA: The MIT Press, 2016), 76. Arnold Pacey, Eugene S. Ferguson, William Ogburn, Brooke Hindle, and Bayla Singer all cite imagination or playfulness in their histories of in design, invention, or technological problem-solving. Arnold Pacey, *The Maze of Ingenuity: Ideas and Idealism in the Development of Technology* (Cambridge, MA: The MIT Press, 1992); Arnold Pacey, *Meaning in Technology* (Cambridge, MA: The MIT Press, 1999); Eugene S. Ferguson, *Engineering and the Mind's Eye* (London: The MIT Press, 1994); William Fielding Ogburn, *The Social Effects of Aviation* (Houghton Mifflin Company, 1946); Brooke Hindle, *Emulation and Invention* (ACLS Humanities E-Book, 2008); Bayla Singer, *Like Sex with Gods: An Unorthodox History of Flying* (College Station, TX: Texas A&M University Press, 2003).

90. Philip Scranton, "Urgency, Uncertainty, and Innovation: Building Jet Engines in Postwar America," *Management & Organizational History* 1, no. 2 (May 1, 2006): 127–57, https://doi.org/10.1177/ 1744935906064096.

91. George Basalla, *The Evolution of Technology* (New York: Cambridge University Press, 1989), 14, 77.

92. Basalla, 3. He opens his book stating, "Metaphors and analogies are at the heart of all extended analytical or critical thought." He goes on to construct a theory of technological change using similarities between biological evolution and technological change.

93. David Nye, *Narratives and Spaces: Technology and the Construction of American Culture* (New York, NY: Columbia University Press, 1998). Other examples are Daniel Dinello's *Technophobia! Science Fiction Visions of Posthuman Technology* (2006), Kaufman-Osborn's *Creatures of Prometheus*, Fred Erisman's *Boys' Books, Boys' Dreams, and the Mystique of Flight* (2006), and Rosalind H. Williams, "Opening the Big Box," *Technology and Culture* 48, no. 1 (7 February 2007): 104–116.

94. Historians of technology seem progressively comfortable with the idea of relating their work to the narrative turn in academia. In addition to Nye, Rebecca Herzig's asserted that telling stories is "what holds SHOT together after all," and Ronald R. Kline's 2012 Presidential address to SHOT argued "strengthening the foundations of the stories we tell about technology will make a difference in the wider world" (Rebecca Herzig, "A Thing for Stories," *Technology and Culture* 50, no. 3 (19 July 2009): 614; Ronald Kline, "Foundational Stories," *Technology and Culture* 54, no. 1 (21 February 2013): 127). An example particularly relevant for this book is Carolyn C. Cooper's argument "to view myths and legends about inventors not merely as false history but as stories from which to learn about the storytellers" (Carolyn C. Cooper, "Myth, Rumor, and History: The Yankee Whittling Boy as Hero and Villain" (*Technology and Culture* 44, no. 1, January 2003, 96). John Staudenmaier comments on this in his 2002 article, noting, "the past ten years fairly bristle with signs of SHOT's move into larger worlds of discourse" (John M. Staudenmaier, "Rationality, Agency, Contingency: Recent Trends in the History of Technology," *Reviews in American History* 30, no. 1 (March 1, 2002): 170).

95. Edwards, *The Closed World*, xv. Another example, and an inspiration for this approach, is Singer's *Like Sex with Gods*, in which the historian does not just start with an event and work backwards in time to uncover antecedents, but weaves together multifarious elements extant in the ancient past as a means of reframing what is already known about more recent events.

96. Ruth Schwartz Cowan and Ruth Oldenziel are two examples of this critique, which is discussed by Edgerton, Constant, and Lindqvist (David Edgerton, "Innovation, Technology, or History: What Is the Historiography of Technology About?," *Technology and Culture* 51, no. 3 (15 August 2010): 680–697; Lindqvist, *Changes in the Technological Landscape*; Edward W. Constant, "A Tale of Two Bonanzas: How Knowledgeable Communities Think about Technology," *Technology and Culture* 47, no. 2 (29 June 2006): 253-285). Constant notes that SCOT lacks focus on "simple folk" or what happens after "closure." Two works that do include such a focus are Alan Meyer's *Weekend Pilots* (Baltimore: Johns Hopkins University Press, 2016) and Mats Fridlund, "Buckets, Bollards and Bombs: Towards Subject Histories of Technologies and Terrors," *History and Technology* 27, no. 4 (1 December 2011): 391–416.

97. Pacey, *Meaning in Technology*, 4.

98. Kristen Haring, *Ham Radio's Technical Culture* (Cambridge, MA: The MIT Press, 2008), xv. Haring defines a technical culture as "a culture built around and establishing an ideology about technology." Williams demonstrates the fruits of an organizational approach in her *Retooling: A Historian Confronts Technological Change* (2002).

99. Berthold Laufer, *The Prehistory of Aviation* (Chicago: Field Museum of Natural History, 1928), 10–11. As one earlier history of aviation exclaimed, "progress in aviation is not solely due to efforts of the present generation . . . but presents the process of a gradual evolution of ideas which have grown out of the imagination, endeavors, experiments, triumphs, and failures of many past ages . . . . There is no field of human exertions in which imagination and romantic dreams have played a greater role and have proved more fertile than in the development of aviation. Intuition, romance, and adventure are its leading motives . . . . This conquest goes back to

the trend of man's mind toward the romantic and adventurous. Describing merely the gradual perfection of mechanical devices does not make a complete history of aviation. It is the spirit and the idea behind the devices that count . . . . The idea itself means everything."

100. For example, see David F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (England: Oxford University Press, 1979), xix. Historian Noble wants to "demystify" all technology. Pisano seems fixated on demystifying aviation in particular (Dominick A. Pisano, "The Social and Cultural History of Aviation and Spaceflight, Part I," US Centennial of Flight Commission, accessed 27 July 2016, http://www.centennialofflight.net/essay/Social/SH-OV2.htm. Dominick A. Pisano, Thomas J. Dietz, and Joanne M. Gernstein, *Legend, Memory, and the Great War in the Air* (Seattle, WA: University of Washington Press, 1992).

101. Jacques Pouchepadass, "Pluralising Reason," *History and Theory* 41, no. 3 (Hoboken: Wiley Publishing, 2002), reviewing Dipesh Chakrabarty's *Provincializing Europe: Postcolonial Thought and Historical Difference* (Princeton, NJ: Princeton University Press, 2000).

102. Edgerton, "Innovation, Technology, or History"; Bruno Latour quoted in Philip Scranton, "Urgency, Uncertainty, and Innovation: Building Jet Engines in Postwar America," *Management & Organizational History* 1, no. 2 (1 May 2006): 129, https://doi.org/10.1177/1744935906064096; and Rosalind Williams, "Lewis Mumford's Technics and Civilization." *Technology and Culture* 43, no. 1 (2002): 147. This is Pacey's attention to "personal experience," Jeremy Black's call for more analysis of the impact of technology on morale, as well as Bruno Latour's desire to show humanists that machines are "cultural objects worthy of their attention and respect," while showing technologists "they cannot even conceive of a technological object without taking into account the mass of human beings with all their passions and politics and pitiful calculations, and that by becoming good sociologists and good humanists they can become better engineers and better informed decision makers" (Pacey, *Meaning in Technology*, 7–8; Jeremy Black, "Determinisms and Other Issues," *The Journal of Military History* 68, no. 4 (23 September 2004): 1220, https://doi.org/10.1353/jmh. 2004.0169; and Bruno Latour, *Aramis, or the Love of Technology* (Cambridge, MA: Harvard University Press, 1996), viii.

103. Eugene S. Ferguson, "Toward a Discipline of the History of Technology," *Technology and Culture* 15, no. 1 (1974): 21. Likewise, per Merritt Roe Smith, "Integral to this process of innovation is an enthusiasm for technological change that often borders on the fanatical . . . a compulsive interest in technically elegant problem, an almost childlike fascination for new things, and, of course, a patriotic commitment to national defense . . . . Such enthusiasm is a conspicuous feature of the West's ideology of progress, which so often manifests itself in the ideology of progress, which so often manifests itself in the institutional search for 'order' and 'system'" (Merritt Roe Smith, ed., *Military Enterprise and Technological Change,* Cambridge, MA: The MIT Press, 1985, 29).

104. James R. Hansen, "Aviation History in the Wider View," *Technology and Culture* 30, no. 3 (1 July 1989): 643-656 and Staudenmaier, "Rationality, Agency, Contingency," 173. By failing to embrace new methodologies and by not incorporating other disciplines, aviation history had, according to Hansen, failed to deliver a broad synthesis capable of making the field more "meaningful in the overall record of human existence."

105. Williams, "All That Is Solid Melts into Air," 667.

106. Dominick A. Pisano, "New Directions for the History of Aviation," *American Studies* 53, no. 3 (2014): 66; and Singer, *Like Sex with Gods*, 45. Pisano notes a "New Aerospace History" that is "committed to relating the subject to larger issues of soci-

ety, politics, and culture, taking a more sophisticated view of the science, technology, and individual projects than historians previously held."

107. Brooke Hindle, *Technology in Early America: Needs and Opportunities for Study* (Chapel Hill: University of North Carolina Press, 1966), 4–5, 10. Buchanan notes that "definitions that emphasize the 'earthy' quality of technology . . . ensure attention for the hard core of factual evidence by students of the history of technology. But they probably give too little attention to those aspects of technology such as knowledge, thought and design" (Buchanan, "Technology and History," 491). Wybo Houkes notes that, "after the publication of Walter Vincenti's *What Engineers Know and How They Know It* (1990), research concerning the nature of technological knowledge seems to have come to a standstill. Historians of technology have lost interest in the topic" (Houkes, "The Nature Of Technological Knowledge," 309).

108. Builder, *The Masks of War*, 32; and Singer, *Like Sex with Gods*, 3.

109. Edwards, *The Closed World*, xv, xiii. Roland notes that some of the most respected authors leave the box closed, including many works honored by SHOT awards (at the time, 6 of 11 Dexter Prize winners, 3 of 11 Usher Prize winners). He specifically cites Noble's *America by Design,* Layton's *Revolt of the Engineers* (Baltimore: Johns Hopkins University Press, 1971), Ruth Cowan's *More Work for Mother* (New York: Basic Books, 1983), and Walter McDougall's *Heavens and the Earth* (Baltimore: Johns Hopkins University Press, 1985).

110. Thomas J. Misa, "Theories of Technological Change: Parameters and Purposes," *Science, Technology, & Human Values* 17, no. 1 (1992): 3–12. Inspirations for this definition come from the works already cited by Eugene S. Ferguson, Thomas Hughes, Alex Roland, Brooke Hindle, and Arnold Pacey. Others include Thomas Misa, Robert Adams, and Johan Goudsblom; Robert M. Adams, *Paths of Fire* (Princeton, NJ: Princeton University Press, 1996); and Johan Goudsblom, *Fire and Civilization* (London: The PenguinPress, 1993).

111. Alfred W. Crosby, *Throwing Fire: Projectile Technology through History* (Cambridge, UK: University Press, 2010); Dougherty, *Prometheus*, 19.

112. The phrase "air power" means the ability to wage war in and through the air. Like in the Prussian military theorist Carl von Clausewitz's *On War*, the focus here is on fighting through the air ("air power") and not on other air power capabilities (e.g. airlift) or the other domains of "airpower" (i.e., space, and cyberspace) even though all missions and domains are increasingly vital for the employment of aircraft for kinetic effect.

113. Freedman, *Strategy: A History*, 42.

114. "Bia, Greek Goddess of Force, Might & Power," Theoi Project, accessed 2 July 2017, http://www.theoi.com/Daimon/Bia.html.

115. Hesiod, *Theogony*, 385–394. This element is also in the versions by Plato and Aeschylus.

116. Hesiod, *Theogony*, 886–900.

117. Atwill, *Rhetoric Reclaimed*, 50; and Hesiod, *Theogony*, 886, 924. In some versions, such as Pseudo-Apollodorus's *Bibliotheca*, it is Prometheus that is called upon to hit Zeus's skull. Another variation, relevant to this book, comes from the Orphic religion of ancient Greece. In their theogonies, Zeus is replaced by Dionysius who "represents the total unity of the dispersed, multiple, individualized, shifting world over which he comes to extend . . . of all the Greek deities, his is the only divine career which incorporates this alternating equilibrium, this oscillation between the one and the multiple, the same and the other, between the concentration of the whole and its dispersion . . . men can themselves return through Dionysus to the lost unity and

find once more the golden age" (Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 134).

118. Instead of seeking the singular Platonic ideal, this perspective follows the cardinal rule of improvisational acting: "yes, and . . ." (Chris Trew and Tami Nelson, *Improv Wins* (S.L.: lulu.com, 2013), 10, 118–20). That is, if asked to choose between science and art, between emotion and reason, between continuity and change, the answer is affirmative of both. The goal is not resolving paradox, but capitalizing upon it: stress, not stasis. The analogy with improv is fitting for a metaphor inspired by the same Greek god that is associated with early Greek theater (see chap. 1).

119. One of the risks of this transdisciplinary mash-up is the very incommensurability Thomas Kuhn highlighted in the process of paradigm shifts. In other words, while there is some validity in judging the import on the basis of utility alone (i.e., "is it useful?"; see footnotes 85 and 87 in chap. 1), the aspirant transdisciplinary scholar shoulders the burden of doing justice to the original intent of authors with disparate purposes, styles, and terminology. Indeed, the resulting need for nuance (and thus academic peril) is a likely reason academic specialization is difficult to resist. A minor objective of this project is to, like Airmen, get comfortable with the risk of playing in these interstitial spaces.

120. Williams, "Opening the Big Box," 104.

Chapter 1

Dionysius and the Social Life of World War I Aviators

Figure 1. Bonne Chance by James Dietz. The background portrays a French country house repurposed to serve as the unit's mess. A copy of this print served as inspiration for the 27th Fighter School to renovate their squadron bar in 2001. Harkening back to the role of useful fictions, even though the artist's inspiration came from a Hollywood film and not from a historically accurate scene, it still captures the essence of such places.[1]

> *A natural place to examine an organization's culture is at its birth. Therefore, one key to understanding Airmen as technological users is their experiences in World War I. The machines and missions are well documented. But among historians there is relative silence on the vast amount of time spent between flights. Examining the stories written by Airmen themselves, however, reveals a clear sense of playfulness despite the gravity of their duties and the technical nature of their craft. Indeed, the mechanical properties of their weapon produced a tempo of war that afforded aircrew time to play in a variety of forms. The descriptions of some activities are reminiscent of notorious episodes of modern aviators. Another, more subtle and substantial practice emerges: a form of cognitive play increasingly valued for its ability to inspire, teach, and make sense of a messy world; a type of* techne *that would be familiar to ancient Greeks; and the very source of this chapter's primary evidence: storytelling.*

Introduction

In 2012, an enlisted member of a USAF fighter squadron at Shaw Air Force Base (AFB) filed an administrative complaint for systemic and intentional sexual discrimination. As evidence of the unprofessional environment, the claimant cited unit books containing "obscene, violent, and misogynistic language and pornographic images"; written recordings of unit stories; and the practice of singing explicit songs, some celebrating sexual acts.[2]

The accusation was reminiscent of the scandal surrounding the 1991 Tailhook convention. The annual meetings of the Tailhook Association, an organization of US naval aviators, had a reputation for cultivating "boorish, reckless, and misogynistic" behavior.[3] At this meeting in Las Vegas, allegations of sexual assault precipitated additional revelations of unprofessional activities such as indecent exposure or drunk and disorderly conduct.

Those who defended the Navy flyers portrayed their actions as natural traditions. James Webb, a combat veteran from Vietnam and previous secretary of the Navy, defended it as a consequence of the vital "warrior culture."[4] Another defender was more explicit, writing to a newspaper, "Perhaps they don't understand this happens to be a normal occurrence in any social gathering but with a lot more intensity when pilots are partying . . . . Pilots by nature are energetic, competitive, aggressive, and perhaps a little egocentric. Pilots party when they have the opportunity."[5]

The earlier scandal garnered more national attention, but the reaction to the 2012 Shaw AFB incident was similar. Many, in uniform and out, recoiled. Some, however, retrenched. Indeed, the evidence itself preemptively disclaims "this book is our thoughts, our songs and our games . . . . The songs contained in this book are held as sacred by those of us that have [flown fighter aircraft]. Those people [who have not flown fighters] do not know, nor will ever know what it means to be a fighter pilot. This book is not for them . . . it is for us! *The Fighter Pilot's Handbook* is a collection of over 75 years of tradition."[6]

Many other flyers also trace the origins of their culture to World War I. In many ways, this is logical—there were simply no military flying traditions to draw from before the Great War. Additionally, organizational founders always have a disproportionate influence on a group's culture.[7] The foundational role of World War I is echoed in scholarly treatments of aviation as well. For example, in *The First Air*

War, historian Lee Kennett notes that World War I "endowed [military aviation] with a past that was rich and storied, for all its brevity. The aviators had stocked their pantheon with heroes, and the war left them a harvest of totems and traditions to be honored."[8]

Some of those traditions—addressed only briefly by historians, if at all—are about what airmen did when not flying. Unit histories, diaries, memoirs, and personal letters reveal that early flyers did indeed exhibit a sense of playfulness, often to an extreme degree. These sources expose reckless debauchery, philandering, and contests of masculine physicality, along with less offensive practices. Their barbaric behavior, what Kennett likens to a fraternity house, sits at odds with the modernity of their aircraft.[9] The social life of World War I aircrews, however, was shaped by aviation technology, not in spite of it. By way of explanation, this juxtaposition should not appear contradictory but inherent among military airmen who operate in the overlap between the worlds of Apollo and Dionysius.

Many authors use the two gods as metaphors, with the Apollonian realm representing the rational and ordered and the Dionysian image representing the artistic, intuitive, and emotional.[10] The former is "measured, balanced, rational, imbued with reason and self-restraint."[11] It invokes Plato's concept of forms, in which the philosopher seeks to grasp "those changeless, eternal, and nonmaterial essences of patterns of which the actual visible objects we see are only poor copies."[12] Uncovering those immortal principles is an endeavor suitable only for an advanced thinker to undertake and not necessarily achievable for those poor souls stuck inside the cave of illusions. Like the image of Socrates escaping the shadows, the Apollonian model pursues ideas abstracted from context as well as knowledge abstracted from values. The search is for universals, not particulars, and explanations, not observations. The paradigm presumes that a complicated object or process or concept can be broken down into its constituent parts. Studying the individual parts and the causal relationships between them reveals the whole. Over time, the story of reason over passion and control over chaos became a story of science prevailing over intuition, scientific methodology over myth, and purposefulness over playfulness. Order and objectivity reign supreme in the Apollonian perspective.

This perspective assumes humans themselves are most productive when emotion and passion do not cloud their ability to think rationally and perceive the world objectively. This is the paradigm of Plato,

but it is important to note that qualification: it is still only a paradigm. It is only one paradigm, and like all paradigms, it is *partial (*both incomplete and biased).

An alternative perspective is the Dionysian force. It is described as "visceral, wild, untamed, hard to understand, emerging from the inner layers of our selves;" the realm of uncertainty, variability, chaos, volatility, randomness, and error that values the "rich texture of empiricism" and the opportunity to "gain from disorder."[13] This view embraces a dynamic world of intersubjectivity, artistry, intuition, mystery, passion, adaptability, novelty, and surprise.[14] Philosopher Martha Nussbaum points out that Dionysius is the only Greek god who is not self-sufficient and who dies: he is "no use for teaching young citizens the 'god's eye' point of view." His ritual death and resurrection "suggests that an unstable city, an unstable passion, might grow and flourish in a way truly appropriate to a god—a thought that has no place in the theology of [Plato's] ideal city."[15]

In the last century, the Dionysian perspective has gained traction throughout academia and popular culture. In science, new approaches such as Chaos Theory and Complexity Theory directly challenge Apollonian assumptions of linearity and mechanical determinism. Organizational theorists increasingly embrace what T. Irene Sanders describes as the "shift from a deterministic universe of atomistic agents to a dynamic world of inter-subjectivity, from rigid hierarchies to adaptive networks, from reductionism to synergism, from rational and discrete planning to reflective practice and emergent opportunities."[16] Likewise, Bart Kosko describes an increasing appreciation for informal logic, much neglected in formal education, which resists binary thinking and philosophical uniformity in favor of nuance, relativity, and ad hoc approaches.[17] New images also emerged in other fields as well, such as biology, sociology, political science, and psychology.[18] Even a core presumption of economic theory, that individuals maximize value through rational and self-interested actions, has been questioned to the degree that some characterize *homo economicus* as a psychopath.[19] The American defense establishment is also increasingly explicit about the Dionysian nature of modern warfare. Consider the frequent reference to VUCA (an acronym for "volatile, uncertain, complex, and ambiguous" situations), the increasing focus on the human domain, and the use of the concept of wicked problems in official documents.[20]

These approaches, in and out of the military context, offer a new framework to account for a growing list of anomalies in the Apollonian paradigm: the fundamentally social nature of humanity, the central role of emotions and values in cognition, the inability to understand a whole by isolating its components, the futility of master plans, and the value of play as a fundamental activity of humanity.

Despite the seriousness of a dangerous world, the Dionysian image implies a role for play, which is the very activity associated with the Greek god.[21] While Dionysius is also known for representing forces of ecstasy, fertility, lushness, and winemaking, these are all directly connected to the festivals honoring the patron god of Greek theater. In Athens, festivals to honor Dionysius became widespread in the 6th century BCE. These celebrations, known as *Dionysia*, centered around competitions among poets and storytellers. The events were also known for dancing, music, sports, and wild revelry. The participants, which even included members of the upper class, believed this intoxicated masquerading provided catharsis and creative inspiration.[22] The experience, according to historian E. R. Dodd, produced an "abnormal inner experience" and inspired "poetry as a revelation apart from reason and above reason."[23] Nussbaum summarizes the symbolism as "a supple, flowing structure that moves in, and takes its character from, darkness and mystery; a speech that is humanly artful, and yet responsive to strangeness . . . the power of the strange and sudden; of the world's indissoluble intermingling of ecstasy and danger, of light and shadow."[24] Plato, unsurprisingly, was not impressed by much of what occurred and disparaged it as uncivilized.[25]

In contrast to Plato's ideal of dispassionate order and cold logic, *Dionysia* were all about *play. T*he term captures what happened in, around, before, and after the theatrical performances held in Dionysius's name. There are some indications that it also describes air combat missions. One aviator, whose words capture the feelings of many, proclaimed aerial combat as "the greatest form of sport on Earth."[26] Images of airmen as heroic knights jousting in a competition are commonly recorded in the many histories of World War I aviation. Yet, what is mostly missing from the vast historiography—and what is even more playful—is what they did when not airborne.

The Playfulness of World War I Airmen

Flying units were organized into squadrons of approximately 10 to 20 young men with a dozen or so aircraft located at a single aerodrome. Currently, no scholarly treatments focus on the daily life around the airfield. At most, there are only brief references to what World War I aviators did when not airborne, such as when Kennett describes squadron life as *Bacchanalia,* the Roman equivalent of *Dionysia*.[27] In the view of one observer in the Royal Flying Corps (RFC), "the RFC began by being a party, and continued being a party."[28]

Despite these characterizations, sometimes time on the ground was spent quietly. When not flying, [we] "did nothing but lounge about with your hands in your pockets," according to one veteran.[29] The diary of an English flyer, Guy M. Knocker, recalls trips to the movies and to the eventual construction of their own cinema on the airfield.[30] Going to church, reading, playing card games, or dining in nearby cities were other common diversions. Knocker wrote that these activities "provided sufficient relaxation into which everyone entered with gusto . . . . This appealed to me as the most comfortable method of waging war . . . . In the evenings, it was our custom to sit round the tennis court listening to the gramophone and arguing about theatres, sports and the war."[31] In airmen's diaries and letters, however, what gets as much attention as these quiet hobbies is time spent singing, dancing, playing sports, drinking, and even theater—all actions reminiscent of Dionysian revelry.

Sometimes the records just allude to Dionysian behavior. Quoting from a member's diary of the time, one squadron history notes: "Every night we have our usual music and games. Some nights it gets more riotous than others."[32] Often the evidence is more explicit. One pilot's diary entry simply recorded, "Binge after dinner. Sang a 'wee DD'!" Again on Christmas Eve he noted, "To dinner at the Club. All 70 squadrons there—Huge show! Stood on tables and sang songs."[33] Another describes a drinking game involving a liquor-soaked sponge pressed upon an individual's head, which devolved into a wrestling match. "They collapsed, chairs dripping, tunics soaking, walls running, laughing, shouting, swearing, on to the puddled floor" before someone then poured whisky down the gramophone. "This was the life!" the author proclaimed.[34]

Sometimes the drunken antics spilled over into flying. Once a newfound source of booze led to mass midday inebriation. The group

then decided to play an aerial version of follow-the-leader. Eighteen of the unit's pilots went weaving around the aerodrome until one of them decided it would be more fun to repeatedly buzz a visiting general who was surveying the runway.[35]

Singing was another popular pastime. Unit histories often contain a list of their own personalized tunes. The 135th Aero Squadron (AS) history lists nine pages of their "new crop of songs, inspired by our recent experiences, [in] the manner of ancient ballads."[36] Some squadrons had an official group of singers, and one commander even built a respectable orchestra by having experienced musicians transferred into his unit.[37]

Squadrons were equally interested in manning respectable sports teams. Baseball games between units were common, as were tennis and soccer. Where facilities did not exist, some took the effort to construct them. One RFC pilot writes about building a swimming pool and a tennis court. Another pilot started a horseback riding school. The same man's diary from 6 September 1917 is particularly interesting for the banal juxtaposition of combat and recreation: "I saw an [aircraft] brought down in flames. It was a ghastly sight and we saw the two occupants fall out. I played badminton in the evening."[38] In a reflection of many of these activities, another pilot recorded these lines in his 18 May 1918 diary entry: "umpired a ball game between the officers of the two squadrons," then, after recounting the menu, he continued, "[dinner was] interspersed with songs, cheers, a strong orchestra . . . and some very good dancing by a young pilot . . . . Truly does not seem like war. Well, it is a good thing to forget it occasionally."[39] The only regular distraction airmen enjoyed that he did not mention was theater.

In addition to enjoying Parisian theaters on occasion, units often staged their own theatrical performances. The 20 AS history reports shows occurring on a nearly weekly basis.[40] Sometimes travelling troupes provided the entertainment, but some units had their own ensembles ranging from vaudeville acts to fully rehearsed, fully costumed musical dramas.[41]

"The way of life of those days," one British aviator recorded later, "was governed by a very simple formula, obviously countenanced and backed by authority on high: 'Carry out your flying to the utmost limit of your endurance. Apart from that, get all the fun that you can.'"[42] Sometimes that fun was found in France's large metropolitan cities. The author of *The Unsubstantial Air,* himself a World War II pilot, contends that time "spent in Paris [during World War I] sounds

more like binges than parties."[43] When weather prevented the 95 AS from departing the capital, most of them took in a show at the La Femina Theatre "where they witnessed a show that [one] described as 'the rottenness exhibition of naked women I've ever seen on stage.' " When they were unable to depart for two more days "women, wine, and theatres" were their companions (except for the one "puritanical" member of their group).[44]

Some Allied aircrews were fortunate enough to be stationed close to the French capital. In April 1918, a flyer assigned to nearby Orly Field discovered a favorite bar which even the imposition of German bombers could not close.[45] Other big cities were also popular destinations. The Liegeoise café in Nancy is mentioned in multiple memoirs. "Many happy afternoons and evenings were passed [at the café] eating, drinking and visiting with aviators from other squadrons and French officers who happened to be present . . . two of the local sirens, were always on hand to entertain, and were seemingly impressed by our group singing."[46] After the café was destroyed in a bombing attack, one squadron claimed the surviving couch and piano for its own airfield.[47]

Many of the airfields, however, were much more remote. For them, the best entertainment was at a nearby village or sometimes the hospitality of a local farmer. For their part, the members of the 95 AS began socializing with the nurses at dances sponsored by a US hospital close by.[48]

The Unit Mess

Regardless of the availability of party spots outside the airfield, each unit had a common area for its social gatherings. The officer's mess was part dining area, part gathering place, and part ready room for aircrew on alert. It was also a bar and the scene of much of the singing, dancing, drinking, and roughhousing described above. Some sources note that the first thing a unit would do upon arrival at a new airfield was to set up the mess. These spaces, one participant observed, allowed for a "a good life" of "peacetime warfare."[49]

Each nation's flying units had these places which originated from the traditional practice of Army officers dining together while on campaign (and air forces worldwide largely arose from their nations' armies). For the French airmen, it was called the *popote.* For German flyers, the name was indicative of the type of activities contained within: the *kasino*. In fact, its origins can be traced back to time of

Homer. In Plutarch's *Life of Lycurgus,* he described how the Spartan ruler instituted mandatory communal meals among his soldiers. These common messes, or *syssitia*, were designed to boost camaraderie and acculturate young warriors.[50]

Like the Spartan dining halls, airfields were located away from the battlefield. Typically 15 to 20 miles behind the front lines, airmen were far from the immediate effects of trench warfare. Stagnation of the Western front meant that squadrons could expect to remain in the rudimentary accommodations for long periods of time.[51] When the battle lines became more fluid again, at least one pilot bemoaned the inconvenience in a letter home: "All squadrons are moving up, and we are more or less prepared to live in discomfort for some time. It will be canvas tents when we move up, they say. Canvas, in November! Ugh!"[52]

Attachment to their familiar airfield was strengthened by the unit's great efforts to make their mess as comfortable as possible. As one unit history recorded: "Anyone surprising us between patrols in those first weeks would have seen pilots and commanding officers standing on trestle-tables or piled gasoline boxes, painting the ceiling of the shack white and the little beams a pale green, or busily laying old canvas on the rough floor. They did not despise comfort and some touch of beauty. They came in from fighting the Hun to roll the tennis court—an operation that consisted in dragging an old cement beam behind a Fiat truck round and round in the mud in front of the Mess."[53]

This particular American unit even made trips to Calais for furnishings, including artwork, musical instruments, and droplights made from polished shell cases. Likewise, consider this firsthand description of a Royal Flying Corps mess and its resident activities:

> [It] was no more than a glorified hut, though it had its only charm—with a couple of well-worn settees and some easy chairs crowding about a half-size billiard-table, an upright piano in the corner where the Squadron orchestra gathered on guest night, at the far end the cast-iron stove that roared red-hot on wintry days; against one wall papers and magazines littered a table next to the narrow doorway through which, before dinner, the mess orderly shuttled incessantly bearing trays of tepid drinks; in the opposite wall the wider, main door led out to the long porch where, off duty, the pilots loitered swopping tales of combat or yarns of home. In this rectangular, green-painted hut that had accompanied the Squadron from field to field and had

> echoed to many a youthful voice once keen, now forever silent, there hung in those days a three-ply board simply framed. Above it was fixed a propeller from a captured aircraft; black canvas crosses cut from other vanquished enemies dropped to either side; and upon the board itself were inscribed the score or so names of those who had won distinctions since the Squadron's first forming.[54]

Decorating with war trophies was common in other squadrons, as well. Despite the protests of intelligence officers, downed enemy airplanes were quickly scavenged to adorn the mess. As one author describes, "Many a mess in the American air service had cut-out black crosses, numbers, unit markings, propellers, and instruments adorning their walls."[55]

Pictures of women were also common. The mess in Hubert Griffith's unit had an "everlasting series of mild pornographies from the '*Vie Parisienne*' decorating their walls."[56] Another airman wrote, "In the Mess at the aerodrome hung a half a dozen Kirchner drawings, showing exquisite creatures in various states of nudity—but never, of course, quite nude or all the illusion would be gone."[57]

While big cities and local bars were the scene of many of their antics, the mess is the most commonly referenced location for airmen to exhibit Dionysian behavior. Although the quality of the food or drink may not have warranted a celebration worthy of the god of winemaking, "what was lacking in quality was made up for in quantity, and the spirit of gaiety which invariably ruled compensated for the want of variety."[58] In addition to the drinking, there were the rowdy singsongs: "the Mess is in an awful state, everyone crashing about singing!"[59]

In the records, some units seem tamer than others. The 17th AS history states:

> There were unwritten rules of the Mess. One had to be more or less dressed for dinner; one had to come up to the [Commanding Officer] and formally apologize if one were late; one did not begin one's soup until he did; one did not light a cigar or cigarette until he had lighted his . . . . No excuse was valid for breaking any of these rules, or by speech or act disturbing the decorum of the Mess. Not that we were quiet or gloomy. Far from it! We soothed our digestion with laughter and endless poking fun at one another. And nothing brought forth such peals of merriment as the infraction, though thoughtlessness, of any of our

> rules. The offender bought drinks or cigars or both all around, depending upon the gravity of his crime, to shouts of "Randolph, Randolph, take an order!"[60]

When the 135 AS finished dinner, the officer in charge of the mess "would solemnly rise and pound on the table for order, and when all was quiet would announce, 'Gentlemen, there will be music and games in the Red Cross hut.'"[61]

Contrast that example with Squadron No. 216, the Bedouins, the same unit that stole the piano and couch from the Liegeoise café: "The senior officer in the squadron was the 'Chief of the Bedouins.' We had all sorts of rituals. We had a 'sacred camel' made from esparto grass. The chief wore a 'sacred blanket' and he had a hunting horn. When he blew his horn, it was the signal for a sing-song or a get-together."[62]

None of these descriptions should insinuate a lack of intensity in aerial combat. First, consider the environment of a World War I airplane. There was noise and vibration from an unmuffled engine only feet away. The open-air, unheated cockpits exposed the aircrew to wind at high speeds, exacerbating the frigid temperatures of higher altitudes. Then there was the act of trying to control these crude machines. Flying required deft skills and more than a little muscle to compensate for aerodynamic forces pressing back against the control surfaces and against the propeller's torque, which threatened to send the nose slicing to the side.[63] Now add to this the actual combat; the hunters on constant alert for their targets, and all aircraft on constant alert to avoid becoming a target themselves. Then, once engaged in a fight, the episode may only last a few minutes. But it was a blurred, three-dimensional melee of men pushing their machines, and themselves, to the limits.

Arguably, this environment attracted young men who were bold, adventurous, and resistant to military discipline.[64] One pilot noted this logic in his journal, "Can you imagine a lot of boys—naturally wild or they wouldn't be in this game."[65] This served them well in the uncharted domain of aerial warfare, where such characteristics fit the context. Indeed, the social life of World War I aviators can be partially explained as a spillover of their approach to airborne operations. History, however, is silent on how their playfulness in the mess was also determined by the rhythm of aerial combat—a tempo shaped by the nature of aviation technology.

The Tempo of War

For the armed forces engaged in World War I, there was no break in the fighting season and units remained in the throes of combat until rotated off the front lines. The overall war effort was continuous. For airmen, however, the fighting was intermittent. And for them, this was one of the "many compensations" for the risky business of flying combat missions. According to that same airman, "When we returned to the aerodrome our war was over. We had a bed, a bath, a mess with good food, and peace until the next patrol."[66]

There were periods, days or even weeks long, with little flying.[67] Even during normal periods of operations, though, aviators' memoirs noted the undulating rhythm. One British airman observed, "If one believes his account of his own doings, he divides his time fairly equally between lounging idly in his billet, playing frivolous or deleterious games of chance, and amusing himself vainly in the nearest big town. Occasionally he spends a while in being horribly frightened over the enemy's lines."[68] Another relayed a fellow pilot's "idyllic" description of daily life in a flying squadron: " 'First we went bathing, and then we did some flying; then we went out shooting rabbits, and then we saw a swarm of bees and went bee-taking' . . . . The life half hectic and half pastoral!"[69] "We always had plenty of spare time, so we thoroughly enjoyed it," one airman recalled.[70]

According to historian Peter Liddle, it is too simplistic to say, "in contrast to the soldier, the airman lived at peace and went daily to war, he slept and ate under civilized conditions undisturbed by the war and then during the day visited the war, became a part of it but even then detached from it." This caricature, however, does have a tinge of fidelity and Liddle asserts airmen "would almost certainly recognize it as having a fundamental basis of truth."[71] One such writer poetically recorded these corroborating lines: "So the days went hurrying along. Days of sunshine, flying bullets, and excitement. Days of rain, mud, reading and 'bunk fatigue.' Sporadic outbursts of drinking, periods of revulsion and temperance. Nights of wild hilarity and mornings of 'hangovers' and depression."[72]

This tempo was also noted in the observations of nonflyers. For instance, a medical manual included this analysis of airmen, based on both world wars:

> Physical stress of combat is severe but not as prolonged or as debilitating as the physical strain to which combat troops on the ground experience: long marches, little sleep, many hours of fighting, inadequate food, mud, insects, rain, noise; in contrast, air warfare stress is intermittent rather than continual, and in general much less exhausting. When not on a combat mission, they are usually in safe and comparatively comfortable quarters . . . . As a general rule, they sleep away from the sounds of gunfire, and have a fair opportunity for rest and relaxation in their bivouac areas. Boredom is usually more of a problem than acute discomfort.[73]

The rhythm of air warfare was determined by the nature of their technology. First, the range and speed of airplanes afforded air forces the advantage of staging themselves away from the front lines. The fragility of their craft, essential for them to perform well in flight, necessitated a retreat to such relative safety as well. Other weaknesses shaped the tempo as well. For example, flight times were limited by the aircraft's fuel capacity or mechanical problems. The inhospitable nature of the air domain and the expense of replacing aircraft and crew required more caution than ground-based assets did. For the same reasons, airmen were required to depart a fight if outnumbered, which could easily happen since air power lacked the persistence of land forces. In other words, the inability to hold territory meant that any given piece of sky in the combat zone could be filled with either side's aircraft. Often those skies were simply empty as sorties cancelled due to the inability to fly in bad weather, the need to repair aircraft, or inadequate communication with the supported forces on the ground.

Interestingly, this pattern of fighting—moments of intensity followed by extended periods of tranquility—was not novel. Aviation technology, as modern as it was, facilitated a return to a tempo familiar in the history of war. Tribal warfare, for instance, was dominated by brief raids. Even in the midst of battle, primitive fighters sometimes agreed to pause their confrontations to rest or avoid bad weather.[74] Likewise, Greek fighters left the battlefield to recover or consolidate captured goods.[75] The timing of battles ensured copious time between fights as well. Some scholars even assert the emergence of a distinct Western way of war in which horrific, but sporadic, confrontations became the conventional means of deciding political contests.[76]

Ancient warriors and World War I flyers did not just share the same episodic pattern of fighting. They also participated in some of the same Dionysian behaviors. For instance, Spartan *syssitia* required its members to undergo rites of initiation before they could participate in moderate drinking, singing traditional paeans, and endure harsh commentary from the appointed jester.[77] Victor David Hansen's book, *The Western Way of War*, has an entire chapter on the role of alcohol and ancient warfare. Yet, there is one other shared behavior that has not yet been mentioned: telling stories. Communal bonds among prehistorical people as well as ancient Greeks were strengthened by storytelling, and those stories often spun tales of fighting. The earliest known oral epics, including Homer's works, revolve around their characters performing such acts of oratory *techne*, as well as being exemplary stories themselves.[78] Modern airmen are still known for their vivid storytelling.[79]

Telling meaningful stories is inherently subjective, creative, and tacit—the exact opposite values of the Apollonian mode of thinking. Furthermore, storytelling is a form of playful thinking, as the next section explains, which further strengthens the connection between airmen and Dionysius.

Storytelling

In *On the Origin of Stories,* Brian Boyd argues that storytelling, like all art, is an adaptive function founded on the mammalian instinct for play. Animals that play do so because playful activity enhances the fitness of their species, and thus those animals have evolved to intrinsically enjoy it.[80] Its self-rewarding nature ensures the practice is repeated. Repetition reinforces neural pathways, creating an evolutionary advantage by strengthening skills applicable to that species' niche.

For mammals, physical play is a critical component of childhood development. But humans also play, and play for much longer throughout their life in the domain we command: the so-called cognitive niche. Our evolutionary advantages in this niche accrue from intelligent decisions. Thus, we instinctually yearn for information, particularly anything that reveals a pattern.[81] The most significant example of cognitive play is stories.[82]

Stories do not have to be devoid of emotion or perfectly accurate to be useful. As long as they find a story to be internally coherent,

relevant to one's life, faithful to one's perspective of reality, and in accordance with one's culture and character, humans innately expect a story to contain valuable insight.[83]

Storytelling, in fact, is not just a practice. It is its own form of reasoning, a narrative intelligence on par with other types of intelligence (social, emotional, and so on). Walter Fisher, political scientist and communications scholar, labels this the logic of good reasons. Good reasons come from what we subjectively *feel* to be true and useful and valuable. Specifically, they are *good*, as in persuasive, as well as *good*, as in appealing to our sense of morality.[84] This form of reasoning still has a place for Platonic logic.

Like the word *logos* before Plato, this rationality is never purely objective or ordered, though it sometimes is. Apollonian phenomena are puzzles to be solved by technical discourse. The puzzle-solving techniques are highly specialized. Experts in specific domains of knowledge are masters of arguing in accordance with the conventions of their discipline.[85] Still, answers to technical arguments are subsumed by the larger question of "so, what?": what is the value of that puzzle's solution? The answer to this question is always subjective and hence based on the logic of good reasons. In other words, the logic of reasons provides insights on things but fails to account for understanding people. And we need knowledge of both realms: the truth, as partial as it will be, and how this incomplete and biased knowledge is invested with meaning.[86]

This issue of verisimilitude gets to the heart of the matter: the deeper contribution of stories lies not in their factual data but with the fact that the process itself is formative. Facts cannot function without values; values are formed intersubjectively; and intersubjective communication is founded on stories.

Stories told among a group may have begun with gossip as a form of "verbal grooming:" quasi-truths tracking members' relationships and moral transgressions.[87] The cognitive ability to track that social data strengthened our ability to hold each other's attention. It also enhanced our capacity for mental dexterity, since social interactions are contextual, variable, and unpredictable—the very traits denied by the Apollonian perspective in its search for universal truths.

To Plato's chagrin, however, timeless truth is not the only—nor the central—issue. Of course, to invoke these benefits, stories must be true *enough*. Verisimilitude, the *appearance* of accuracy, trumps veracity. We do not, and should not, obsess over truth when it comes to

storytelling. In fact, accuracy can subvert the power of a story because surprise and intensity come easier outside the conventions of factuality.[88] Furthermore, these attractive qualities drive us to devote our mental resources to a story, to pay attention. Engagement can be a worthy investment.

"Our compulsion to tell and listen to stories with no relation to the here and now or even to any real past," Boyd writes, "improves our capacity to think in the evolutionary novel, complex, and strategically invaluable way[s]." He continues, "By developing our ability to think beyond the here and now, storytelling helps us not to *override* the given, but to be less restricted by it, to cope with it more flexibly and on something more like our own terms."[89] This directly contributes to the ability to follow Gareth Morgan's advice to remain unattached to any one image, to cultivate a "mosaic of competing and complementary insights."[90] It allows what Albert Einstein called "combinatory play."[91]

Stories provide "an ancient virtual reality technology that specializes in simulating human problems."[92] These vicarious experiences then combine with firsthand experiences to generate theories about ourselves and others and how to prevail in the world around us. Flexibility, agility, and adaptability are precisely the appropriate reactions to the contextual, subjective regime of Dionysius. Wisdom is thus accumulated playfully, that is, by wandering and wondering.

Dionysian logic fulfills F. Scott Fitzgerald's criteria for "first rate intelligence:" holding "two opposed ideas in the mind at the same time and still retain[ing] the ability to function."[93] From the Platonic view, this kaleidoscopic approach is illogical. From an artist's view, it is irreplaceable.

What we gain from stories is a way to navigate and nudge the world in strategic and novel ways. The ability to mentally grasp other people, their intentions, their capabilities, their relationships, and their social status is possibly the single greatest benefit of our advanced intelligence.[94] It is a practice and mode of thought enjoyed, in fact, by early airmen as they occupied the space between Dionysius and Apollo.

Stories of Storytelling

In addition to the more boisterous activities, flyers also practiced another form of play: they were rabid storytellers. Indeed, the practice of exchanging stories, or "hanger flying," remains a part of avia-

tion culture. It is how some defend the utility of gatherings such as the Tailhook Convention and Friday night "roll calls" in USAF fighter squadron bars. For example, in an article unrelated to either scandal, one general officer wrote in 2000, "I'm a firm believer that aviators learn more from experiences than we do from books. Exchanging a 'There I was . . .' or 'war' story is an extremely valuable, time-honored part of a flyer's education. By learning from other people's experiences we hopefully don't have to learn the hard way. There are very few new ways of crashing planes; it's simply new pilots repeating old mistakes they personally haven't yet experienced."[95] This pedagogical function served a valuable purpose during the early years of military aviation and the practice started with an airman's first days of flight school.

Consider the letters and sketches of Penrose Vass Stout, a member of the 27th Pursuit Squadron. One of his pencil drawings of stateside training depicts young men engaged in conversation with the caption, "Barracks flying is the favorite sport of the cadet."[96] The phrase comes up again in Harold Buckley's colorful description of the tradition of telling each other stories about the day's sorties:

> Among other simple pleasures "barracks flying" was in high favor. This rehashing of the exciting moments of the day, close calls, hairbreadth escapes, forced landings, and crack-ups, was a favorite pastime with all of us, though with some it was really a disease. The heroes of the various episodes recounted minute descriptions of all that had happened, losing nothing in the telling. Agile hands described the exact position of the plane at each instant, agile brains retold their innermost emotions at every stage, and throughout the modest refrain, the masterful skill and airmanship which had saved the day, were plain to be seen. It was marvelous, the dare-devil and death-defying stunts which took place every night around the big iron stove . . . all of us did the best flying of our careers right then, comfortable and warm, with both feet on the ground.[97]

Once in combat, the practice continued and with more grist for the storyteller's mill.

Most days of the war—at least those days when they were not grounded by meteorological or mechanical woes—had a similar rhythm for World War I aircrew. After preparatory briefings, aircraft were given their preflight inspections. After the mission, the aircraft

were inspected for battle damage or mechanical issues. Once debrief reports were filed, the mess was typically the next stop. One aviator recorded their daily routine in his 1917 book, *An Airman's Outings:* "Dinner over, the usual crowd settle around the card-table, and the gramophone churns out the same old tunes . . . . From the babel of yarning emerges the voice of our licensed liar."[98] Similarly, another pilot wrote: "We land, piece together our report, and count the bullet-holes on the machines. In ten minutes' time you will find us around the mess-table, reconstructing the fight over late afternoon tea."[99]

As more and more replacement pilots—with less and less experience—filled vacancies in frontline squadrons, "dinner-table conferences on tactics" offered valuable, if vicarious, training.[100] New pilots lacked combat experience, and flying was so new that all aviators were essentially test pilots. Aircrews were constantly trying out new techniques—including how to position the aptly named "joy-stick"—and pushing the limits of their crude machines.[101] The dearth of written instructional materials and the inability to communicate verbally while airborne meant that learning came in the form of stories.[102] Thus, the mess was the scene of "everlasting technical 'shop' talk—about the behaviour of aircraft in the air, the best ways of directing an artillery shoot, at what speed [our aircraft] could be made to dive without its wings folding back and dropping off . . . and so forth and so on."[103]

Not only was every piece of information useful to their survival, but it also contributed to their morale and shared identity. In fact, the 50 AS unit history catalogs a corpus of "wild tales" apparently so familiar that the author felt it sufficient to reference each one using only a single fragmentary phrase (e.g., "the famous 'Zumm' [Sain] and [Thompson] made over the hanger," "how 'Bill' Frayne got his burning plane down," or how two of them "raised hell with the Hun troops and artillery on the road near Sy").[104]

The 135 AS history describes a pilot's retelling of a kill "with great histrionic ability, simulating the tactics of the Hun by spreading his arms out and bending at impossible angles, and then grabbing for his pair of imaginary machine guns and firing them with devastating effect. An added touch of realism was once provided when he lost his balance and fell to the floor."[105] Another flyer proclaimed:

> I have listened to an incalculable number of hundreds of hours' conversation based on the technique of flying, and particularly of active-service flying—the takeoff, the landing, the navigation

> during the voyage, how to spot [the enemy] in the distance, how to deal with (or avoid) [the enemy] once spotted, the respective advantages of close-formation and of open formation when flying in company—and because all the talk was "vital" talk, in the sense that one's own and other people's lives depended on its conclusions, and also, perhaps, because a crisp, lucid and racy vernacular seems to be the peculiar inheritance of all who fly in the air—I have never been bored by a single second of it.[106]

Frequent practice apparently made them proficient storytellers, at least in their own self-assured calculations.

Conclusion

Among early aviators, there was no shortage of writers or poets to weave Dionysian tales about their Apollonian machines. Their storytelling did not end with the war, either. Indeed, the evidence for play—of all types—comes largely from the stories World War I airmen continued to tell after the conflict. Their letters, diaries, memoirs, and squadron histories, whether written for themselves or others, at the time or years later, for entertainment or for posterity, are exemplars of airmen as both *homo narrans* and *homo ludens*. And, by virtue of how technology facilitated these behaviors, these airmen highlight the techno-social nexus of life as *homo faber*.

Aviation did not just have this effect on flyers, either. The airplane became a cultural phenomenon across Western civilization. The impact of the technology was, in fact, aided by stories such as those told by these aviators. This technologically constructed social world is the subject of the next chapter. It will demonstrate how the perspective conferred by aviation—the mode of thought manifested in airmen's storytelling—fuses the technical and the poetic, the practical with the playful.

Notes

1. James Dietz, email to author, 2 November 2015.

2. "Complaint," TSgt Jennifer Smith Administrative Complaint, accessed 11 December 2015,http://protectourdefenders.com/downloads/Final_Smith_Admin_Complaint.pdf. A professionally produced video, available online, shows the 95 FS engaged in similar actions circa 2001 ("Eagle Rage," accessed October 25, 2015, http://www.youtube.com).

3. Peter Karsten, *Encyclopedia of War and American Society* (Thousand Oaks, CA: SAGE Publications, 2005), 817.

4. Karsten, 818.

5. D. A. Walden, "In Defense of 'Tailhook' Participants," *The Telegraph,* 26 May 1993, accessed 21 November 2015, https://news.google.com/.

6. TSgt Jennifer Smith Administrative Complaint, accessed 11 December 2015 http://protectourdefenders.com/downloads/Smith_ExhibitSelects_20121101.pdf.

7. Edgar H. Schein, *Organizational Culture and Leadership*, 4th ed. (San Francisco: Jossey-Bass, 2010), 3.

8. Lee B Kennett, *The First Air War 1914–1918* (New York: Simon & Schuster, 1999), 226–27.

9. Kennett, 135.

10. Adrian Del Caro, "Dionysian Classicism, or Nietzsche's Appropriation of an Aesthetic Norm," in *Journal of the History of Ideas* 50, no. 4 (October–December, 1989): 589–605. These metaphors, while inspired by Greek mythology, are not strictly based on Greek usage. The interpretation used herein is prominently associated with Nietzsche's *The Birth of Tragedy* (1872). The terms were used before. For more, see Camille Paglia's *Sexual Personae* (chap 3); or Nassim Taleb's *Antifragile,* Camille Paglia, *Sexual Personae: Art and Decadence from Nefertiti to Emily Dickinson* (New York: Vintage Books, 1991); and Nassim Nicholas Taleb, *Antifragile: Things That Gain from Disorder* (New York: Random House Trade Paperbacks, 2014).

11. Taleb, *Antifragile*, 255.

12. Stumpf, *Philosophy: History and Problems*, 58–59.

13. Taleb, *Antifragile*, 13, 255–256.

14. Frans P. B. Osinga, *Science, Strategy and War: The Strategic Theory of John Boyd* (Cheltenham: Routledge, 2007), 88.

15. Martha C. Nussbaum, *The Fragility of Goodness: Luck and Ethics in Greek Tragedy and Philosophy*, 2nd ed. (New York: Cambridge University Press, 2001), 194–95.

16. T. Irene Sanders, *Strategic Thinking and the New Science: Planning in the Midst of Chaos, Complexity, and Change* (New York: Free Press, 2010), 146–50.

17. Bart Kosko, *Fuzzy Thinking: The New Science of Fuzzy Logic* (New York: Hyperion, 1994). Atwill points out the connection between this "fuzzy thinking" and what Rootchik calls *techne2*; Atwill, *Rhetoric Reclaimed*, 98–99.

18. Henry Mintzberg's *Rise and Fall of Strategic Planning* (New York: Free Press, 2013); Robert Jervis's "Complexity and the Analysis of Political and Social Life," *Political Science Quarterly* 112, no. 4 (1997–98): 569–593; Dean Rickles, et al., "A Simple Guide to Chaos and Complexity," *Journal of Epidemiology and Community Health* 61, no. 11 (2007): 933–937; or Senge, *The Fifth Discipline*. As early as 1932, one author remarked, "All the notions we thought solid, all the values of civilized life, all that made for stability . . . all this seems badly compromised . . . . Never has humanity combined so much power with so much disorder, so much anxiety with so many playthings, so much knowledge with so much uncertainty"; Paul Valery, quoted in Peter Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World* (New York: Currency Doubleday, 1996), 1.

19. Rafeal López et al., "Are People with High Psychoticism the True Homo Economicus?," *Studies of Applied Economics* 38 (27 April 2020), https://doi.org/10.25115/eea.v38i3.3028; Peter Ubel, "Is Homo Economicus a Psychopath?" Bioethics Blogs, Georgetown University Bioethics Research Library, https://bioethics.georgetown.edu/2014/12/is-homo-economicus-a-psychopath/#:~:text=A%20study%20in%20Japan%20shows,including%20a%20touch%20of%20psychopathy.

20. Consider the following Army publications: *Institutionalizing the Human Domain* (Nicole Jobe, 1 January 2014, http://www.tradoc.army.mil/stlp/docs/Pubs/140325%20

Institutionalizing%20Human% 20Domain.pdf, accessed 5 September 2004), *Strategic Leadership Primer* (Col (Ret) Stephen J. Gerras, ed., Army War College, 3rd edition, http://www.au.af.mil/au/awc/awcgate/army-usawc/sprimer.pdf, accessed 3 December 2014), and *Commander's Appreciation and Campaign Design* (TRADOC Pamphlet 525–5-500, 28 January 2008, http://www.tradoc.army.mil/tpubs/pams/p525-5-500.pdf, accessed 22 January 2015).

21. Spariosu, *Dionysus Reborn*, 144.

22. E. R. Dodds, *The Greeks and the Irrational*, vol. 25, Sather Classical Lectures (Berkeley, CA: University of California Press, 1951), 76–77, 79. Similarly, Henricks writes about a "play-festival-rite" complex, arguing, "public play events are important elements of archaic and traditional societies . . . public gatherings where community members consider some of their society's most important themes, albeit in a joyful, creative, and spontaneous way . . . [honoring] play's profound civilizing functions." Thomas S. Henricks, "Sociological Perspectives on Play" in *The Handbook of the Study of Play*, edited by James E. Johnson et al. (Lanham, MD: Rowman & Littlefield Publishers, 2015), 102.

23. Dodds, *The Greeks and the Irrational*, 82.

24. Nussbaum, *The Fragility of Goodness*, 82.

25. Plato, Laws 815cd, quoted in Dodds, *The Greeks and the Irrational*, 95.

26. Quoted in Kennett, *The First Air War 1914–1918,* 168.

27. Kennett, 135.

28. Hubert Griffith, *R. A. F. Occasions* (London: The Cresset Press, 1941), 9.

29. Anna Malinovska, *Voices in Flight: Conversations with Air Veterans of the Great War* (Barnsley, England: Pen & Sword Aviation, 2006), 115.

30. Guy Mainwaring Knocker and Christopher M. Burgess, *The Diary and Letters of a World War I Fighter Pilot* (Barnsley, England: Pen & Sword Aviation, 2008), 66, 119.

31. McScotch, *Fighter Pilot* (London: Greenhill Aeolus, 1985), 57.

32. Percival Gray Hart, *History of the 135th Aero Squadron from July 25 to November 11, 1918* (Chicago: Battery Press, 1939), 106.

33. Knocker, *The Diary and Letters of a World War I Fighter Pilot*, 95, 117.

34. Cecil Lewis, *Sagittarius Rising* (London: P. Davies, 1936), 87–89.

35. Lewis, 211–213.

36. Hart, *History of the 135th Aero Squadron*, 83, 169–78.

37. Daniel Parmelee Morse, *The History of the 50th Aero Squadron*, The Great War Series 6 (Nashville, TN: Battery Press, 1990), 75; and James Thomas Byford McCudden, *Flying Fury* (London: Aviation Book Club, 1930), 159–60.

38. Peter Liddle, *The Airman's War 1914–1918* (Poole, England: Blandford, 1987), 62.

39. Frank Purdy Lahm, *The World War I Diary of Col. Frank P. Lahm, Air Service, A.E.F.*, ed. Albert F. Simpson (Maxwell Air Force Base, AL: Historical Research Division, Aerospace Studies Institute, 1970), 79.

40. C. G. Barth, *History of the Twentieth Aero Squadron: First Day Bombardment Group, First Pursuit Wing, Air Service, First Army, American Expeditionary Forces* (Nashville, TN: Battery Press, 1990), 19.

41. Malinovska, *Voices in Flight*, 21; and Liddle, *The Airman's War 1914–1918*, 119–120.

42. Griffith, *R. A. F. Occasions*, 5.

43. Samuel Hynes, *The Unsubstantial Air: American Fliers in the First World War* (New York: Farrar, Straus and Giroux, 2014), 238.

44. Charles Woolley, *Echoes of Eagles: A Son's Search for His Father and the Legacy of America's First Fighter Pilots* (New York: Dutton, 2003), 73–74. In multiple sources, there are individuals who abstain from these behaviors, but these are the exemptions

that prove the rule. Writers note the rareness of these individuals, but there is no insinuation of being less militarily effective by their disciplined choices.

45. Ezra Bowen, *Knights of the Air, The Epic of Flight* (Alexandria, VA: Time-Life Books, 1980), 152.

46. Hart, *History of the 135th Aero Squadron*, 102. Note the reference to the sirens, Greek mythological characters described in Homer's *The Odyssey*.

47. Malinovska, *Voices in Flight,* 168.

48. Woolley, *Echoes of Eagles*, 113–114.

49. Kennett, *The First Air War 1914–1918*, 135; and Griffith, *R. A. F. Occasions*, 53.

50. Thomas R. Martin, *Ancient Greece: From Prehistoric to Hellenistic Times* (New Haven, CT: Yale University Press, 1996), 77–78.

51. Kennett, *The First Air War 1914–1918*, 136–37.

52. Lewis, *Sagittarius Rising*, 249.

53. Frederick Mortimer Clapp, *A History of the 17th Aero Squadron* (Nashville, TN: Battery Press, 1990), 19–20.

54. McCudden, *Flying Fury*, vi.

55. James J. Cooke, *The U.S. Air Service in the Great War*, 1917–1919 (Westport, CN: Praeger, 1996), 182.

56. Griffith, *R. A. F. Occasions, 52*–53.

57. Lewis, *Sagittarius Rising*, 74.

58. Hart, *History of the 135th Aero Squadron*, 29.

59. Knocker, *The Diary and Letters of a World War I Fighter Pilot*, 118–119.

60. Clapp, *A History of the 17th Aero Squadron*, 20.

61. Hart, *History of the 135th Aero Squadron from July 25 to November 11, 1918*, 29.

62. Malinovska, *Voices in Flight*, 168.

63. Kennett, *The First Air War 1914–1918*, 75. The task was made more difficult as the practice of formation flying emerged during the conflict.

64. Hynes, *The Unsubstantial Air*, 5; McScotch, *Fighter Pilot*, 242; and Richard Townshend Bickers, *The First Great Air War* (London: Endeavour Press, 2015), 6–7. The flyboys' informality in speech, dress, and behavior was infamous among other military branches.

65. Hynes, *The Unsubstantial Air*, 238. Note the way the author links war to playing a game, a point developed in chapter 3.

66. Lewis, *Sagittarius Rising*, 137.

67. Kennett, *The First Air War 1914–1918,* 157.

68. Quoted in Kennett, *The First Air War 1914–1918*, 138.

69. Griffith, *R. A. F. Occasions*, 73.

70. McCudden, *Flying Fury*, 183.

71. Liddle, *The Airman's War 1914–1918*, 9.

72. Harold Buckley and George Puryear, *Squadron 95* (Paris: The Obelisk Press, 1933), 28.

73. Roy R. Grinker and John P. Spiegel, *Men Under Stress* (Philadelphia, PA: Blakiston, 1945), 29.

74. Azar Gat, *War in Human Civilization* (Englnd: Oxford University Press, 2008), 115–17, 120, 124.

75. Hans Van Wees, "The Homeric Way of War: The 'Iliad' and the Hoplite Phalanx (I)," *Greece & Rome*, Second Series 41, no. 1 (1 April 1994): 1–18.

76. Victor D. Hanson, *Western Way of War: Infantry Battle in Classical Greece*, 2nd ed. (Berkeley, CA: University of California Press, 2009).

77. Plutarch, *Life of Lycurgus* in "Mess Hall," *Lapham's Quarterly,* accessed 2 November 2015, http://www.laphamsquarterly.org/food/mess-hall.

78. Gat, *War in Human Civilization*, 185.

79. While this work focuses on officers, enlisted members of the air service are just as keen on telling tales. For example, a recent program created by a handful of enlisted Airmen encourages bases to hold large-scale events with a handful of Airmen prepared to tell a personal story. These presentations, known as "Storytellers," offer a combination of TED talk and "coffee-house vibe" and have been replicated around the US Air Force. The initiative, which has an online guide and a presence on social media, uses the tagline: "Every Airman has a Story. What's yours?" (*Storytellers—The Guide*, in author's possession; "Storytellers," accessed 24 March 2018, https://www.facebook.com/ afstorytellers).

80. Brian Boyd, *On the Origin of Stories: Evolution, Cognition, and Fiction* (Cambridge, MA: Belknap Press, 2010), 1.

81. Boyd, *On the Origin of Stories*, 14.

82. Boyd, 15.

83. Walter R. Fisher, *Human Communication as Narration: Toward a Philosophy of Reason, Value, and Action* (Columbia: University of South Carolina Press, 1989), 47.

84. Fisher, *Human Communication as Narration*, 47–48, 111.

85. Fisher, *Human Communication as Narration*, 59–60. Bruner calls this logic a "powerful prosthetic device," which has "been developed over the millennia" to guide analysis and application of Apollonian phenomena. Jerome Bruner, *Actual Minds, Possible Worlds* (Cambridge, MA: Harvard University Press, 1987), 13.

86. Fisher, *Human Communication as Narration*, 78. Dolman writes, "Truth and accuracy are only rarely the same. Facts are not truth, and the truth is only partially factual. Truth is a matter of utility; accuracy is not . . . . A theory is considered true—or more properly valid—to the extent that it is useful. That is, to the extent to which it aligns our expectations of the future and in this way makes our actions meaningful . . . greater truth is in no way the result of greater accuracy. Indeed, as we shall see later, greater accuracy quite often obscures the truth."(Everett C. Dolman, *Pure Strategy: Power and Principle in the Space and Information Age* (London: Routledge, 2005), 72.

87. Boyd, *On the Origin of Stories*, 57–58.

88. Kenneth N Waltz, *Theory of International Politics* (Long Grove, IL: Waveland Press, 2010), 6–7, 14–16. Interestingly, modern fighter pilot squadrons honor what is known as the "10 percent truth" rule as the minimum required when telling stories. This is ostensibly meant to "protect the innocent" but it also allows for more colorful liberties when storytelling. There is an oblique analogy within academia, evidenced when scholars argue that the explanatory power of a theoretical model is more important than how well the model comports with reality.

89. Boyd, *On the Origin of Stories*, 49–50. This is also what Landy calls the ability to "dwell in metaphor":

> There is something over and above the local deployment of metaphors for strategic or aesthetic purposes, and that is what we might call a *figurative state of mind* . . . cultivating a generalized love for the figurative—if we come to dwell in metaphor, as Emily Dickinson would say—then our stance toward existence becomes subtly but powerfully shifted: the world becomes less concrete and more abstract, less impersonal and more humanized, its components less monadic and more interconnected. And as everything we see begins to point sideways to what is like it, rather than backward to what preceded it or forward to what follows, we find ourselves released from the tyranny of time.

Joshua Landy, *How to Do Things with Fictions* (England: Oxford University Press, 2014), 64. Note the "sideways" reference that is reminiscent of *metis*.

90. Gareth Morgan, *Images of Organization* (New York: SAGE Publications Inc, 2006), 343.

91. Stanley I. Greenspan and Beryl Lieff Benderly, *The Growth of the Mind: And the Endangered Origins of Intelligence* (Reading, MA: Da Capo Press, 1998), 20. Einstein's full quote is also noteworthy for the emphasis on productivity of playfulness:

> The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The physical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be 'voluntarily' reproduced and combined. There is, of course, a certain connection between those elements and relevant logical concepts. It is also clear that the desire to arrive finally at logically connected concepts is the emotional basis of this rather vague play with the above-mentioned elements. But taken from a psychological viewpoint, this combinatory play seems to be the essential feature in productive thought—before there is any connection with logical construction in words or other kinds of signs which can be communicated to others.

92. Jonathan Gottschall, *The Storytelling Animal: How Stories Make Us Human* (Boston, MA: Mariner Books, 2013), 59.

93. F. Scott Fitzgerald, *The Crack-Up,* ed. Edmund Wilson, reprint edition (New York, NY: New Directions, 2009), 69.

94. Academic literature is full of studies showing the wisdom of storytelling, including: Roger Schank and Gary Saul Morson, *Tell Me a Story: Narrative and Intelligence* ((Illinois: Northwestern University, 1995); Steven Pinker, *How the Mind Works* (New York: W. W. Norton & Company, 2009); S. Ragan and E. Wittenberg-Lyles, "Narrative Medicine and Education in Palliative Care," in *Narratives, Health, and Healing* (2005); Deborah Sole and Daniel Wilson, "Storytelling in Organizations: The Power and Traps of Using Stories to Share Knowledge in Organizations" in *The Knowledge Management Advantage* (2004); Lewis Mehl-Madrona, *Coyote Wisdom: The Power of Story in Healing* (Vermont: Bear & Company, 2005); and Peter Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World* (Sydney: Currency Publisher, 1996). Of course, the value of stories or narrative intelligence does not excuse the offensives that happened at Shaw AFB or the Tailhook convention, that only token disciplinary action occurred, or that the military today still has problems curbing sexual misconduct.

95. Larry Arnold, " 'There I Was . . .,' " *Combat Edge 9*, no. 6 (November 2000): 4.

96. "Penrose Vass Stout Sketchbook: Alabama Photographs and Pictures Collection," accessed December 11, 2015, http://digital.archives.alabama.gov/cdm/compoundobject/ collection/photo/id/27733/rec/1. This behavior is evident in other areas studied by historians of technology, including automobile enthusiasts and their version of barracks flying known as "bench racing" (Robert C. Post, *High Performance: The Culture and Technology of Drag Racing, 1950–2000,* Baltimore, MD: Johns Hopkins University Press, 2001, 3; and H. F. Moorhouse, *Driving Ambitions: An Analysis of the American Hot Rod Enthusiasm,* New York: Manchester University Press, 1991, 39).

97. Buckley and Puryear, *Squadron 95,* 20–21.

98. Alan Bott and W. S. Brancker, *An Airman's Outings*, 4th ed. (London: William Blackwood and Sons, 1917), 191.

99. Bott and Brancker, *An Airman's Outings,* 246–247.

100. McScotch, *Fighter Pilot*, 57.

101. According to the Oxford English Dictionary, the first known use of the word "joystick" was in 1910 ("joy, n." OED Online. June 2017. Oxford University Press.

http://www.oed.com.spot.lib.auburn.edu/view/Entry/101795?redirectedFrom=joystick& (accessed January 03, 2018). For a discussion on the possible links between the term and play, see "Joystick," Michael Quinion, *World Wide Words*, http://worldwidewords.org /qa/qa-joy1.htm, accessed 17 December 2016.

102. Hynes, *The Unsubstantial Air*, 117. One flyer noted the lack of textbooks on tactics and suggested a 30-page pamphlet in May 1917 that may have been the first. Another author states early US Airmen training at the French *Ecole d'Aviation Militaire* received only an eight page booklet called "Flying School of Tours—Instruction of the American Pupils" (Woolley, *Echoes of Eagles*, 41).

103. Griffith, *R. A. F. Occasions*, 17.

104. Morse, *The History of the 50th Aero Squadron*, 74–75.

105. Hart, *History of the 135th Aero Squadron*, 20–21.

106. Griffith, *R. A. F. Occasions*, 17–18.

Chapter 2

Icarus and Daedalus: Airmindedness in the Interwar Period

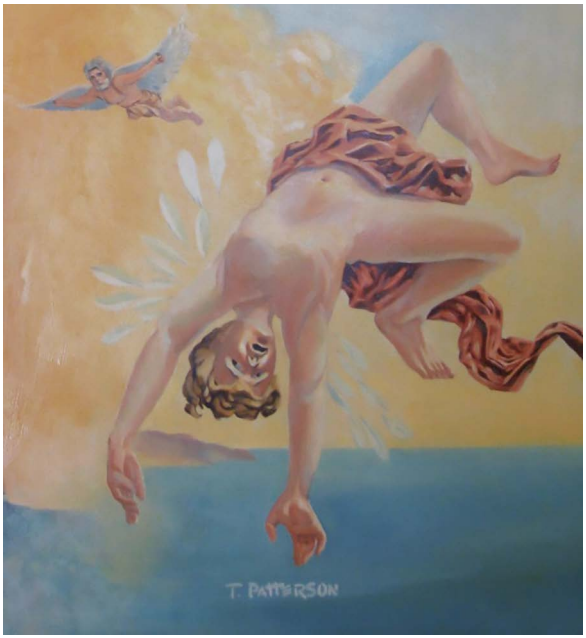

Figure 2. Section of Untitled Painting. The US Air Force Art Program adopted the painting by an unfamiliar artist, T. Patterson, in 2011.

Source: "Dusty paintings make Air Force history," Peterson Air Force Base, Colorado, 20 June 2011, accessed 5 November 2016, http://www.afspc.af.mil/News/Photos/igphoto /2000245076.

To exist at the intersection of two worlds—one of order, engineering, and reason; the other, one of chaos, art, and play—airmen in the Great War relied on the two technical qualities of their machines: range and speed. This chapter is about how a third characteristic, altitude, changed the physical and metaphorical perspectives of early flyers as well as Western societies. Flight as an escape from gravity became equally symbolic of an escape from outdated ideas and technological limitations. Practical and aspirational considerations came together in a cultural phenomenon of "airmindedness." Although increasingly referenced by scholars over the last few decades, the con-

cept's definition seldom reflects the full dimensions of this consciousness, which infected both the public writ large and professionals of the Western air forces. Expanding the aperture or, more appropriately, viewing airmindedness from a higher vantage point, it is clear that key founders of USAF culture echoed the way interwar reactions to flight easily combined pragmatic and psychological elements. They imbued the institution with a paradigm of progress unhindered by custom.

Introduction

There are two institutions of higher learning in the US Air Force. One is Air University, Maxwell AFB, Alabama, and the other is the US Air Force Institute of Technology (AFIT), Wright-Patterson AFB, Ohio. Each base has a statue of a Greek mythological character, and their presence reveals something about the organization's culture. The first, at Maxwell AFB, is a sculpture of Daedalus dedicated in 2017. It honors the association of World War I military pilots, the National Order of Daedalians, which was established at the base in 1934.[1] The second statue is Daedalus's son, Icarus, erected in memory of AFIT graduates who met the same fate as the adventurous young boy.

Multiple versions of the ancient myth have been written, and they share the same general outline. The father and son are imprisoned in a maze and use artificial wings to escape. In most retellings, the boy serves as a cautionary figure. He became too enamored with flight and the wax holding the bird feathers together melted when he recklessly got too close to the sun. The young boy abused the power of flight for his own pleasure instead of using it to escape imprisonment, as his father intended when he crafted the two sets of wings. One of the earliest known written versions of the tragic story appears in Ovid's *Metamorphoses* (which also describes Prometheus).[2] Only four paragraphs long, the poem's central theme clearly contrasts Daedalus's rational calculations and pragmatic motivations with the playfulness and high spirits—literally and metaphorically—that led to Icarus's downfall.

Homer's *The Iliad*, which has the oldest direct reference to Daedalus, highlights him as the greatest craftsman among mortals. He produced statues that were so accurate, the legend goes, that they appeared to be animate agents instead of technical artifacts.[3] The father

and son are trapped, in fact, in an intractable labyrinth of Daedalus's own design. Not only was he the "archetypical craftsman," but he also demonstrated that trait so closely coupled with *techne—metis*. The construction of the wings and the strategy to exit the maze vertically serve as a double example of these related qualities. Literary critic Piero Boitani, in analyzing mythological flight as a motif in art and literature, shows the strong association between Daedalus and Odysseus. Likewise, Francoise Frontisi-Ducroux, scholar of mythology and Hellenism, calls Daedalus the exemplar *par excellence* of Greek artisans, a "hero of intelligence."[4] Bruno Latour, philosopher of technology, reiterates that same comparison in his writings and again links the two concepts in his idea of "a labyrinth that is curved, veering from the straight line, artful but fake, beautiful but contrived."[5]

The mythological father and son are also common references among flyers and those who study them. According to Berthold Laufer's *Prehistory of Aviation*, "Of all flying stories of classical antiquity it is this one which has left a lasting impression on future generations and fired the ambition of many imitators; and it is on this point, its moral effect, that the importance of the story rests." The twentieth century, in fact, produced more artistic treatments of the myth than all previous eras.[6] The tale also figures prominently in scholarly works about the cultural "prehistory" of flight, but it also surfaces in more conventional histories as well.[7] Furthermore, it is not just artists and academics, but aviators as well. Pioneering air power theorist Gulio Douhet referred to aircraft as "Daedalus' large devices," and Icarus is mentioned in the writings of "Hap" Arnold, possibly the central cultural founder of the US Air Force.[8]

In the conventional interpretation of the myth's moral, Daedalus is the paragon of a mature craftsman; his son, a passionate, rebellious, self-destructive artist. Writers have variously attributed Icarus' disgrace to hubris, ambition, excessive dreaming, and the lure of instant gratification. His name has been invoked by psychiatrists as a condition characterized by narcissism, fascination with fire, isolation, or an imagination that exceeds capabilities, dooming one to failure and mental conflict.[9] One author used the image to criticize American foreign policies as overly adventurist, titling his work *The Icarus Syndrome: A History of American Hubris*.[10]

For historians writing about aviation, the father and son represent varying emphases on the two different functions of flight. Daedalus characterizes its pragmatic and political aspects. Icarus embodies its

aspirational and enthralling qualities. For instance, in *A Nation of Fliers*, Peter Fritzsche reminds readers that the allegory is not just about individuals escaping the bonds of gravity. Fundamentally, Daedalus and Icarus's is a story of nationalism and geopolitical power.[11] Indeed, the whole reason the famous inventor from antiquity is forced to flee with his son is to escape captivity by King Minos, for whom he had been creating weapons. According to legend, Daedalus's skill in applying mechanical arts to warfare exceeded all others.[12] After his escape, he offered his services to yet another kingdom.

Each time modern authors repeat the story, the father and son are presented as mutually exclusive examples. Furthermore, it is clear which model is superior. Icarus represents narcissism, hubris, self-destruction, and many other negative connotations. This bias is evident in the USAF statutes as well as other cultural artifacts. For example, Squadron Officer College—which every active-duty officer attends—uses a war-gaming exercise named Icarus "to instill a sense of dire consequence if we do not fully understand our role as Airmen."[13]

It may seem surprising, then, that at the peak of Western society's excitement over aviation, both images were embraced by the so-called "airminded public." This cultural phenomenon is yet another demonstration of how aviation technology brings together the technical and artistic.

The Origins of Airmindedness

In the decades after heavier-than-air flight became a reality, flying remained ineffective for many of the practical functions it would eventually perform in transportation, commerce, and war. Indeed, decades passed before aviation began to influence the way most people lived their daily lives. Its psychological impact, however, registered much sooner.

According to historian Robert Wohl, who traced the cultural impact of flying in the decades immediately after the Wright brothers demonstrated their flyer in France, the airplane became a symbol of societal regeneration. It allayed the concerns of those who feared that the legacy of industrialization was a disenchanted world. Aviation disproved the "prophets of despair and the doomsayers [who] had complained that the twentieth century lacked passion and that materialism would leave the 'soul' without transcendent tasks."[14] In Amer-

ica, the sky became the frontier that the wide-open West had once been. Opportunities abounded for both the bold individual adventurer and for a nation able to continually renew itself through expansion.[15] Historian Michael Sherry characterized this "Age of Fantasy" in a similar tone: "The airplane was the instrument of flight, of a whole new dimension in human activity. Therefore it was uniquely capable of stimulating fantasies of peacetime possibilities for lifting worldly burdens, transforming man's sense of time and space, transcending geography, knitting together nations and peoples, and releasing humankind from its biological limits."[16] One history, interestingly titled *The Wright Brothers: Heirs of Prometheus*, notes how the brothers became "giants in the American Pantheon of popular heroes."[17] Even the outbreak of World War I in 1914 and the associated acceleration of aviation's destructive potential failed to tarnish the airplane's reputation.

The 1920s inaugurated the era historians dub the "Golden Age of Flight." Technology matured in every way during this period, making the airplane an increasingly useful tool. Distance, payload, speed, and altitude records were repeatedly broken, to the celebrations of an increasingly supportive and excited public. In America, flying became a popular hobby for those who had enough cash and courage. Aviation also became a popular subject for publishers and Hollywood filmmakers. The latter took advantage of the surplus of planes and pilots after the war to stage elaborate dogfights for the silver screen. Barnstorming tours were another way newly idle machines and fliers exposed even remote communities to firsthand experience with aviation. Many observers believed everyone would soon enjoy an age of "aerial mobility" when "flying would become as common as riding or even walking." Contemporary sources boasted that "democracy would prevail in the sky" and Americans could soon expect an "airplane in every garage."[18] Children and their teachers were also on board. Aviation was the main theme in technologically oriented series aimed at young Americans such as the "Bill Bruce" books in which the main character claims "nothing that he did gave the zest to life that the thrills of aviation had given him."[19] Advocates urged curriculum changes and some classrooms even received flight simulators.[20]

This enthusiasm for aviation became known as airmindedness. According to the *Oxford English Dictionary,* which dates the first appearance to 1927, "air-minded" means to be "interested in or enthusiastic for the use and development of aircraft."[21] The term was widely

used during the interwar years.[22] For example, *The Saturday Evening Post* published a short story, titled "Air-Minded," which described the "inspiring symbol" of "the steel bird."[23] Multiple jazz musicians, including the famous Glenn Miller—a former World War I Army Air Corps officer—recorded their rendition of the song "The Airminded Executive," who was the "man of the year." One reviewer of the Broadway play and Hollywood movie about flying, "Ceiling Zero," gushed that "everyone" in high society was there, and "any air-minded person is bound to love it."[24] Finally, an article in *Childhood Education*, "Air-Minded Seven-Year-Olds," described how "enthusiastic interest overwhelmed" the students on a field trip to the municipal airport.[25]

Dimensions of Airmindedness—Pragmatic and Romantic

A comprehensive review of aviation historiography reveals a variety of meanings embedded in the definition of airminded. In a practical sense, airmindedness can be an appreciation of what aviation technology can achieve, or airmindedness can be the condition of having realized that potential. An airminded nation may appreciate what aviation can do for the country and therefore support aviation development. Or, an airminded nation may be one that already enjoys those developments. Likewise, an airminded individual may be someone who appreciates the advantages of flying, someone who possessed the ability to fly, or both. The simple ability to fly an airplane was not the only—or the most interesting—element of the airminded condition, nor was the excitement over human flight simply about the practical aspects of flight.

The ceaseless pace of material advancements in aviation transmuted into expectations for advancing the individual's spirit—just as Daedalus' *techne* enabled Icarus' transcendence. Aviation became imbued with the power of spiritual rebirth, and airmindedness gained a sense of religious fervor. The oft-referenced "miracle" of flight seemed to portend a new age for humanity, a sign of progress bringing the world closer to God. Sometimes the prophecies linked to spiritual matters in figurative ways: an airplane symbolizing the Star of Bethlehem or the shadow of the crucifix.[26] Charles Lindbergh's historic Atlantic crossing was celebrated as a "heroic adventure of Christian life," and he became a prophet of this

"gospel of aviation." Marcel Proust, writing in 1919, described watching a pilot in an equally mythologized manner:

> I was as moved as a Greek would be who saw for the first time a demi-god. . . . The aviator seemed to hesitate in choosing his way; I felt there lay open before him—before me, if habit had not held me prisoner—all the routes of space, of life; he flew away, glided for a few instants over the sea, then brusquely making his decision, seeming to surrender to an attraction the opposite of that of gravity, as if returning to his homeland, with a light movement of his golden wings, he ascended straight up toward the sky.[27]

Other times it was more literal, as when a woman asked Lindbergh how much it would cost for a ride to heaven.[28]

Whether heralded in religious terms or not, some thinkers speculated that aviation could change individuals, altering how they thought, how they felt, and how they interacted with others. Therefore, becoming airminded could also be the degree to which a person embodied this potential and became what some contemporaries called the "aerial person." In this view, aviators became supermen in the spirit of Nietzsche. In their new machines, these "virile technological knights" would power a "new age of boundless revolutionary potential, moral, and civilization-transforming forces."[29] This concept was also reflected by the publisher and aviation enthusiast, Alfred Lawson. In 1916, he penned an article, "Natural Prophecies," predicting that by the year 3000 a new species would emerge among those who spent sufficient time airborne. In another seven millennia "Alti-man" would emerge and completely inhabit the air niche. The changes would be both physical and mental: these "superhumans" would know "great truths" and rule those below.[30] According to Joseph Corn, whose 1983 *The Winged Gospel* resurrected the term airmindedness among academics, these apparently fanatical statements accurately reflected the public's general attitude toward aviation throughout the interwar period.

Others locate similar sentiments even before the invention of heavier-than-air flight. In "The Rise of the Airmen: The Origins of Air Force Elitism," Michael Paris argues that the heroic image of World War I British pilots was not just based on the events of the war. The "cult of the airman" emerged from preexisting attitudes toward aviation.[31] Another writer describes how a pioneering balloonist and aerial photographer supposedly crossed "a cognitive threshold" as he

developed technical means to capture the aerial view that was previously relegated to literary, intellectual, or religious traditions.[32]

To complicate matters further, this version of airmindedness may have nothing to do with knowing how to fly or physically viewing the world from above. Instead, it may be simply a revolutionary imaginative capacity accessible to anyone willing to embrace aviation as a metaphor for freedom, a literal and symbolic transcendence from the limits of time and space.[33] This connects to a larger body of literature regarding the ability of technology to impact people psychologically.

Historians, commenting on the social effects of human flight on Americans, have noted that aviation is a particularly strong example of "the technological sublime," the sense of wonder and awe generated by large-scale technical projects.[34] In *American Technological Sublime*, Nye states that "19th-century engineers, architects, inventors were hardly rational technicians . . . . They often embraced transcendental ideas; along with clergy, writers, artists, they imbued technology with moral values; practical goals with political and spiritual regeneration." Other technologies, such as railroads, electricity, and steamships, inspired similar reactions, but none were as highly anticipated by humanity or linked to a sense of hope, freedom, or divinity as was the airplane.[35]

Aviation had a unique capacity for inspiration that was literally—and figuratively—above all other emerging technologies. According to Nye, "human flight long remained the most exciting form of the dynamic sublime . . . [with] an element of romance."[36] Dominick Pisano, a historian at the National Air and Space Museum, argues the entertainment value of aviation will remain, regardless of its practical utility: "The public's fascination with flying as a source of amusement and entertainment, thrills and fun, however, will continue because . . . [it is the] only sport provides 'the glorification of chance and the unexpected,' the feeling of being truly alive. That a machine such as the airplane can provide such a feeling in a technologically complex and increasingly mechanized and dehumanized world may be ironic, but it is not likely to change."[37]

The easiest and most common way to partake of this new consciousness was simply to witness the images of flight. This occurred in two ways. First, there was what Wohl calls the "spectacle of flight," the visual representations that formed most peoples' experience with aviation before mass commercial air travel.[38] For instance, an aviation correspondent for an English newspaper, witnessing the first flight to cross the English Channel, reported an "overpowering rush of excite-

ment which I find almost everyone has experienced who has seen a man fly. It is an exhilaration, a thrill, an ecstasy . . . . When the machine leaves the ground and with a soaring movement really flies upon its spreading wings, one feels impelled to shout, to rush after it, to do anything which will relieve the overcharged emotion."[39] Later, aviation was coupled with motion pictures, another spectacular technology of the time, to make flyers such as Lindbergh the first modern celebrities. The first Academy Award for Best Picture was in fact a 1927 American silent film set during World War I, *Wings.* Other examples include *The Air Mail* (1925), Disney's *Plane Crazy* (1928), *Hell's Angels* (1930), and *Dawn Patrol* (1930).[40]

In addition to images of flight, the public consumed images enabled by flight. The views captured by airborne cameras were also thought to impact human consciousness. Since vision is our dominant sense, a change in visual perspective influences the cognitive perspectives of individuals and cultures. It is also the dominant mode of sensing the technological sublime, according to Nye.[41] Humans seem to naturally accord authority to the view from above: we fallaciously conflate the difficulty in obtaining the view with its veracity; we perceive aerial images as objective, rational, scientific, and epistemologically sound; and the "God's eye view" is associated with divinity, superiority, and omniscience.[42] One modern author describes how scientists, artists, and politicians had engaged the aerial view for a century and this tradition paved the way for aviation to become the "twentieth-century Enlightenment project."[43] Another identifies the view from above as one of the "oldest imaginative resources" in Western intellectual currents.[44] Others show its deep resonance across time and space, pointing to a universal spatial hierarchy across human speech that correlates altitude with value. "Up" is associated with the gods, growth, hope, light, freedom, and ecstasy, as in the feeling of being "on top of the world." "Down" connotes death, vulgarity, poverty, and the practical, as in down-to-earth.[45] This matches Plato's hierarchy wherein the head, representing rational thought, is literally and metaphorically higher than the heart, representing emotions, or the hands, representing the manual labor of *techne*.

Whether the object of the gaze was the aircraft itself or the images it enabled—or just knowing these options were now available to humanity—the experience encouraged many to think beyond conventional limits. In his survey of aviation and culture, Wohl concludes that flight "became a metaphor for the transformation of conscious-

ness, its liberation from the constraints of normal day-to-day existence, and the redefinition of time and space."[46] A more technologically oriented historian sounded a similar tone in the edited work *Innovation and the Development of Flight:* "For the twentieth century, no set of technological innovations is more intriguing than that associated with aviation. . . . Perhaps no technological development in this century has more fundamentally transformed human life . . . . [Airplanes] brought a see change [sic] in the collective mindset."[47]

These notions were first expressed by the avant-garde, for whom the airplane became a recurring theme. Consider Thomas Hart Benton's painting *Instruments of Power* with a plane emerging out of an amalgam of mechanical images. It was not merely a new object or a new view, but in the words of museum art curator Anne Collins Goodyear, a "new understanding of materials and mythologies . . . the mystical and political dimensions of human flight."[48] In art, flying served as an inspiration for radical experiments in technique that, like the airplane itself, challenged conventional perspectives. Poets such as the Italian Gabriele D'Annunzio wrote about the possibilities of a "vaster life" in which utilitarian concerns could still be subservient to dreams. He thus called for the invention of a new language to "describe this unprecedented spectacle."[49] Russian painter and composer Mikhail Matyushin—particularly affected by aviation—issued a manifesto for unconventional art forms that would be intelligible only to those able to lift their minds "with a single stroke of their wings." Flight also entered the world of popular dance with the "Lindy Hop," in honor of Charles Lindbergh, and the creation of "aerodance," a style of choreography described by a Futurist as "exaltation of flight." The artist went on to describe it as "a lyrical flight, a flight of the spirit" and "its movement is beautiful like that of Icarus."[50]

Beyond the arts, the culture at large also experienced the urge to take the technical achievement of flight and celebrate its ability to raise human imagination and spur spiritual reawakening. Wohl concluded that in doing so, Western society finally achieved "an epic poetry of technological deeds" it had "secretly desired."[51] Lindbergh epitomized this new era in which American society navigated a machine age without losing its sense of individualism.[52] Charles and Mary Beard used an aircraft image for "The Machine Age" chapter in *The Rise of American Civilization.* Even Lewis Mumford, noted in chapter 1 for his criticism of technology, held up aviation as a model for engineering.[53] T. E. Lawrence, already famous for his heroics in

World War I and living a comfortable life as a writer, told a companion that aviation was "the only first-class thing that our generation has to do." When he exclaimed, "everyone should either take to the air themselves or help it forward," he meant it—enlisting in the RAF under a pseudonym on two separate occasions.[54]

In a study of culture and technology at the end of the twentieth century, one author concluded that flight represented "the one universal directional shift" in humanity's otherwise variable visions of progress.[55] Echoing a century earlier, some recent scholars still claim airmindedness has altered our capacity to "think, feel, and act:" "is central to the modern imagination;" or that "aerial imagination" is the world's most transformational force, opening up "new cognitive possibilities." Not surprisingly, flyers themselves often note a broader sense of consciousness.[56] For example, the famous American ace Eddie Rickenbacker wrote of how flying endowed one with a "vision of the air."[57] The ace wrote much of the 1920s cartoon strip *Ace Drummond*, which was carried in over 100 newspapers, furthering the cultural impact of aviation and, as in chapter 1, showcasing airmen as storytellers.

Airmindedness, therefore, is the realization of aviation's potential, in both senses of the term: to be aware of something and to bring it into reality. Again, those benefits are practical and psychological. Aviation is a tool and a muse; it heightens our ability to be industrious and our capacity for imagination. Furthermore, that potential can be framed at different scales. Its impact on all humanity makes it a global phenomenon. Employment in warfare frames the story of aviation in terms of nation-states. So far, however, this explanation has focused on the individual. A person can appreciate the impact of flight on human thinking as well as represent the fulfillment of that new thinking. The poles of airmindedness—as a way of thinking—are represented by the technical skills to fly at one end and transformational creativity at the other. Yet, another option exists in between those extremes.

This middle way evokes Thomas Kuhn's description of paradigms, or more accurately, what Morgan and this book refer to as the level of "theory" or "school of thought." Paradigms frame both the content and the style of thinking: mental models that establish which problems are legitimate, what methods of solution are valid, and all of the associated terms of discourse that pervade these processes. In this context, an airminded person is attuned to aviation as a means to solve problems and the need to solve the problems of aviation. These problems, which include areas such as transportation, commerce, in-

dustry, education, and national defense, can be manifested at the individual level or even around humanity itself. Most commonly, however, these issues are framed by national borders.

The focus on states is very explicit in one of the earliest synoptic studies of aviation, sociologist William Ogburn's 1946 work, *The Social Effects of Aviation*. Examining technological trends, he argued that aeronautics would continue to advance "our social heritage," by which he meant the development of governmental power. By increasing "opportunities for greater efficiency and usefulness" of the state, aviation would naturally lead to larger administrative units. According to Ogburn, this even included the possibility for "a single political organization of the peoples of the world."[58]

Scholars since Ogburn have continued to analyze the growth of aviation in specific nations as both a consequence and cause of national development.[59] In every instance, the airplane was expected to deliver an interrelated set of physical and psychological benefits to the country. Airplanes enabled and necessitated large-scale government endeavors such as internal security, urban planning, and infrastructure projects (e.g., airports and the lines of communication to and from them). Another example of the advantages aviation could deliver was the benefit to manufacturing. The extensive work of producing aircraft under license directly stimulated production (where advanced industries already existed) and encouraged a positive attitude toward industrialization (even in places heretofore resistant to it). In some cases, aviation improved communications across large distances or rough terrain, which again had sociological impacts. In places such as Canada, Russia, and South America, this capability cultivated nationalism among a widely dispersed population. Similarly, in 1928, a businessman in Kenya pleaded with an Englishman to "educate the people . . . in 'air-mindedness' " so they would become more aware of how the airplane could help the colonialists conquer the problems of time and distance in Africa.[60]

Another important and practical benefit of aviation was the ability to use air forces to achieve national military objectives. The Chinese government, for example, applied air power internally throughout its civil war with the communists. In the case of the British mandates in the Middle East, airplanes played an important role as instruments of colonial control. Such airmindedness imparted a sense of security and patriotic pride in the nation's aerial prowess, often showcased in airshows, and sometimes led to an outright sense of national superi-

ority.[61] As the airplane was the quintessential symbol of modernity, states eagerly sought to establish national airlines and viable air forces. To stunt the growth of aviation would endanger the cultural renaissance many anticipated and was equal to relinquishing a nation's global power. It might even invite attack from others with more advanced air power.

Aviation's military potential reveals the dark side of airmindedness not captured in the dictionary definition. For all its practical and psychological benefits, whatever power it conferred was also available to one's enemies. Appreciating the potential of aircraft meant individuals and nations needed to prepare to mitigate its dangers instead of merely cultivating its promise.[62] Therefore, an airminded nation could be one that was aware of how this new weapon increased its vulnerability. This ambivalence is well illustrated by British sentiments during the interwar years, when aviation was viewed as the threat and the solution to national defense of the isles.[63] Indeed, many airminded individuals, in and out of uniform, made passionate arguments for military air power.

In World War I, combatants explored almost every way the airplane could be employed in warfare. Still, there was not enough empirical evidence to support one theory of air power over another. While some postulated that independent bombing missions targeting the enemy's ability to support its own forces could have a decisive effect, they were unable to prove those ideas before the armistice. When the war ended in 1918, fledgling American air forces had only performed 150 bombing missions.[64] Even the oft-cited airpower contribution at the Battle of Saint-Mihiel was merely a large use of tactical airpower.[65] The lack of experience did not dissuade advocates of strategic bombing.[66] As the next chapter will describe, they continued to develop their theory, likening the enemy system to a web—a web in which the destruction of critical points would lead to catastrophic failure of the entire system. As odd as the juxtaposition may seem, there was an element of playfulness in this approach because airmen did not presume to know exactly where and how much destruction this required. It would be a matter of trial and error. Considered in total, air power itself was handled with an element of Icarian play. Airmen explored a variety of ways air power could be used to revolutionize warfare. Despite a diversity of ideas, their common thread was the airminded assumption that aviation technology was a powerful, transformative agent of change.

The Image of Icarus

This survey demonstrates that airmindedness is much more than just the enthusiastic support for aviation. To be airminded is to be aware of aviation's multidimensional possibilities—physical and psychological; positive and negative; individual, national, and global—as well as the degree that aviation's potential is achieved in practice. In the interwar period, to be airminded was also a dynamic combination of its two symbols, Daedalus and Icarus.

Icarus perishes of his own imprudence, making him an odd candidate for anyone to celebrate. Yet, just as definitions of airmindedness evolve and diverge, so does the retelling and reinterpretation of myth. This story has undergone multiple iterations and revisions, including versions in which Icarus survives the fall. Some accept the conventional ending but reverse the moral of the allegory, valuing Icarus for his boldness, his creativity, his playfulness, and as Ovid himself put it, his "daring art."[67] The boy variously symbolizes innovation, genius, passion, and even a spiritual savior (mirroring the *logos* of Jesus Christ).[68] A nineteenth-century historian surmised that, in the Romantic Movement, "The fate of Icarus frightened no one. Wings! Wings! Wings! They cried from all sides, even if we should fall into the sea. To fall from the sky, one must climb there, even for but a moment, and that is more beautiful than to spend one's whole life crawling on the earth."[69]

The myth has had special attraction for twentieth-century artists who recognized its implications in the era of air and space travel.[70] For the poet Gabriele D'Annunzio, flying's potential for death was the very reason it could produce a sublime experience.[71] He also revised the story, portraying Icarus as the creative genius behind the idea to escape using manufactured wings. Daedalus is still the master craftsman, but his son is the inspiration. Their mutual dependence—that is, the robust concept of *techne* before Plato's redefinition—is highlighted by the end of the myth cycle: without his son, the wings become the father's last great invention.

Artists and writers were not the only ones to adopt—and adapt—the image of Icarus. Some psychologists treat the Icarian urge to explore as a vital stimulus to human maturation.[72] Studies of playfulness show how it is associated with resilience, creativity, adaptability, and inquisitiveness.[73] One researcher situates play at the center of a quest for self-realization which he describes in ways that match the description of *metis*.[74] Early airmen rarely invoked the image of Ica-

rus explicitly. The same is true of Daedalus. They did not, however, ignore the spirit of either.

US Military Airmindedness Through World War II

During the first half of the twentieth century, American advocates for military air power capitalized on an idea that already had high social currency. Even though all leaders in the nascent US air service demonstrated the enthusiasm that was later termed airmindedness, the best examples are three individuals whose own airmindedness emerged in the same period as the term itself: Alexander P. de Seversky, William "Billy" Mitchell, and Henry "Hap" Arnold. Each appreciated the potential of aviation for national development and as a novel way of approaching the problems of war. At the same time, they realized aviation's interconnections to innovation and creativity. While this led to some specific ideas for air warfare (discussed in chapter 3), the point here is how their airmindedness played out in their recommendations for the US defense establishment and for the character of warfare, namely, promoting a separate air service capable of winning wars through independent strategic bombing.

Mitchell is the best-known "martyr" for the gospel of military air power. He eagerly sought and was eventually granted a position among the first military aviators. Then, during World War I, he commanded all American air combat units in France. Following his experiences in Europe, Mitchell was convinced that building a fully developed air force was a national imperative. He passionately worked out a theory while serving as an Army Staff College instructor.

Emulating Alfred Thayer Mahan's earlier plea for a "seafaring" nation, an argument that helped stimulate a worldwide naval arms race in the late nineteenth century, Mitchell saw aviation as the key to the nation's future.[75] The prerequisite for that development was, naturally, airmindedness—at least airmindedness as an appreciation of aviation's potential. Of course, to realize the advantages of aviation in practice, it was important to have leaders who were airminded in a paradigmatic sense, leaders who could think differently about the problems of aviation and the problems to be solved by aviation.

Mitchell's own airmindedness comes out most strongly when he is referring to the military, even though air power in this form was only one part of his program. Thus, the foreword to his *Winged Defense*

opened with the claim that "few people outside of the air fraternity itself know or understand the dangers that these men face, the lives that they lead, and how they actually act when in the air . . . what they actually do in improving the science and art of flying and how they feel when engaged in combat with enemy aircraft." He went on to exclaim, "no one can explain these things except airmen themselves" and to label senior Army and Navy leaders as "psychologically unfit to develop this new arm to the fullest extent practicable."[76] This sense of exclusive airmindedness and urgency of the cause justified his accusations of the War and Navy departments, claiming their insufficient attention to aviation's promise demonstrated "incompetency, criminal negligence, and almost treasonable administration."[77] This comment led directly to his court-martial in 1925. Found guilty of insubordination, Mitchell refused to remain silent once he was out of uniform. His credibility, however, was permanently damaged, and others such as Alexander P. de Seversky took up the cause.[78]

In his 1942 work, *Victory Through Airpower*—dedicated to Mitchell—de Seversky showcased his own airmindedness: "I want to focus attention on the *new principles of warfare* shaped by the emergence of military aviation . . . a dynamic, expanding force, the growth of which must be anticipated by courageous minds. It happens to be a force that *eludes static*, orthodox minds no matter how brilliant they may be. *Air power speaks a strategic language* so new that translation into the hackneyed idiom of the past is impossible. It calls not only for new machines and techniques of war making but for *new men unencumbered by routine thinking*" [emphasis added].[79]

Later in the book, which was turned into a World War II propaganda film by Walt Disney, de Seversky referred to those who were "aviation-minded" as "emancipated minds." In contrast, those "raised in totally different traditions," that is, the Navy or Army, "seem psychologically incapable of recognizing aviation in its primary character as the new military force which . . . dominates the world." Instead, they merely "tolerate [semi-independent military aviation] as a concession to modernity [and] the spirit of the times."[80] Although much more modest in its tone, this claim is corroborated by United States Army psychologists in the North African campaign of 1942–43 who noted how the airplane—the "central unifying force" among Airmen—transformed the thinking of Air Corps officers.[81]

"Hap" Arnold, the third example, believed in a unique airminded way of thinking. He exhibited such thinking himself in his writings

and his professional duties. Along the way to becoming the commanding general of the Army Air Forces, he promoted airmindedness by granting interviews with journalists and coupling his organization to the embryonic aerospace industry. He was also an avid storyteller, publishing multiple works for popular audiences.

Arnold's publications include three works coauthored with fellow Airman Ira Eaker: *This Flying Game* (1936, reprinted in 1943), *Winged Victory* (1941), and *Army Flyer* (1942). He independently wrote books for children, including the series mentioned earlier, *Bill Bruce and the Pioneer Aviators* (1928). After his retirement in 1946, he published another book, *Global Mission* (1949). Throughout all his promotional writings, Arnold presented "this new and thrilling game" as the last frontier for adventure and romance for airminded youth.[82] In giving career advice to Airmen, he highlighted themes of awe, enhanced cognition, novelty, and perspective:

> *Flying offers the greatest recompense to the human being; . . . he sees [the world] in broader outline . . . .* As *his knowledge and his vision is greater*, so also are his responsibilities, the requirements of his profession. No other fighter is so alone as the Airman who rides above the clouds in the vastness of the sky . . . . He has more duties to perform in any other fighter; they are more complicated and less normal to simple pursuits . . . . The terrific pace and speed of *air combat calls for a mental alertness and muscular reaction wholly foreign to all the other pursuits of man* either military or nonmilitary . . . . The normal rules of human kind are indoctrinated by long practice . . . . Not so with military aviation. Many of the *requirements of the aviator and combat are new, strange, and unusual* [emphasis added].[83]

Months prior to his retirement and in his capacity as the head of the air service, Arnold delivered the *Third Report of the Commanding General of the Army Air Forces to the Secretary of War*. In the chapter titled "Air Power and the Future," he wrote a line—much quoted in US Air Force doctrine—that revealed his grasp of other dimensions of airmindedness. Arnold wrote that since military Air Power depended for its existence upon the aviation industry and the airmindedness of the nation, "the Air Force must promote the development of American civil Air Power in all of its forms, both commercial and private."[84] Unlike those who treat airmindedness as an actualized condition, he differentiated capacity "aviation industry" from society's appreciation

of why that capacity is a worthy investment "air-mindedness of the nation". Like Mahan and Mitchell, he connected military power with its civilian counterpart, and, more importantly, he linked both to the nation's overall security and prosperity.

For Mitchell, de Seversky, and Arnold, the United States needed to realize the significance of the airplane. Commerce, diplomacy, and defense all required aviation power. In turn, aviation required airminded individuals who appreciated its capabilities and could approach these issues with new, creative perspectives. Thus, while not explicitly employing the same celebratory, inspirational language used by the cultural avant-garde, they certainly endorsed a sense of airminded thinking as radically different. Indeed, *Proficimus More Irretenti* was the motto of the Air Corps Tactical School: "We make progress unhindered by custom."[85]

Custom is what inhibited military officers in other services from taking full advantage of air power. Lack of airmindedness seemed to stunt, at least in the eyes of these Airmen, the ability to realize the myriad ways which aviation technology could and should alter the character of war. Most famously, but not exclusively, this manifested in the idea of strategic bombing—a theme in the next chapter. Given the widely held perception that industrialized cities consisted of tightly coupled infrastructure, then aircraft could hypothetically fly straight to the most critical points in this web and win conflicts decisively by disrupting the enemy's ability to wage war. This, of course, required airminded military leaders, and the historical sketch above clearly shows that Airmen sensed no such support in the existing defense establishment.

Early airmen's drive for organizational independence was a natural, seemingly inevitable, path for the air power narrative to take. It was not as self-interested as some authors charge.[86] Indeed, their logic appeared self-evident: aviation technology conferred new capabilities and new perspectives to those who were airminded; only airminded individuals could direct air power's growth and subsequent employment (all others were stuck in the past); and to realize its revolutionary possibilities, including the ability to win wars through independent bombing campaigns, this technology must be given its full respect in an autonomous air force. Until then, Airmen would continue work somewhat "under the radar" to turn their ideas—including, but not limited to, strategic bombing—into specific operational theories, based on the larger sense of airmindedness's problems and possibilities.

Conclusion

The exponential growth of aviation technology throughout the first half of the twentieth century demonstrates two points. First, many found those arguments persuasive and acted upon them. Second, advocates for military air power had to formulate theories—without the benefit of empirical examples—regarding how to employ air power. It is a task of noted difficulty, even by someone as eloquent as Winston Churchill, who claimed, "Airpower is the most difficult of all forms of military force to measure, or even to express in precise terms."[87] Yet, the historical record implies there is something about airmen's ability to understand, if not fully communicate, the potential of their revolutionary technology. A World War I flyer asserted that airmen naturally have "a different point of view, a new perspective, a more consistent aim [for] coordinating and correlating circumstances and conditions for the common good."[88] Or, to cite a much earlier source, the sixth-century poet Boethius declared that the very idea of flying offers "wings to your mind."[89]

In World War I, such flights of fancy were manifested in airmen's playful behaviors and particularly in their storytelling. In the interwar period, "airmindedness" captured an even deeper realization of aviation's possibilities, and airminded officers reflected a combination of its twin dimensions: the image of Icarus counterbalanced that of Daedalus. Airmen, although not aspiring to the artistry some called for, began to play with the possibilities of air power and to craft theories. Furthermore, like the social life of World War I aircrew and interwar airmindedness, these theoretical stories emerged from a paradigm shaped by technology. Specifically, while the range of aircraft enabled the first military airmen to practice Dionysian behaviors between missions, the altitude at which they operated conferred a different perspective upon interwar theorists. The perspective was not only physical, but also psychological. In their mind, the enemy was a system—a system that could be breached without repeating the horrors of the stalemated battle lines. It would be an approach based on technological innovation and strategic playfulness; it would enact destruction, but selectively, and for cumulative effect. It would, in other words, put Bia in service of Metis.

Notes

1. Press release, "Maxwell Unveils Daedalus Statue Commemorating World War I Pilots," Maxwell Air Force Base, AL, 7 April 2017, http://www.maxwell.af.mil/News/Display/Article/1145712/maxwell-unveils-daedalus-statue-commemorating-wwi-pilots/. Apropos to the last chapter, the National Order of Daedalians uses a web portal named after Apollo.

2. Ovid, *The Metamorphoses*, trans. A. S. Kline, 2nd ed. (CreateSpace Independent Publishing Platform, 2014), VIII: 183–235. Other writers, such as Homer and Plato, however, mention the characters centuries earlier; Necip Fikri Alican, *Rethinking Plato: A Cartesian Quest for the Real Plato* (New York: Rodopi, 2012), 245. Ovid's reference to Prometheus occurs in 78ff.

3. Homer and Bernard Knox, *The Iliad*, trans. Robert Fagles (New York: Penguin Classics, 1998), XVIII, XIX 13–19; Jacob E. Nyenhuis, *Myth and the Creative Process: Michael Ayrton and the Myth of Daedalus* (Detroit, MI: Wayne State University Press, 2003), xx; and Walter Miller, "Daedalus and Thespis," in *The University of Missouri Studies: A Quarterly of Research,* vol. 6 (Columbia: The University of Missouri Press, 1931), *342.*

4. Piero Boitani, *Winged Words: Flight in Poetry and History* (Chicago: University of Chicago Press, 2007), 35. Frontisi-Ducroux uses Daedalus's name to create a word, *daidalon*, to "encompass all kinds of traps and ruses under the appearances of seduction" (Frontisi-Ducroux quoted in Roland A. Champagne, *The Methods of the Gernet Classicists,* New York: Routledge, 2015, 174). Indeed, the wings he creates for himself and his son to escape the labyrinth he had designed to contain the Minotaur recall the "crooked path" in Hephaestus's myth.

5. Bruno Latour, "A Collective of Humans and Non-humans: Following Daedalus's Labyrinth" in *Readings in the Philosophy of Technology*, 2nd ed., ed. David M. Kaplan (Lanham, MD: Rowman & Littlefield Publishers, 2009), 157; and Nyenhuis, *Myth and the Creative Process,* 211. For the symbolism of Hephaestus's "crooked" feet as it relates to *techne* and *metis,* see Cheryl De Ciantis, "The Gait of Hephaistos: Crooked Perceptions into Consilience," *Icono* 14, vol. 15, no. 1 (2017): 128–48.

6. Berthold Laufer, *The Prehistory of Aviation*, Field Museum of Natural History Anthropological Series, 253 v. 18, no. 1 (Chicago: Field Museum of Natural History, 1928), 63; and Nyenhuis, *Myth and the Creative Process*, 5–55, 57. Elsewhere Nyenhuis suggests the reason for its widespread appeal is in how well the story resonates with the current technological age (Jacob E. Nyenhuis, "Daedalus and Icarus: A Symbol of Our Time?" *Graduate Comment* 10, no. 4, 1967: 223–238).

7. For examples of the former, Clive Hart, *Like Sex With Gods*, *The Prehistory of Flight* (Berkeley: University of California Press, 1985), *Taking Flight*, *Prehistory of Aviation*, or *Winged Words*. Other examples of the latter, Scott Palmer, *Dictatorship of the Air* (England: Cambridge University Press, 2006), Michael Sherry, *The Rise of American Air Power* (Connecticut: Yale University Press, 1987), or Gavin Mortimer, *Chasing Icarus* (New York: Walker & Company, 2010). These authors did not restrict their analyses to Western culture, highlighting analogies to Daedalus and Icarus in other cultures.

8. Azar Gat, *A History of Military Thought*, 574. Arnold uses the mythological figure in chap. 4.

9. Michael A. Sperber, "Albert Camus: Camus' the Fall: The Icarus Complex," *American Imago* 26 (1969): 269–80; "Icarus complex," *McGraw-Hill Concise Dictionary of Modern Medicine*, 1 November 2016, http://medical-dictionary.thefreedictionary.com/Icarus+complex; and Nyenhuis, *Myth and the Creative Process*, 48.

10. Peter Beinart, *The Icarus Syndrome: A History of American Hubris* (New York: Harper, 2010).

11. Peter Fritzsche, *A Nation of Fliers: German Aviation and the Popular Imagination* (Cambridge, MA: Harvard University Press, 1994), 2.

12. Robert Graves, *Greek Gods and Heroes* (New York: Dell Laurel Leaf, 1960), 55. See the ancient poetry of Pindar for further connections between Daedalus's skills and warfare.

13. Quote taken from a plaque displayed at Squadron Officer College that explains the origins and purpose of the exercise. The explanation also cites Carl Builder's *Icarus Syndrome* (chap. 4).

14. Robert Wohl, *A Passion for Wings: Aviation and the Western Imagination, 1908–1918* (New Haven, CT: Yale University Press, 1994), 136.

15. Frederick Jackson Turner famously applied a frontier thesis to America's continental expansion and commented on how the closing of the frontier impacted the nation. In contrast, David Courtwright argued the American frontier did not close. Instead, "it became multidimensional, with continuous, technologically premised, socially constructed, and mutually reinforcing movement on the land, in the nighttime, and through the sky." David T. Courtwright, *Sky as Frontier: Adventure, Aviation, and Empire* (College Station, TX: Texas A&M University Press, 2004), 14.

16. Michael S. Sherry, *The Rise of American Air Power: The Creation of Armageddon* (New Haven, CT: Yale University Press, 1987), 2.

17. Richard Hallion, ed., *The Wright Brothers: Heirs of Prometheus* (Washington, DC: Smithsonian Institute Press, 1978), x. Note the allusion to Greek mythology, "Pantheon," and the point—which corroborates the point made in the introduction—that, despite the subtitle, the work contains no substantial use of Promethean myth. Others, such as the poet D'Annunzio, do link the myth to the Wrights (see Wohl, *A Passion for Wings*, 120). Likewise, French aviator Edmond Rostand's 1911 poem, "Le Cantique de l'Aile" [The Canticle to the Wing], ends with this allusion to Prometheus (and some of the same themes reiterated throughout this chapter): "Higher! always higher, pilot! and glory to men/of great will!/Glory to these stealers of flame that we are!/Glory to Humanity!/Glory to the old Enchanted One who, guessing the joy/of soaring when his turn came,/Studied the wings of the Vulture,/While it gnawed away at his innards!" (quoted in Wohl, 262).

18. Joseph J. Corn, *The Winged Gospel: America's Romance with Aviation* (Baltimore, MD: The Johns Hopkins University Press, 2002), 12–13, 32, 91.

19. Henry H. Arnold, *Bill Bruce, the Flying Cadet* (New York: A. L. Burt Company, 1928), 239.

20. Steve Call, *Selling Air Power: Military Aviation and American Popular Culture after World War II* (College Station, TX: Texas A&M University Press, 2009), 40–41.

21. OED Online "air, n.1," (England: Oxford University Press, 2018). http://www.oed.com.spot.lib.auburn.edu/ view/Entry/4366?redirectedFrom=air-minded (accessed 19 January 2018).

22. Alan Vick, *Proclaiming Airpower: Air Force Narratives and American Public Opinion from 1917 to 2014* (Santa Monica, CA: RAND, 2015), 27. According to Google nGram (a search engine that charts word frequencies from a large corpus of books) which has some inherent flaws, it appeared most frequently in print between 1920 and 1950.

23. Guy Gilpatric, "Air-Minded," *The Saturday Evening Post*, 21 March 1931, 14.

24. Florence Fisher Parry, "On With the Show," *The Pittsburgh Press*, 16 April 1935, 18.

25. Kathryn L. Canisius, "Air-Minded Seven-Year-Olds," *Childhood Education* 11, no. 7 (1935), 311.

26. Corn, *The Winged Gospel*, 12, 30; and Robert Wohl, *The Spectacle of Flight: Aviation and the Western Imagination, 1920-1950* (New Haven, CT: Yale University Press, 2005), 59.

27. Marcel Proust, *A la Recherche du Temps Perdu*, vol. 2. Wohl, *The Spectacle of Flight*, 280.

28. Corn, *The Winged Gospel*, 13, 23, 27.

29. Gat, *A History of Military Thought*, 563.

30. Cy Q. Faunce, *The Airliner and Its Inventor, Alfred W. Lawson*, reprint (Ann Arbor: University of Michigan Library, 1921), 195–201; and Alfred Lawson, "Natural Prophecies," *Aircraft* VI (October 1916).

31. Michael Paris, "The Rise of the Airmen: The Origins of Air Force Elitism, c. 1890–1918," *Journal of Contemporary History* 28, no. 1 (January 1993): 129.

32. Mark Dorrian and Frédéric Pousin, ed., *Seeing from Above: The Aerial View in Visual Culture* (London: I. B. Tauris, 2013), 83, 86.

33. Wohl, *A Passion for Wings*, 257.

34. Atwill, *Rhetoric Reclaimed*, 54. Others argue the relationship between the technical and the sublime may not necessarily be a symptom of modernity. Atwill discusses the pre-Plato concept of *techne* as the ability to craft "objects designed to evoke wonder and awe."

35. David E. Nye, *American Technological Sublime* (Cambridge, MA: The MIT Press, 1996), xx; and Jerome Tharaud quoted in *A Passion for Wings*, 290. Regarding the technological sublime, also reference the following histories: John F. Kasson's *Civilizing the Machine* (New York: Grossman Publishers, 1976) and Marx, *Machine in the Garden.* In a specific example of "seeing from above," White argues that viewing the Earth from space can induce a mental shift in perspective that replaces the divisions and conflicts down on Earth with a holistic view of humanity (Frank White, *The Overview Effect: Space Exploration and Human Evolution,* Boston: Houghton Mifflin, 1987). He does not use the term, but one may could cite this as a component of "spacemindedness," but this would again confuse awareness of the effect with the effect itself.

36. Nye, *American Technological Sublime*, 202.

37. Dominick A. Pisano, "The Greatest Show Not on Earth: The Confrontation between Utility and Entertainment in Aviation," in *The Airplane in American Culture,* ed. Dominick A. Pisano (Ann Arbor: University of Michigan Press, 2003), 69. For instance, the beverage company Red Bull has sponsored an Air World series since 2003 ("History: All You Need to Know About the History of the Red Bull Air Race World Championship," http://airrace.redbull.com/en_US/article/history, accessed 22 January 2018).

38. Wohl, *The Spectacle of Flight*, 4.

39. Harry Harper, *Daily Mail*, 26 July 1909, quoted in Wohl, *A Passion for Wings*, 66.

40. Wohl, *The Spectacle of Flight*, 4; Call, *Selling Air Power*, 15; Roger Bilstein, *Flight Patterns: Trends of Aeronautical Development in the United States*, 1918–1929 (Athens: University of Georgia Press, 1984), 150.

41. Nye, *American Technological Sublime*, 284. Wohl writes "one of the great attractions of flight for the men and women who engaged in it during the 1920s and 1930s was the visual excitement that it offered." Wohl, *The Spectacle of Flight, 4.*

42. William L. Fox, *Aereality: On the World from Above* (Berkeley, CA: Counterpoint, 2009), 50–51, 99; Peter Adey, Mark Whitehead, and Alison Williams, eds., *From Above: War, Violence, and Verticality* (New York: Oxford University Press, 2014), 2; and Jason Weems, *Barnstorming the Prairies: How Aerial Vision Shaped the*

Midwest (Minneapolis: University of Minnesota Press, 2015), xiv. For a critique of the assumptions regarding the "god's eye view," see James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998). Linking Scott's overconfident statist planners with the ideas of aviation, some "prehistorians" of aviation note that "the will to fly is the will to conquer," and dreams of flight have always involve power and conflict (even as they are playful) Berthold Laufer, *The Prehistory of Aviation* (Chicago: Field Museum of Natural History, 1928), 11; and Richard P. Hallion, *Taking Flight: Inventing the Aerial Age, from Antiquity through the First World War* (New York: Oxford University Press, 2003).

43. Jeanne Haffner, *The View from Above: The Science of Social Space* (Cambridge, MA: The MIT Press, 2013), 14, 16.

44. Jean-Marc Besse, "Aerial Geography," in *Designs on the Land: Exploring America from the Air,* edited by Alex S. MacLean et al. (New York: Thames & Hudson, 2003), 339.

45. Stephen Kern, *The Culture of Time and Space, 1880–1918*, 2nd ed. (Cambridge, MA: Harvard University Press, 2003), 242; and Singer, *Like Sex with Gods*, 14–15. Interestingly, the idiom "on top of the world" is reportedly from 1920, around the same time as the Golden Age of Aviation.

46. Wohl, *A Passion for Wings*, 162.

47. Roger D. Launius, ed., *Innovation and the Development of Flight*, (College Station, TX: Texas A&M University Press, 1999), 4. Mistakenly replacing "sea change" with "see change" is ironic, given the relationship between a new physical perspective and a new psychological perspective.

48. Anne Collins Goodyear, "The Effect of Flight on Art in the Twentieth Century," in *Reconsidering a Century of Flight,* edited by Roger D. Launius and Janet R. Daly Bednarek (Chapel Hill: The University of North Carolina Press, 2003), 237.

49. Gabriele D'Annunzio quoted in Wohl, *A Passion for Wings*, 164–165, 310; and Mikhail Matyushin quoted in Wohl, *Passion,* 164.

50. Bilstein, *Flight Patterns*, 149; and Anton Giulio Bragaglia quoted in Gerald Silk, "Our Future Is in the Air," in *The Airplane in American Culture*, ed. Pisano, 285.

51. Wohl, *A Passion for Wings*, 2, 24. Jeffrey T. Schnapp, a professor of Italian and comparative literature, Harvard University, Cambridge, MA, expresses a similar conclusion: "Instinct and science . . . technical progress and the return to primordial forces. . .humankind's final frontier: a last remaining source of mystery, miracles, novelty and the unknown . . . a last place of transcendence in a resolutely secular age." Jeffrey Schnapp, "Propeller Talk," *Modernism/Modernity* 1, no. 3 (September 1994), 170.

52. John W. Ward, "The Meaning of Lindbergh's Flight," *American Quarterly* 10 (Spring 1958): 14–16.

53. Lewis Mumford, *Technics and Civilization* (London: Routledge & Kegan Paul PLC, 1934), Plate XI. Commentary on plate XI, "Airplane Shapes" (Figure 1): "the airplane has set the pace for refined and exact engineering" and comments on how aircraft design improved comfort and power of automobiles and trains as an example of "experimental and possibly somewhat romantic attempts to adapt to surface transportation the advantages of airplane and dirigibles . . . the airplane has freed the inventor from the stereotypes of wheel-locomation."

54. T. E. Lawrence quoted in Gat, *A History of Military Thought*, 594; and Robert S. Dudney, "Lawrence of Airpower." *Air Force Magazine* 95, no. 4 (April 2012), 66–70.

55. Kern, *The Culture of Time and Space*, *1880–1918*, 241–242.

56. Peter Adey, *Aerial Life: Spaces, Mobilities, Affects* (Malden, MA: Wiley-Blackwell, 2010), 9; Mark Dorrian and Frédéric Pousin, "Introduction," in *Seeing from Above: The*

Aerial View in Visual Culture, edited by Mark Dorrian and Frédéric Pousin (London: I.B.Tauris, 2013), 1; Fox, *Aereality*, 3; Schnapp, "Propeller Talk," 154; and Jonathan F. Vance, *High Flight: Aviation and the Canadian Imagination* (Toronto: Penguin Canada, 2002), 101.

57. Hynes, *The Unsubstantial Air*, 125; and Bilstein, *Flight Patterns*, 151.

58. William Fielding Ogburn, *The Social Effects of Aviation* (Boston: Houghton Mifflin Company, 1946), 705.

59. As examples, see Edgerton, *England and the Aeroplane* (28 September 2017); Fritzche, *A Nation of Fliers* (Cambridge, MA: Harvard University Press, 1994); Dan Hagedorn, *Conquistadors of the Sky* (Gainesville, FL: University Press of Florida, 2010); Palmer, *Dictatorship of the Air*, 2006); or Vance, *High Flight*. Most of these works, citing Corn and sometimes Wohl, use "airmindedness" to label the enthusiastic appreciation of the power of flight to impart tangible and intangible advantages onto a nation. Palmer alters the term, offering a nuanced distinction between "airminded" and "airmindedness." The first is still about enthusiasm. The second is about the specific ways a culture nurtures and expresses that enthusiasm.

60. Murray F. Sueter, *Airmen or Noahs: Fair Play for our Airmen; The Great "Neon" Air Myth Exposed* (London: Isaac Pitman & Sons, 1928), 296.

61. On airshows, see Gordon Pirie, "British air shows in South Africa, 1932/33: 'Airmindedness,' Ambition and Anxiety," *Kronos* 35, no. 1 (November 2009): 48–70.

62. Contemporaries would not have used "airmindedness" to describe this decidedly unenthusiastic aspect of aviation, but scholars such as Holman and Fritzsche have profitably extended the term. Contemporaries would, however, agree with these two that this "airmindedness" could be obtained on the ground.

63. Brett Holman, "The Next War in the Air: Civilian Fears of Strategic Bombardment in Britain, 1908–1941" (PhD diss., University of Melbourne, 2009), 12. For another example, see Peter Fritzsche, "Machine Dreams: Airmindedness and the Reinvention of Germany," *The American Historical Review* 98, no. 3 (1 June 1993): 685–709.

64. Robert Frank Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1907–1960* (Maxwell Air Force Base, AL: Air University Press, 1989), 26–27.

65. Michael S. Sherry, *The Rise of American Air Power: The Creation of Armageddon* (New Haven, CT: Yale University Press, 1987), 19.

66. "Billy" Mitchell, introduced below, boasted: "I was sure that if the war lasted, air power would decide it" (quoted in Futrell, *Ideas, Concepts, Doctrine*, vol. 1 (Maxwell Air Force Base, AL: Air University Press, 1989), 27).

67. Nyenhuis, *Myth and the Creative Process*, 46–47, 54; Ovid quoted in Boitani, *Winged Words*, 33. Overall, there is "rich diversity of interpretation and creative expression" surrounding the myth of Icarus and Daedalus (Nyenhuis, *Myth and the Creative Process*, 45).

68. Boitani, *Winged Words*, 35, 46; and Nyenhuis, *Myth and the Creative Process*, 44–46, 53.

69. Theophile Gautier quoted in Nyenhuis, *Myth and the Creative Process*, 53.

70. Nyenthius, xvii. Wohl's *Passion for Wings* reproduces a painting of "a defiant Icarus [as he] spreads his wings to protect his twentieth-century heirs," aviators in the earliest aircraft models (262).

71. Wohl, *A Passion for Wings*, 66, 263.

72. Nyenthius, *Myth and the Creative Process*, 56.

73. Barnett, L. & Owens, M., "Does play have to be playful?," in *The Handbook of the Study of Play,* edited by James E. Johnson et al., (Lanham, MD: Rowman & Littlefield Publishers, 2015), 453–459; Stuart Brown and Christopher Vaughan, *Play: How*

It Shapes the Brain, Opens the Imagination, and Invigorates the Soul (New York: Avery, 2010), 5; and René T. Proyer and Willibald Ruch, "The Virtuousness of Adult Playfulness: The Relation of Playfulness with Strengths of Character," *Psychology of Well-Being: Theory, Research and Practice* 1 (24 October 2011), 4.

74. Thomas S. Henricks, "Play as Self-Realization: Toward a General Theory of Play," *American Journal of Play* 6, no. 2 (Winter, 2014) 190–213.

75. Mark Clodfelter, "Molding Airpower Convictions: Development and Legacy of William Mitchell's Strategic Thought" in *The Paths to Heaven: The Evolution of Air Power Theory*, ed. Phillip S. Meilinger (Maxwell Air Force Base, AL: Air University Press, 1997), 101.

76. William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power* (Tuscaloosa, AL: University of Alabama Press, 2009), vii, 21.

77. "Both Insubordination and Folly," *New York Times*, 1925.

78. Alfred F. Hurley, *Billy Mitchell: Crusader for Air Power* (Bloomington, IN: Indiana University Press, 2006), 10.

79. Alexander P. de Seversky, *Victory Through Air Power*, Book Club edition (New York: Simon and Schuster, 1942), 5–6.

80. De Seversky, *Victory Through Air Power*, 84, 219–220.

81. Roy R. Grinker and John Paul Spiegel, *War Neuroses in North Africa; the Tunisian Campaign, January–May 1943* (New York: Josiah Macy Jr. Foundation, 1943), 99–100. This resurfaces in Air Force Manual (AFM) 1–1, vol. 2, *Basic Aerospace Doctrine* (March 1992) as discussed in chapter 4.

82. Henry H. Arnold, *This Flying Game* (Funk & Wagnalls, 1936), xviii-xix.

83. Henry H. Arnold and Ira C. Eaker, *Army Flyer* (Harper & Bros., 1942), 8–9.

84. Henry H. Arnold, *Third Report of the Commanding General of the Army Air Forces to the Secretary of War, 12 November 1945* (Washington, DC: Government Printing Office), 70. This is essentially the same line he used in a 1946 article for *National Geographic Magazine* (February 1946, 193). Also, in "If War Comes Again," he stated, "an air-minded public is the broad base of American air power" (*New York Times Magazine*, 18 November 1945, 39). Note that Arnold's "air power" is equivalent to my use of "aviation power," since current usage associates air power with military aviation. Mitchell's usage, however, matches his protégés when he wrote "air power . . . is, and will be, a dominating factor in the world's development" (Mitchell, *Winged Defense,* 119).

85. Robert T. Finney, *History of the Air Corps Tactical School 1920–1940*, 3rd ed. (Arlington, VA: Air Force History and Museums Program, 1998), v.

86. Mark Clodfelter, *Beneficial Bombing*, (Lincoln, NE: University of Nebraska Press, 2011). For more historical analysis on this institutional thesis—which sometimes has the distinct hint of a predetermined narrative—see also Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas About Strategic Bombing, 1914–1945* (Princeton, NJ: Princeton University Press, 2002); Timothy Moy, *War Machines: Transforming Technologies in the U.S. Military, 1920–1940* (College Station, TX: Texas A&M University Press, 2001); and H. Bruce Franklin, "'Peace Is Our Profession': The Bombers Take Over," *The Airplane in American Culture*, ed. Dominick A. Pisano (Ann Arbor: University of Michigan Press, 2003).

87. Winston S. Churchill, *The Gathering Storm*, vol. II (Boston: Mariner Books, 1986), 100.

88. Cecil Lewis, *Sagittarius Rising* (London: Penguin, 1977), 83. The book was first published in 1936.

89. Nyenhuis, *Myth and the Creative Process*, 40. Boethius, *Consolation of Philosophy*.

Chapter 3

Metis and *Bia*: Air Power Theory

Figure 3. Section of Paris Shot Achilles with An Arrow by Peter Paul Rubens. The 17th century painting shows the potentially decisive results of precise destruction.

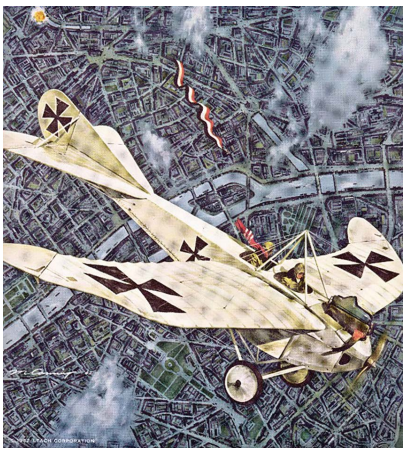

Figure 4. The Five o'clock Taube by Merv Corning, an American artist (1926–2006). Three centuries after Ruben's painting, a similar attempt for surgical precision, again delivered through the air, is evident in the upper left-hand corner as a single German aircraft drops three bombs on Paris, along with leaflets demanding France's surrender. The connection between air power and Paris, the mythological character, was made explicit in Basil H. Liddell Hart's 1925 work, *Paris, or the Future of War*.

Conventionally, commentators on US Air Force culture claim the institution fosters a focus on the tactical over the strategic, the artifacts of warfare over the art of war, and bureaucratic autonomy over institutional integrity. This partial view is often derisively labeled as "technological," but such accusations overlook the more dynamic themes inherent in the history of that word. To demonstrate these missing elements, which include craftiness, rhetoric, and adaptability, this chapter examines one manifestation of Air Force culture: air power theory. As a form of technological knowledge, ideas about the proper employment of US air forces reflect the dual legacy of airmindedness—a mental flexibility that uses intellectual playfulness to combine technological capabilities for strategic effects. As in the earlier chapters, this metaphorical component of Air Force culture parallels the operational flexibility conferred by the technical qualities of aviation. Indeed, the ability to go almost anywhere, anytime—but not everywhere at once—implies the need to design intelligent theories to guide the use of this powerful, but precious, asset. Indeed, in moments of geopolitical crisis, such as World War II and the first Gulf War, Airmen have successfully moved into the more dynamic connotations of their "technological" mindset. Yet, the standard trope holds true for most of the organization's life: moments of revolutionary theorizing morph into periods of normalized principles and dogmatic practices. In heralding the creation, but forsaking the creative process, Airmen lose sight of the playful side of their technological paradigm, which recedes back into a dormant state.

Introduction

The start of chapter 1 displayed a print by artist James Dietz. The image served as the inspiration for the 27th Fighter Squadron's remodeling of its squadron bar, what Airmen euphemistically call a "heritage room," at Langley AFB, Virginia. The pilots had talked about the renovations for some time, but amidst the demanding tempo of operations, the project had not begun.

That changed one September morning. Only days after returning from a deployment to enforce the Southern no-fly zone over Iraq, the squadron looked forward to restarting their normal training regiment—and possibly to finally upgrading the modern version of the officer's mess. It would be a long time, however, before normal home station operations returned. In fact, what made the demolition and rebuilding of the bar possible were the 24-hour operations the unit began that day. The changes, in both the bar and in the unit's daily activities, actually took place against the background of much larger changes in US national security and popular attitudes towards air power.[1]

As the workday began at Langley field, four sets of terrorists were hijacking commercial airliners, and—in a perversion of interwar air-mindedness, at least in its optimistic form—they would soon turn those airplanes into weapons of mass destruction. The US military command, responsible for safeguarding American skies since 1957, the North American Aerospace Defense Command (NORAD), failed to anticipate a threat ever coming from within its borders. Forced to improvise on that Tuesday morning, the air defense response from the command, which is largely run by the US Air Force, was hampered by poor communication with external governmental agencies and a lack of coordination within its various units. Some squadrons launched without weapons capable of destroying a commercial airliner, or even with clear instructions. The F-15s of the 27th, for example, were vectored to Washington, DC, and directed to search all approaches to the capitol. Other units, who had been on air defense alert, were scrambled as well. All the Airmen's efforts were to no avail, a story that has been well documented.[2]

Despite a long-standing directive preventing any fighter aircraft from firing upon hijacked aircraft, even if they had intercepted them, the United States Air Force faltered in the eyes of many.[3] Furthermore, while the combat that followed in Afghanistan displayed a novel coordination between air power and special forces operating on the ground, success was soon overshadowed by events in Iraq.[4] Far from the robust, well-publicized air campaign that prepared the way for the ground offensive during Operation Desert Storm in 1991, there were no press conference videos of guided weapons to awe audiences. The only preemptive air strike in Operation Iraqi Freedom was a single mission of two aircraft. The attempted decapitation strike against Saddam Hussein failed, not because the underground bunkers were empty, but because the bunkers did not even exist. Air operations that followed—as

operationally successful as they were—did not play the leading role during the three weeks of major combat operations. There was no repeat of the independent air campaign, and most of the embedded journalists told the story of the ground forces. Even if air power had been more visible to the US public, kinetic air power seemed to be the least relevant use of military might in the morass that ensued.

Robert Gates, Secretary of Defense, speaking in 2008 at Air University (the US Air Force organization for postgraduate education), observed that getting Airmen to adapt to counterinsurgency was "like pulling teeth."[5] Around the same time, Gen James Mattis, commanding general of the US Joint Forces Command, dealt another blow to the US Air Force and a keystone of Airmen's doctrine, Effects Based Operations (EBO). The 2006 Israel–Hezbollah War and a US military assessment both seemingly invalidated the model, which trusted that strategic outcomes could be predetermined by the application of precise and minimal force. In the aftermath, Mattis made a bold and public pronouncement against EBO.[6] Criticism of the US Air Force even went as far as calls for its dissolution as a separate service.[7] Critiques against American air power are not new and, in fact, perpetuate a long history of disparaging those who specialize in projecting tactical force over distance. Such criticism goes back to the time of Homer and to ancient ways of fighting.

In primitive wars, missile warfare was ubiquitous but seldom decisive. Prehistoric battles tended to start with a volley of projectiles such as stones, spears, or arrows. Sometimes no further escalation occurred. These confrontations demonstrated strength and resolve. In other words, they were coercive, exacting little destruction from either side. The deadliest form of warfare came from surprise raids. These infrequent, but intense, assaults capitalized on the attackers' ability to mass forces at an enemy vulnerability.[8]

As civilizations grew bigger and politically, socially, and technologically more sophisticated, wars grew in terms of duration, distance, and destruction. The open battlefield replaced stealthy raids. Sporadic, but horrific, battles became the conventional means of deciding political contests.[9] Within these encounters, belligerents eschewed coercion. Instead, they concentrated destruction into a single event wherein forces literally clashed into one another until a victor was obvious. Opposing sides willingly endured great costs to secure increasingly valuable, increasingly accumulated resources of another people.[10] In this pursuit of decisiveness, there was no place for subter-

fuge or stratagems, but only force against force. Likewise, there was no place for the missileers' kinetic effects at a distance, at least among the celebrated elements of warfare: killing—heroic killing, worthy of honoring in stories—occurred in close quarters.

Warfare is inherently about organized violence, and the bond between members of a warring group has always been strengthened by storytelling. Naturally, those stories often revolved around accounts of fighting. Indeed, the earliest known oral epics revolve around such tales, with Homer's poems perhaps the most obvious example.[11] A common theme of those stories is the denigration of projectile warfare. For example, Paris is the only major character in *The Iliad* who uses a bow. He is chastised by others for it, as when another character states, "My way is not to fight my battles standing far away from my enemies."[12] Some scholars even assert the preference for this close-in, destructive, decisive character of warfare as a distinct Western way of war.

In the preface to *The Western War of War,* Victor David Hanson acknowledges "that the Greeks' stark way of battle left us with what is now a burdensome legacy in the West: the presumption that battle [should be] a no-nonsense, head-to-head confrontation between sober enemies."[13] What was intended to be too brutal to be continuous instead morphed into something else when transported into a different context. Thus, by World War I, obsession with the decisive battle combined with the means supplied by industrialization to yield its opposite: a war of continuous, stalemated bloodletting that was ultimately decided by politicians instead of military victory. The appalling conditions of trench warfare threatened to wipe away any vestige of the heroic idealism associated with decisive battles.

Yet, there was one group of fighters who seemed to escape the corruption of modern warfare: the airmen who rose above the trenches to become celebrated as knights of the air. For instance, David Lloyd George, British statesman, famously admired aviators as "the knighthood of the war, without fear and without reproach. They recall the old legends of chivalry, not merely the daring of their exploits, but by the nobility of their spirit, and amongst the multitudes of heroes, let us think of the chivalry of the air."[14] Yet, instead of descending from hoplite infantry, as the knights had, pilots could more accurately be described as the modern version of the original throwing warriors. Even if their modes of destruction were not as thorough as direct combat, both projected physical effects to achieve a coercive, psychological impact.[15] While characters in *The Iliad* may have mocked this

indirect approach to warfare, it capitalized on the very trait Homer honored in *The Odyssey*.

Thus far in this book, Homer's epic poetry has provided images of mythological characters, insights into Greek conceptions of technology, and an exemplar of storytelling, including the most famous accounts of the Trojan War. His epics also illustrate the two fundamental approaches to strategy based on the goddesses Bia and Metis. Writing in his magnum opus *On Strategy,* the renowned Sir Lawrence Freedman declares "the most powerful dichotomy in all strategic thought was the one first introduced by Homer as the distinction between *bia* and *metis*, one seeking victory in the physical domain and the other in the mental, one relying on being strong and the other on being smart, one depending on courage and the other imagination, one facing the enemy directly and the other approaching indirectly."[16] Homer juxtaposed Metis's intelligence and Bia's strength in his two main characters, Odysseus and Achilles.

Across the entire Western canon, the mortal most identified with *metis* is Odysseus. Though he did employ force at times, his default was, according to Freedman, "indirect and psychological . . . seeking to confuse, disorient, and outwit opponents."[17] His Trojan Horse ruse tipped the war in the favor of the Greeks, but the quintessential example of *metis* is Odysseus's escape from the Polyphemus.[18]

As the Trojan War ends and Odysseus starts his journey home, his ships land on an island of one-eyed giants. Imprisoned by one of them, Polyphemus, Odysseus crafts a plan. Only the Cyclops can move the stone blocking the prisoners inside a cave so killing Polyphemus would strand them. Having tricked the captor into drinking too much, Odysseus blinds him instead. The next morning, when the giant moves the stone to let his flock graze, the men escape by strapping themselves underneath the sheep. The sophisticated part of the plan plays out next. To ensure that no other Cyclopes pursue him and his men, Odysseus had the forethought during the previous night's imbibing to tell the captor his name was "no one." Therefore, as the men flee, the other Cyclopes ask Polyphemus who is responsible for his blindness. He replies, as Odysseus foresaw, "no one," and they leave him to suffer alone in his apparently self-inflicted pain. Interestingly, in Greek, "no one" is *me tis,* which is phonetically equivalent to *metis*.[19] To Greek audiences, Homer's clever reference would have been obvious.

In a landmark study, *Cunning Intelligence in Greek Culture and Society,* Marcel Detienne and Jean-Pierre Vernant note the coherence and centrality of *metis* among ancient Hellenistic societies. The concept, they argue, remained fundamentally unchanged for more than a thousand years and can be interpreted as: "a type of intelligence and of thought, a way of knowing; it implies a complex but very coherent body of mental attitudes and intellectual behavior which combine flair, wisdom, forethought, subtlety of mind, deception, resourcefulness, vigilance, opportunism, various skills, and experience acquired over the years."[20] Other scholars have taken up the topic, but the resulting discourse has clarified the concept rather than rejected it.[21]

Detienne and Vernant focus on masculine activities of seizing, holding, and controlling. This style of thinking is largely predictive, manipulative, and artifactual. Odysseus remains the paragon of this nonpassive *metis,* as he seeks a degree of control over outcomes. He is not the only character in the work that exemplifies *metis*, however. Martha Nussbaum identified another dimension, equally prevalent in Greek culture, exemplified by Odysseus's wife, Penelope. This form of *metis* accepts a lack of control and inadequate foresight and thus embraces vulnerability. It therefore privileges social communion, intellectual wonder, and more passive, subtle designs. While the *metis* of both the husband and wife rely upon visceral experiences, tacit skills, and indirect approaches to volatile contexts, hers is more flexible, organic, and tolerant of uncertainty. If the image of the first is the army general or hunter, then the second is symbolized by a weaver or gardener—both requiring cooperation with nature. Instead of the goal-directed behavior of the trapper, it is the process-orientation and provisional growth of an ivy vine. Between the couple, Homer provides a robust portrayal of *metis* and its complementary components and establishes both as equally important for strategic success.[22] It is an idea with significant ramifications for airmen.

Throughout the literature on *metis*—which remains untapped by either historians of technology or air power theorists—activities described as metic are diverse, from sophistry, weaving, navigation, or politics to the way an invasive plant spreads, an octopus changes shape and color, or water flows.[23] Yet the fundamental qualities are always the same. When framed around human agents as opposed to animals or inanimate materials, the paradigm of *metis* is a psychological orientation toward time, experience, and change. It has cogni-

tive, affective, and social dimensions that, moreover, resonate with the post-Platonic themes highlighted in this book.

Metis is a way of thinking that is pragmatic and playful, reasoned and passionate, systemic and yet still specific. It is an instrumental intelligence, meant to resolve a particular problem without any insinuation that its solutions are universal or, like speculative philosophy, that any consequent idea is an end in itself. Its methodology toolkit is, like those inaugurating Kuhnian revolutions, a combination of objective logic and subjective inspiration, from both rigorous experimentation and serendipity; a degree of evidence combined with a dose of irrational faith.[24] *Metis* embraces these creative tensions. It cultivates Morgan's mosaic instead of becoming attached to a single image or metaphor that is inevitably partial and perishable. It "bears on fluid situations which are constantly changing and which at every moment combine contrary features and forces that are opposed to each other," according to the authors of *Cunning Intelligence*.[25] Its means are premised on a wicked world: every effort counts because every action or thought alters the context, making the past useful, but not authoritative; all perspectives are partial, both biased and incomplete, making total solutions impossible and making even the most sophisticated solutions merely temporary.[26]

Metis, however, does not just accept unresolvable paradox, systemic uncertainty, and unpredictable change—it leverages these conditions to secure an advantage. Its response is a playful one: experimental, improvisational, vigilant, and attuned to how events unfold in time and space. The metic thinker works to disprove her own assumptions as she crafts artful—and often unpredictable—recombinations of ends, ways, and means, in the spirit of bricolage. This attitude expects the unexpected and is rewarded for its prescience.[27]

In sharp contrast to these qualities, the protagonist of *The Iliad* is known for his physical courage, strength, and agility in combat. Achilles deplores duplicity, stating, in reference to Odysseus, "I hate like the gates of Hades, the man who says one thing and hides another inside him."[28] In the same scene, he highlights the failure of subterfuge to bring victory in the Trojan War. Yet, the culmination of that conflict later came with the ruse of the Trojan Horse, a ploy Achilles missed, having been killed during one of his renowned battlefield rages. According to one classicist, Homer's insinuation here and throughout proves that "the humane heroism of Odysseus, based

as it is on intelligence and endurance, is set above the quicksilver glory of Achilles."[29]

To Plato, however, the operative contrast was not between Metis and Bia (which evolved into common nouns), but between *metis* and speculative philosophy. The latter, built on the premise of a world amenable to the reason of an elite few, placed the philosopher above all.[30] As earlier mentioned, this included downgrading the technician, as Plato redefined and devalued *techne*. While *techne* was degraded, *metis* was discarded. The Platonic paradigm simply could not acknowledge a multidimensional, practical intelligence that "applied to situations which are transient, shifting, disconcerting and ambiguous, situations which do not lend themselves to precise measurement, exact calculation or rigorous logic." Philosophers instead turned their focus toward less capricious, more reliable matters such as theoretical knowledge amenable to generalizations. Thus, the explicit use of the concept never made it into the Western canon, thanks to the prejudice of Plato.[31]

In the twentieth century turn away from the Platonic paradigm, the concept of *metis* gained recognition among scholars. It is, however, absent among military professionals even though Wheeler argues *metis* "characterizes the entire stratagemic vocabulary."[32] Despite its absence in the lexicon of warfare, it has always been implicit in the paradigm of one group of warriors—Airmen. That is, the *technological logos* of Airmen contradicts Plato, not just in the wisdom of storytelling or the dynamic nature of *techne* but also in how they imagine air power prevailing in a world that is wicked once over.

"Technological-ness" of Air Power Theories

Although unaware of the Greek term, *metis* is precisely what Airmen aspired to embody as they imagined how air power technology could be leveraged against an enemy. Just as the range and speed of Apollonian aircraft allowed Dionysian behaviors in World War I, and just as flight elevated Airmen's perspective—literally and cognitively—in a way that embraced the images of Daedalus and Icarus, the *metis* within their paradigm also arises from qualities of their technological artifact.

To begin with, the airminded appreciation of aviation as a radically new capability primed Airmen with a sense of change and ex-

citement. *Metis* thrives in such a context, as well as in the context of a power disparity, which Airmen experienced in two ways during the first half of the twentieth century. One was on the modern battlefield, wherein limited military capabilities of air power paled in comparison to the destructive potential of land forces. The other imbalance was organizationally within the United States defense establishment, where the future of an American air force depended upon Airmen's ability to craft a persuasive narrative of its combat effectiveness. Most fundamental to inculcating *metis,* however, is another trait commonly cited as one of the unique attributes of air power.

The "key to air power is flexibility," according to General "Hap" Arnold, chief Army Air Forces in World War II. It is a quote Air Force officer trainees have been required to memorize for years.[33] A World War II War Department Manual sanctified this belief: "the inherent flexibility of air power is its greatest asset. This flexibility makes it possible to employ the whole weight of the available air power against selected areas in turn; such concentrated use of the air striking force is a battle-winning factor of the first importance."[34] Restated, the nature of air warfare also includes the ability to span the battlespace and shift from one type of mission to another. For bomber advocates that meant large-scale bombing missions against two different targets in as many days. Fighter aircraft could shift missions multiple times a day and even within the same sortie.

This sentiment remains part of US Air Force culture today. "Airpower's inherent speed, range, and flexibility combine to make it one of the most versatile components of military power," according to the service's basic doctrine. "Its versatility allows it to be rapidly employed against strategic, operational, and tactical objectives simultaneously. The versatility of airpower derives not only from the inherent characteristics of air forces themselves, but also from the manner in which they are organized and controlled."[35] Even though conventional air power does not have the staying presence and overt destructive capacity of an army on the ground, the nature of the technology allows it to converge upon a single point in time and space, much like the raids of primitive warfare. A Homeric example is how Paris the archer uses his missile to strike Achilles's one vulnerability.

There is no lack of violence in air strikes, surprise raids, or in the death of Achilles, Homer's embodiment of *bia*. The use or threat of physical destruction is the essence of warfare; but *metis* is the degree to which that destructive force is guided by an overarching strategic

intelligence. For the metic strategist, violence is never force for its own sake, nor is it necessarily organized sequentially, moving in a linear progression along a universally valid solution. Traditional land campaigns had little choice but to progress by pushing the enemy's frontlines further and further back.[36] Eventually the desired resource would be secured or the seat of government destroyed. Within the limits of their range, airplanes offered the ability to apply force almost any place the commander desired, including on the opponent's political leadership, and do so without the prerequisite destruction along the way.

Air forces could go almost anywhere but could not be everywhere. This implies a need to know where and when its modest strength would be most efficiently applied. Colin Gray calls air power's "militarily unique flexibility and adaptability" the "the natural gift of its environment" but notes that this creates "ever-growing problems of choice" for Airmen.[37] The *metis* within the *technological logos*, however, views these problems as opportunities to exploit, opportunities to craft a different type of story. It is a story still oriented to their beloved technical artifact and still playful, but the plot is how air power can prevail through selective actions and accumulated effects. These storytelling Airmen offered technological theories, but not in the mold of Plato's abstract philosophy or his dehumanized *techne.* Instead, their stories—their *logos*—offered theories for action that were grounded in context, born in imagination, unburdened by tradition, and inspired—and indeed shaped—by their cherished machines.[38]

Explaining how Airmen formulate and communicate their own theories of employing air power goes a long way towards understanding the service's organizational culture. Indeed, Colin Gray, a theorist as reputable as Freedman, explains that "theory is not all that matters in the grand historical narrative of air power, but it does matter most, and it always has."[39]

There is room for much confusion regarding the relationship between strategy and theory. "Strategic," as used here, does not reference a level of government, a weapon system with great range, decisiveness of an action, or nuclear weapons. Strategy is a constellation of ideas regarding the art and science of realizing a "continuing advantage."[40] Strategy is what guides politics, in the grand sense of politics as any contest for and with power (or, as in Sidney Hillman's famous phrase, competition over "who gets what, when, and why").[41] Strategy is obviously also applicable to politics in the narrow sense of government, as well as games, business, and warfare. The very word

arose from a military context. The ancient Greek word for a military general was *strategos,* and this military context is presumed from here on.

According to Gray, there is a general theory of strategy that is "authoritative for all periods, universally, and that commands all kinds of military forces in all geographies."[42] There is a subsidiary "general theory of airpower" that is equally universal but is restricted to the use of that specific type of military force. Subordinate to that are specific theories that underwrite air strategies. Again, strategy is a singular concept. Strategies (plural) are attempts to realize an advantage in a more constrained, less universalized, setting. Air strategies that address the use of air power comprise one such category. Two particular cases are relevant for this study. The first is the 1941 US Army Air Corps plan for strategic bombing prior to the nation's entry into World War II, Air War Plans Division 1 (AWPD-1). The second is the US Air Force plan for an air campaign developed in the weeks following Iraq's 1990 invasion of Kuwait, the Instant Thunder air campaign plan.

The foundations of those two air strategies came from respective operational theories, stories of how to arrange kinetic air power to prevail.[43] In the first case it was the Industrial Web Theory, which imagined modern societies as a set of interdependent processes undergirded by manufacturing. Targeting key nodes in the economic network would supposedly not only wreck an enemy's physical ability to wage war but also would naturally curtail the political and popular will for fighting. The second air strategy arose from the theory of strategic paralysis, which postulated that near simultaneous attacks of multiple sectors—industrial production, infrastructure, and supplies but also political leadership—was a more reliable method to disable an enemy system. This shifted focus away from the enemy's morale onto their ability to understand the situation and control their forces.[44] Again, these theoretical stories emerge from a paradigm justly labeled a *technological logos* for at least two reasons. First, this mindset is about technology and second, the attributes of that very technology—the range, perspective, and flexibility—shape the way Airmen create and employ these stories.

According to Morgan, the link between a paradigm and puzzle solving is theory. The theories of air power crafted by Airmen emerged from a common worldview, a paradigm that is technological, in more than one sense. Technology is their subject. It guides their style. It shapes their logic. It is the guiding *logos* of their stories, which again, in

any context, are narratives about how to prevail. And, just as *logos* here is employed in its more robust, pre-Platonic connotation, the *techne* of Airmen is more than just mechanical skill. It is, in accordance with Homer's usage, a form of technological knowledge that is subjective, improvisational, and sensible. And it is inseparable from *metis*.

Metis is present in both the paradigm—the *technological logos*—and in the individual theories generated from within that mindset. In other words, there is some degree of strategic wisdom within each individual air power theory as well as *metis* within the paradigm that guides how Airmen craft an overall strategy from a menu of theories. This project focuses on the paradigmatic level, but it necessarily entails some insight into puzzle solving.

When theories are operationalized, the result is a specific plan on how to use specific technical abilities to achieve the desired effects. Thus, AWPD-1 was based on Industrial Web Theory and Instant Thunder was based on strategic paralysis.[45] These plans were never the sole ones regarding the use of air power in their respective conflicts. For both, other combat missions included close air support (CAS, requiring detailed integration and close coordination with the friendly forces on the ground that aircraft are directly supporting), air interdiction (stemming the flow of resources to the battlefield), or air superiority (the ability to operate freely in the air domain while denying the same to the opposing air force).[46] Each of these examples had parent theories guiding air power employment, and determining which ones to use and in what ratios requires *metis*.

Metis at Maxwell AFB

The conventional wisdom is that Airmen approached World War II with a single theory of air power: mass aerial raids exacting precise destruction from key nodes in the industrial fabric of an enemy state would lead to victory through air power. The prophets of air power were zealots proselytizing the gospel of strategic bombing at Air Corps Tactical School. At best, they exhibited flexibility only when forced to deal with the messy realities of war. In this view, one would be hard-pressed to find any meaningful semblance of metic wisdom within their thinking.[47]

This narrative ignores the nature of ACTS, what it taught, how the Airmen equipped their young force, how they eventually employed it,

and how *metis* runs through it all. First, as the air service was still part of the United States Army, ACTS was just one of many branch schools. Each existed to advance the art and science of their specific *techne*, be it infantry, artillery, cavalry, or aviation. A large portion of the ACTS curriculum, in fact, included lessons about and taught by these other branches. When it did come to the half of the course that addressed air power, the time was split between various air force theories.

In the wake of World War I, Airmen played with a variety of theories. Some considered a population-centric approach advocated by Douhet, wherein the citizens of an enemy nation were the primary targets. Others retained the Italian's focus on independent air operations but changed the focus from terrorizing urban inhabitants with firebombs and chemical weapons to incapacitating the enemy's industrial infrastructure through precise destruction. Airmen debated whether fighter escorts were more effective as a sweep, clearing the skies of enemy aircraft, or tied closely to the bombers to fend off direct aerial attacks. Some disagreed over whether bombers needed protection at all, since the technology of larger aircraft seemed to have more potential for technical advancements. Multi-engine bombers, for example, were flying faster and higher with each new model while single-engine performance had leveled off. Still others believed air power's capabilities would be maximized when employed closer to surface forces (directly, as in CAS or air interdiction, or indirectly, as with air superiority missions). The Air Force, Bombardment, and Combined Arms courses, those that are most closely associated with the legacy of ACTS, only constituted a tenth of the curriculum and involved no more than a quarter of the faculty.[48] Last, the theory of unescorted strategic bombardment was not accepted wholesale at ACTS.[49]

Even if ACTS faculty had been fully invested in Industrial Web Theory, the school was not a hegemonic influence upon Airmen. Officers in the field challenged the theory of unescorted strategic bombardment.[50] Publications by Airmen also show more diversity than often attributed. As examples, consider William C. Sherman's *Air Warfare* and Mitchell's more famous *Winged Defense,* both of which addressed the full spectrum of air power missions (including logistics, continental defense, reconnaissance, and air-to-air combat). Additionally, all procurement plans throughout the World War II era invested in a variety of air power platforms.[51] Last, key leadership roles were never restricted to the apostles of the bomber.[52]

What these theories had in common, apart from revolving around aviation technology, was the sense that air power could leverage its range, altitude, and flexibility to make warfare more effective and, as the argument went, more civilized. A victory that is less vicious overall, one that ends sooner and more decisively, was supposed to reduce total casualties and costs on both sides. The result, according to Mitchell, would be a "distinct benefit to civilization."[53] In the words of Arnold, "War, no matter how it may be glorified, is unspeakably horrible in every form. The bomber simply adds to the extent of the horror, especially if not used with discretion; but when used with the proper degree of understanding, it becomes the most humane of all weapons."[54] Advocates of other air power theories applied similar logic, claiming, for instance, that air superiority could be achieved solely through aerial combat or that interdiction could achieve the same ends as strategic bombing.[55] Arguments in favor of tactical aviation were based in part on the ability to shift rapidly back and forth between offensive and defensive tasks.[56] Of course, this required an organizational structure that did not spread scarce air resources by assigning small packets of aircraft to all the ground commanders in the theater (an attempt to have some air power available almost everywhere).[57] Furthermore, these benefits were possible only if Airmen thought in terms analogous to their technology's qualities: effects across distance, a systems perspective, and adaptability. These traits are also valued in *metis*, as is their airminded sense of change and opportunity.

Airmen believed they were in the midst of a revolutionary shift in warfare. They eagerly questioned extant concepts about warfare as well as each other's ideas. Mitchell claimed "there has never been anything that has come which has changed war the way the advent of air power has."[58] A 1938 ACTS manual stated strategic bombing was "the most important and far reaching development of modern times." Airmen outside the "bomber mafia" portended equally radical roles for tactical air power. Either way, these were changes that only airminded officers could understand. To reiterate a point from the previous chapter, the style of thinking was, in fact, how some earlier Airmen defined airmindedness—a creative combination of various air power missions to achieve cumulative effects.[59]

Given the emphasis on a unique way of thinking, all Airmen agreed that air power functions best under the command of a single Airman in that theater. Even the Army—a service known for treating

aviation as just another tool for ground forces—issued a 1943 *Command and Employment of Air Power* manual that accepted this point: "Control of available air power must be centralized and command must be exercised through the Air Force commander if this inherent flexibility and ability to deliver a decisive blow are to be fully exploited." Current US Air Force doctrine reflects the same and does so in a way that reflects qualities of *metis*: "Because of airpower's unique potential to directly affect the strategic and operational levels of war [relative to land or sea power], it should be controlled by a single Airman who maintains the *broad, strategic perspective necessary to balance and prioritize the use of a powerful, highly desired yet limited force*" [emphasis added].[60]

Industrial Web Theory and Air War Plans Division-1

When strategic planning began for joining the fight against the Axis powers, the White House needed an estimate of future production requirements to support US involvement in the deepening war. The War Plans Division of the War Department was responsible for the analysis. When it came to air power, they posed a seemingly simple question to the Air War Plans Division: how many air squadrons would be needed? The planners were products of ACTS, and, in the words of Haywood "Possum" Hansell, they "had one valuable asset going for us. We embraced a common concept of air warfare and we spoke a common language."[61] They knew that the answer to the "how many airplanes" question was predicated on the more fundamental question of how they would be used. Their answer included a variety of aircraft types and only suggested that independent bombing could be decisive. Still, it was an opportunity for these men to apply their particular story of air power—a theory with enough appreciation of psychological influences, nonlinear effects, and contextual subtleties to be considered somewhat metic. This, however, is not the crux of this argument. In emphasizing the Industrial Web Theory and in evaluating the strategic wisdom within it, scholars have ignored the *metis* that existed in the overarching paradigm from which it came.

In the waning interwar period, and then into the second global conflict of the twentieth century, geopolitical turmoil and technological advancements cultivated worldwide tumult, which is exactly the conditions in which *metis* thrives. Indeed, the young air service's

intellectual climate was rampant with innovative thinking, as the examples above demonstrate. When it came time to operationalize its ideas, the organization did not abandon creativity by choosing a singular theory of air warfare. There were times when, contrary to the conventional narrative, Airmen did not turn to a "specific formula" for success.[62] For example, when the vulnerability of unescorted bombers became clear, Arnold demanded a study to remedy the problem. A Fighter Command School was established to bolster non-bomber theories.[63] Even before the war, internal research suggested the need to develop an intercept aircraft.[64] Furthermore, when precision bombing from high altitude proved unachievable—whether due to weather, intelligence, or weapons systems—Airmen shifted to incendiary bombing.[65] Indeed, one of the architects of AWPD-1, Hansell, was fired from his position commanding bombers in the Pacific when he failed to operate outside the Industrial Web Theory.

When Hansell was directed to introduce area bombing against a residential area by the 20th Air Force chief of staff, he pleaded for more time to perfect the execution of the bombing doctrine, not to make changes to its underlying premise: "I have with great difficulty implanted the principle that our mission is the destruction of selected primary targets by sustained and determined attacks using precision bombing methods." He continued, "The temptation to abandon our primary targets for secondary area targets is great and I have been under considerable pressure to do so, but I have resisted so far. I am concerned that a change to area bombing of the cities will undermine the progress we have made."[66]

Hansell was replaced by Curtis LeMay. The new commander decided to, in the words of his staff, "revolutionize our whole process and go over Japanese targets at low altitudes."[67] Lower altitudes permitted greater payloads, allowed bombers to get underneath the clouds, reduced the susceptibility to anti-aircraft guns that were designed to reach high-flying aircraft, and saved fuel. The other momentous change was a shift to flying at night, which reduced the threat of Japanese fighters. Consequently, the defensive systems and personnel who operated them could be removed from the bombers, which saved further weight and risked fewer personnel.[68] Night missions precluded precise bombing, but LeMay changed the payloads to incendiary bombs, which required no such accuracy. Moreover, firebombing better suited the flammable nature of Japan's buildings and the dispersed nature of its industries. On 9 March 1945, his ideas

were put to the test over Tokyo. The attack against Japan's capital was the start of 10 days of similar firebombing missions that were all designed to target both industry and morale. It only concluded once both the stock of incendiary bombs and the aircrews delivering them were exhausted. "Hap" lavishly praised LeMay. Around the Army Air Force, the news of the Tokyo raid produced self-congratulation and excitement.[69]

Despite emphasis on long range strategic bombing—both at the time and in historical analyses since—in reality, the United States pursued a multidimensional air strategy. Antishipping and defense operations complemented long-range bombing as well as close range support of land power. This approach, made possible by a highly industrialized society mobilized for total war and codified in the 1943 Army Field Manual 100-20, made air power a decisive factor in the war.[70] This balanced investment in all kinds of air power, however, is not reflected in historiography. A disproportionate weight is placed upon strategic bombardment. The problem is the postwar story with a single air strategy as its main character.

After World War II, the Industrial Web Theory became a sanctioned belief. Gone were the counterexamples found in the air campaigns over China, Spain, and England.[71] Gone was the memory that the Anglo-American Combined Chiefs of Staff only accepted a modified version of AWPD-1. Gone was the appreciation of technical limits (evident in both the plans and the operational execution). Gone was the acknowledgment that finding vital centers in the industrial web was a process of trial and error or a process that could easily slip into destruction for its own sake.[72] Gone even was the pretense of precision. Once hostilities broke out in Korea, the commander of the Far East Air Force Bomber Command immediately suggested they "do a fire job on the five industrial centers of northern Korea."[73] Gone also was the appreciation for tactical air power, such as the technical and organizational innovations made by General Quesada in Europe and General Kenney in the Pacific, as described by historians Thomas E. Hughes and Thomas A. Griffith, respectively. One senior Airman even declared that atomic weapons might have made tactical air forces "as old-fashioned as the Maginot line."[74] Strategic Air Command (SAC) and its narrow focus on singular air power strategy seemed to hold the keys to US national defense.[75]

The postwar narrative also ignored how that single theory of air power was insufficient in the face of changing political and strategic

contexts. During the war, Airmen's strategic flexibility matched their artifact's tactical agility. For example, they accommodated the timeline for the Allied invasion of Europe by allowing efficiency to give way to effectiveness. Likewise, an objective of unconditional surrender meant that coercion gave way to annihilation; selective destruction of key nodes—even if technically possible—would not preclude the enemy's ability and will to make war in the near future.[76] Furthermore, air power adapted to shifting the domestic opinion that privileged retribution and indignation over prewar emphasis on moral superiority and civility. Most famously, in July of 1942, Army Air Force and Royal Air Force bombers conducted incendiary attacks on the German city of Hamburg, killing over 42,000 civilians and leaving 20 times that number without shelter. The results of a second incendiary attack against Hamburg in 1943 and Dresden in 1945 impressed United States political and military leaders even more: civilian death estimates were 900,000 and 25,000 respectively, with 25 million and 500,000 homeless, respectively.[77] Likewise, the divergence from precision bombing, previously exhibited over Tokyo to great effect, raised no robust objections from the US public. In fact, a June 1945 survey by *Fortune* magazine concluded, "the people are sold on peace through air power."

The official AAF history, published soon after World War II, noted that "never in the history of war had such colossal devastation been visited on an enemy at so slight a cost to the conqueror . . . . The 1945 application of American air power . . . forced an enemy's surrender without land invasion for the first time in military history . . . . Very long-range air power gained victory, decisive and complete."[78] Airpower was not only decisive, but it was also new, it was also cheaper, and it also reflected an American style of fighting.

As Annette Simmons writes in *The Story Factor,* "In the end, the best story wins. Not the right story, not even the most frequently told story, but the story that means the most to the greatest number of people—the one that is remembered."[79] By the time Airmen achieved institutional autonomy in 1947, all of this metic flexibility was absent from the newly created US Air Force. Their technological paradigm had hardened into a dogmatic belief. The Industrial Web Theory, supposedly validated by World War II, had become hegemonic. If the historical record of that recent conflict contradicted their heralded theory, Airmen could explain away anomalies as merely unfair tests of air power.[80] What was recognized as wicked at the time was after-

wards presumed tame. What was aberrant was discarded. Therefore, when the US Air Force went to war on the Korean peninsula, just five years after World War II ended, the main expert on tactical aviation in World War II was never contacted. USAF leaders tried to force a limited war against a nonindustrialized enemy into their model of total war against an industrialized nation. And when this did not work, and they were forced to relearn the theories of tactical aviation of World War II, Airmen labeled the experience as "a rather bizarre war" that could lead to "an awful lot of bad habits."[81] The war in Vietnam was similarly approached, with an initial strategic bombing campaign to target 94 key sites over the course of 16 days.[82] In both cases, supporters of the Industrial Web Theory interpreted the conflict as either too politically controlled to offer a fair test of their theory or as corroboration that preparing for total war was sufficient preparation for limited conflicts.

To reiterate, the narrative of air power centered around a single theory. The theory serves as an instance of technological knowledge, which means it is subject to how such knowledge evolves. Indeed, as the next section will reveal, this is yet another way in which the Airmen's worldview can be labelled "technological."

The Evolution of Technological Knowledge

Historians of technology often use the phrase "technological knowledge" to mean the same thing as *techne*. Some see parallels in how technological knowledge changes and the changes of scientific knowledge described in Thomas Kuhn's 1962 work, *The Structure of Scientific Revolution*s. Kuhn's history of science challenged the presumption that scientific advancements transpire only through a linear accumulation of facts and theories. Such "normal science" does occur, but the questions it seeks to answer and the mechanisms it employs to get those answers are both provided by a dominant paradigm.[83] Because all paradigms are partial, some aspects of the field under investigation cannot be explained and are, in fact, not even considered legitimate puzzle-solving activities. The rise of a new paradigm is explained, in part, by being able to account for a wider range of phenomena. According to Kuhn, however, this is only a partial explanation for how new ideas arise and gain popularity.

The rejection of the old paradigm is not necessarily deliberate. Instead, it is often through a "sudden and unstructured event" like a "flash of intuition." In its embryonic stage, the new paradigm is often unable to compete with existing conventions. Instead, it appeals to more subjective qualities, such as improved aesthetics. The decision to adopt a new paradigm, which has not yet established the same level of cumulative evidence, is a decision that "can only be made on faith."[84] The choice between two incompatible paradigms often hinges on what Kuhn later called a mature sensibility that holds rational and nonrational factors together in productive balance.[85] For example, some physicists claim that physics is only 5 percent observation and "ninety-five percent speculation."[86]

Of course, there are differences between technology and science. Technological knowledge does not demand the same level of explication. It can remain tacit, communicated indirectly (through stories or metaphors), and transferred through guided, reflective practice. Also, technical acumen is more pragmatic and contextual.[87] Despite their differences, however, scientific knowledge and technological knowledge both follow a similar cycle. Within a given field of technological know-how, there is a period of "normal" activity. Knowledge is extended incrementally within the boundaries of what that regime of knowledge considers to be valid problems and valid processes by which to solve them. Next, there is a period in which the field's consensus is challenged as some discover divergence between reality and the paradigm's explanations or predictions. This can even apply to anticipated divergences, according to historian Edward Constant. He notes how some technologists anticipated what he labels "presumptive anomalies," as when aviation engineers knew existing propulsion systems would be the limiting factor as other aspects of aircraft performance advanced.[88] The debate over whether a body of knowledge still "works" is socially constructed and highly subjective.[89] Eventually, a shift occurs and the field undergoes a revolutionary change or a new field of knowledge is created.

The entire process of discovery, invention, and innovation is often characterized in terms reminiscent of play.[90] Additionally, early adopters are frequently aided by relative isolation from the regime's enforcers and a degree of serendipity. Moreover, they often act on the basis of intuition and imagination. In fact, the gap between the tight knit framework of information that had developed within the now obsolete regime and the sense there is a better way is often bridged by recourse

to metaphors and stories. As those stories evolve from useful fictions into accepted fact, the cycle starts anew: verisimilitude is taken for veracity, sociocultural influences become hidden, system builders try to design out *metis*, and the entire system develops what Thomas P. Hughes calls "momentum."[91]

While this change represents a fundamental shift within a field of technological knowledge, the overarching process remains the same. That is, the nature of the change remains intact and therefore radically different theories still, at their core, abide by this cyclical process. This is where Morgan's clarification of Kuhn's terminology is particularly useful. In Kuhn's usage, a paradigm can be defined as a specific constellation of beliefs that belong to a particular school of thought. Thus, the process described in the last paragraph is often called a paradigm shift. In Morgan's typology, however, a paradigm is the cognitive worldview that encompasses all the subordinate changes at the level of theory (and each theory has its own set of constituent puzzle-solving techniques). For clarity, discussions of Airmen's "paradigm," such as the thesis that their paradigm is a *technological logos,* will reference the overall mindset while the term "theory" is used for the middle, more explicit level.

The sketch of air power theories demonstrates how technological knowledge changes. Ideas about "strategic" (meaning long-range) and "tactical" (meaning direct or indirect support of land power) were developed in isolation from their parent organization, the US Army.[92] Airmen's ideas, developed away from Army headquarters, were built more on faith than empirical evidence. According to Gen "Jimmy" Doolittle, "the trouble was that we had to talk about air power in terms of promise and prophecy instead of in terms of demonstration and experience." By the war's end, the consensus view accepted a synergistic effect in the confluence of all air power missions.[93] In the aftermath of that conflict, however, the air power narrative narrowed. The US Air Force culture neglected theories about these other missions in order to focus their admiration and attention upon a single dominant story, forcing out anomalies and ignoring complexity. In other words, "normal" strategies offer a rationalistic approach in the mold of the Platonic paradigm.[94]

The same cyclical path as other forms of technological knowledge—from normal and evolutionary to novel and revolutionary and back again—happened again later in the century in the next important theory: strategic paralysis. This seems like a large historiographi-

cal leap. It is validated, however, by the fact that the Industrial Web Theory and strategic paralysis are arguably the only two theories crafted by American Airmen. They were also the only two with significant impact on US Air Force organizational culture.[95] Other voices came from outside the nation or outside the service or were visionaries and promoters as opposed to theorists.[96] What did exist within the service between World War II and Desert Storm, in terms of theory, was not impressive.[97]

For many, the end of the frontier period in American military aviation was also the end of any degree of *metis* in the paradigm of professional Airmen. In 1990, when another group of midlevel staff officers proactively offered an air-centric strategic plan to senior leaders, many saw a revival of the ideas and methods of the interwar Air War Plans Division. Few saw a deeper commonality: both were technological in their content, their style, and the way the organization held the idea in creative tension with other theories before eventually accepting it as gospel.

The Theory of Strategic Paralysis

A variety of people are associated with air power theory in the World War II period.[98] In contrast, there is a single name that is intimately tied to the theory of strategic paralysis: retired US Air Force Colonel, John Warden. He is easily the central character in this story (which is, again, about Airmen telling theoretical stories about the use of air power technology).[99]

A relatively successful career brought Warden to prestigious Pentagon staff positions for two separate tours. During his first tour on the Air Staff, he served as an action officer in the directorate of plans. According to one biographer, Warden was not able to get into the more coveted division with oversight into Europe or even into the Pacific Division. Instead, when he arrived in August 1975, he went into the division with responsibility for the Middle East.[100] Then, after a series of operational assignments and a year at National War College, Warden arrived for his second Pentagon tour in 1988. His contributions to Exercise Constant Demo, the scenario that tested the defense of a NATO air base, revealed the sophistication and energy he brought to the ideas of operational air power. Impressed, his superiors gave him a position in which he could continue to think deeply

about air power theory. Warden became the deputy director for Warfighting Concepts Development, later shortened to Warfighting Concepts. By July 1988, the Concepts Division, the Doctrine Division, the Long-Range Planning Division, and the Strategy Division had all become part of Warfighting Concepts. Sometime in late 1989, the deputate acquired the Checkmate Division, further diversifying Warden's staff. Checkmate Division, charged with innovative analysis of strategic issues, included all career fields except for intelligence officers. He accepted this, reasoning that security restrictions on their classified materials would inhibit the team's creativity.[101]

Creativity was paramount in Warden's philosophy. He tolerated dissent and promoted disruptive thinking about air power. It helped that his superiors sheltered him from the US Air Force's establishment and encouraged his organization's work. His team began to examine some the service's basic doctrines using theories Warden had developed in a series of published and unpublished writings.[102] His official mandate became the development of a new air power theory, a new story of how to best use the US Air Force domain.[103] Notably, his position had no official authority for crafting a US military response to the Iraqi invasion of Kuwait in August 1990. Still, in the marketplace of ideas, his story ended up "winning" in the way the Industrial Web Theory did a half-century earlier. The reasons why his version prevailed go back to the Air Force's *technological logos*—a paradigm that, first and foremost, is about state-of-the-art technology.

Airmen's theories on air warfare have always centered on how to employ emergent air power technologies. Before Warden, the last theory constructed by Airmen was the Industrial Web Theory. It was built around what were then leading-edge capabilities: long-range, high-altitude, heavy bombers outfitted with cutting-edge bombsights, electronic navigational equipment, and multiple machine guns for self-defense against enemy fighters. Theories guiding use of atomic weapons, first on aircraft and then later atop intercontinental missiles, evolved from the Industrial Web Theory. But nuclear deterrence theory, which would guide the Air Force's prestigious Strategic Air Command and its single integrated operational plan (SIOP), was constructed by political scientists and not Airmen. The theory of "graduated and reciprocated initiatives in tension," which animated air operations during the war over Vietnam, originated with political psychologist Charles Osgood in 1962 and was further developed by political scientist Thomas C. Schelling.[104] Likewise, after the US-

Vietnam War, tactical aviation was guided by a concept developed by the US Army. In their vision of AirLand Battle, air power was one of many tools for deep-battle operations meant to slow down Soviet forces if they mounted a land offensive in Europe. Whereas for SAC the relevant technical advances included precision navigation and stealth technology, AirLand Battle capitalized on precision-guided munitions, advanced air superiority fighters (such as the F-15s flown by the 27 FS), and improved capabilities to "find, fix, track, target, engage, assess."[105] Both took advantage of aerial refueling, sophisticated communication networks, and a global mobility system to shuttle weapons and other materiel.

By the 1980s, the two operative theories, neither crafted by Airmen, were seen as the only options for how to employ air power technology. Furthermore, no one truly integrated SIOP and AirLand Battle. Theater conventional warfare was largely a defensive option. Although US Air Force doctrine still retained a role for independent conventional missions, most assumed CAS and Air Interdiction would constitute the majority of kinetic air power in any counteroffensive. Most expected these countertactics would merely delay the inevitable escalation into total nuclear war.[106] Warden, however, viewed the same panoply of modern air power technologies and constructed a new story by connecting his tactical experience with strategic objectives.

Warden's strategic paralysis theory views any enemy as a system of thinking opponents. Within the complexity of a state system, however, there are some material interventions with foreseeable effects. Indeed, there would be targets, places of leverage, where actions would have disproportionate consequences. Warden surmised the most fundamental of these "centers of gravity" is the enemy's leadership, or more precisely, their ability to exercise command and control (C2). He placed this at the center of his five "strategic rings." In descending order of priority, the subsequent ring is essential processes, such as communications and energy production. Next is physical infrastructure, such as industrial connections or transportation, followed by the population, which should only be targeted via psychological operations.[107] The last and least efficient use of air power, in his theory, is the enemy's military forces deployed in the field.

Warden argued that air power was uniquely suited to affect the center of the enemy system, its leadership, which he likened to the nation's brain. Air warfare can threaten this once inaccessible compo-

nent without first defeating an intervening force. Not only does this invalidate the traditional presumption that battlefield destruction—with its high costs in blood and treasure—must be the first priority, but it means Airmen can bypass noncombatants. What made this use of air power different from strategic bombing in World War II was technology. The same strategic effect that had required thousands of aircrew members flying hundreds of aircraft and dropping tons of munitions could now be achieved with as little as a single pilot dropping a single precision-guided bomb.

Modern air power technology confers an operational flexibility to attack critical vulnerabilities in any of the rings (targeting the outer rings only insofar as to expose the center), in any pattern (sequential or parallel), and with varying degrees of damage (from permanent destruction to temporary disruption). Warden's theory predicted that striking the right targets across multiple rings simultaneously could induce strategic paralysis and catastrophic failure of the system.[108]

The *metis* of strategic paralysis is evident in how Warden and his division formulated the model—and in the model itself. First, the theory melded multiple themes, including contemporary theories on nuclear warfare and tactical operations, as well as classical air power ideas. This sense of artistic recombination, or bricolage, is specifically associated with strategic intelligence.[109] Also, like all metic approaches, it fit the context. This is true in a technological sense, given emergent air power capabilities, and in a geopolitical sense, as in international legitimacy and the Cold War balance of power.[110] Furthermore, it accounted for Americans' growing intolerance of casualties, whether friendly or enemy, since the Vietnam War. More significantly, however, is how strategic paralysis handled violence. Warden prioritized economy of force and believed air power could achieve political effects more efficiently than land power, which is designed to directly confront the most resilient of the enemy's five rings, its field forces. In contrast, parallel warfare destroyed only what was deemed necessary to influence the opposing C2. In fact, destruction was not even required; to generate system-wide effects, target sets could be merely suppressed (temporarily degrading performance through active application of firepower). Since this required fewer assets, air power could be used in more places simultaneously. This focus on exponential effects challenged the US Air Force's established mission planning, which used complicated weaponeering formulas to achieve the desired level of damage to individual targets.[111] An-

other novelty was that these effects were not associated with a particular aircraft. Previously, no Airman thought "strategic" bombers were suited for attacking fielded forces or that "tactical" fighters should strike a center of gravity well behind the front line. Warden also advocated for an "air reserve" force, ready to exploit the changing circumstances that he expected in any war.[112] Last, he was willing to assert what there was no empirical evidence for: the decisiveness of an independent air campaign.

None of this is to say that SIOP or AirLand Battle lacked *metis*. Nor is this meant to portray strategic paralysis as an exemplar of strategic wisdom. There has been no dearth of criticism over Warden's theory. His biographer and fellow airman, John Andreas Olsen, describes Warden's theoretical writings as manifestos that err toward oversimplification.[113] *Metis* eschews prescription, and here, too, Warden's model appears less dynamic. While the model points to the presence of critical vulnerabilities without presumptively identifying them, he still asserted national political leadership was always the center of the strategic rings.[114] He could have, more generally, advocated finding whatever the center of gravity happened to be for a specific enemy. These issues, which have been vigorously debated, are not the focus of this chapter, however.

The *metis* within any given air power theory is not the focal point of this argument. The crucial level of analysis is the paradigm that operates above and beyond these individual theories. In periods of change, such as the first few decades of military aviation, the *technological logos* of Airmen contained an admirable degree of strategic wisdom. After World War II, however, a sense of "normal strategy" drove the intellectual climate of the US Air Force. The organization got better at doing what it already did, which was a bifurcation of air power into tactical and strategic domains. Even after the trauma of Vietnam, conditions were not ripe for *metis:* the paradigm was biased to a single image of war. The worst case—total nuclear war between the world's superpowers—seemed to be the only case, and the one approach to prevailing in that scenario was sequential and formulaic. Warden challenged this mentality. But the wisdom of Warden's theory was matched by *metis* at the institutional level as the US Air Force gave him the opportunity to think deeply and then wisely melded his ideas into other theories when it came time to put air power ideas into action.

Instant Thunder Air Campaign Plan

The historical narrative below continues to identify metic elements in Warden's theory as it was transformed into an operational plan. It also shows him as a technologist, but not in the sense of manufacturing a material artifact (although the diversity of his team also mimics the heterogeneity found in the invention, innovation, and development phases of successful technological systems). Instead, Warden embodied the Homeric *techne* in his creative use of material resources, his intuitions, how he crafted physical and psychological interventions for strategic effects, and his rhetorical skills—all aspects that clarify the sense in which Airmen's paradigm is "technological." The story also highlights the role of chance, which, once again, is the domain of *metis*. For example, both tours at the Pentagon forced Warden to grapple with the Middle East, a region many at the time viewed as ancillary to any future hostilities between NATO and the Warsaw Pact.[115] Becoming familiar with the area where war would later erupt was not his only good fortune.

When Saddam Hussein's forces invaded Kuwait on 2 August 1990, Colonel Warden was confident the US would respond militarily. He was also convinced that current approaches were inadequate to guide that response. Operational war plans (OPLANS) only addressed deployment schedules. Furthermore, these plans assumed there would be sufficient time to mobilize Reserve forces.[116] More worrisome, Warden believed, was the lack of any doctrine for offensive warfare in a nonnuclear setting. SAC was not likely to produce a conventional strategic air campaign, and the US Air Force's Tactical Air Command (TAC) was unlikely to produce any strategic air campaign.[117] Indeed, the Air Tasking Order (ATO) software, which organized daily missions for each flying unit, only had options for CAS and air interdiction.[118] Given these circumstances, Warden initiated a planning effort in his own division. He had the right team for the task.

The climate within Warden's Warfighting Division was uniquely suited for creative strategic thought. Checkmate, in particular, had a reputation for intellectual independence. Warden valued these qualities and pushed the teams to develop unorthodox ideas for a wide variety of air power scenarios.[119] That August, he brought in others to make the group even more capable and charged them with producing an air campaign plan to counter Iraq. The theoretical basis for the plan would be the five-ring model they were familiar with and had already prac-

ticed. His directions were broad and emphasized the need for creative, agile, and decentralized thinking as well as the importance of interpersonal networks. One military historian describes the planners in terms reminiscent of *metis*: "[They] seemed to possess a rare combination of uncluttered elegance, economy, and rationality. One could explain them quickly and in simple terms, yet when applied to past or current situations, they cut to the heart of matters and seemed to solve complex problems. As with most intellectually based activities, group members never attained absolute consensus on the exact method of conducting an air campaign, but as their thinking matured, much coalesced around a set of conceptions at once theoretical and practical."[120] In addition to the clarity Warden's team brought to the situation, speed was also essential since the general consensus was that Saddam Hussein would soon continue his offensive into Saudi Arabia.[121] The planners' distance from the immediate, practical, dilemma of organizing and deploying forces also provided them with the same sort of intellectual space that range afforded World War I airmen. In that space, Warden's team also had the advantage of an airminded perspective: systemic, playful, and ready to embrace radical changes.

Two factors kept Checkmate's work from being a purely academic exercise. The first came from the particular circumstances of the situation in the Middle East. The US military officer in charge of Central Command (CENTCOM), which included the Saudi Arabian Peninsula and the surrounding nations, was Gen Norman Schwarzkopf, USA. On 3 August, he called Maj Gen Charles Horner, his senior US Air Force officer. General Horner, the commander of Central Command Air Forces (CENTAF), offered initial suggestions based on a recent CENTCOM staff exercise about how to respond to the invasion of Saudi Arabia. In accordance with AirLand Battle theory, the air strategy focused first on defense and then on a counteroffensive in a combined air-ground campaign. All of these, however, required an influx of US and coalition forces since CENTCOM did not have any assets deployed to the theater. The longer it took to get forces in, the longer Saudi Arabia was vulnerable to attack and the longer the highly proficient Iraqi engineer corps could fortify defenses in Kuwait. Furthermore, the Iraqi army was large and had previously demonstrated the ability to withstand high causalities in its war with Iran.[122]

On 4 August, both men met with senior military and political officials at Camp David. Horner reiterated the principles of his suggested air campaign, which focused on air interdiction and CAS.[123] Afterwards,

President George H. W. Bush expressed concern over the total cost of victory, including the possible death toll on both sides of the fighting.[124] A few days later, Secretary of Defense Richard Cheney, through Chairman of the Joint Chiefs of Staff Gen Colin Powell, directed the military to craft an offensive military option.[125] Based on these interactions, Schwarzkopf made three key decisions. First, the current plan for air power did not satisfy Cheney's order. Second, air power was the only available resource—whether for an offensive or a defensive response—until land forces could travel from afar. Last, CENTAF lacked the resources and time to produce the type of air power option Schwarzkopf needed.[126] His next move is the second element that saved Checkmate's efforts from becoming merely a staff exercise.

The Goldwater-Nichols Department of Defense Reorganization Act of 1986 had established areas of responsibility (AOR) around the world. Commanders such as Schwarzkopf had sole authority to plan and conduct operations within their AOR. The combatant commanders could, on their own, request support from other combatant commanders and as well as each service. This is precisely what Schwarzkopf did when he called the Air Staff at the Pentagon.

On 8 August, Schwarzkopf, as the Commander-in-Chief (CINC) US Central Command, called the Chief of Staff of the Air Force (CSAF), Gen Michael Dugan. With Dugan away on temporary duty, Gen John M. Loh, Air Force Vice Chief of Staff, answered the phone call. On the other end of the line came a request that seemed tailor-made for Warden. Schwarzkopf wanted an air campaign, separate from any existing OPLAN, that could be executed quickly and would include a set of strategic targets "broader" than what Horner had outlined.[127] Loh knew Checkmate had been working on something like this and had it in mind when he offered to give Schwarzkopf a plan within a week.[128]

The same afternoon that Schwarzkopf called the Air Staff, Loh met with Warden and Warden's supervisor, Maj Gen Robert Alexander, director of Air Force Plans. In Warden's words, Schwarzkopf requested "a strategic air campaign."[129] Checkmate now had a mandate. When Warden updated his team, he announced the name for the operation that would come from his theory of strategic paralysis. He called it Instant Thunder.[130] Over the next few days they applied the five rings model to Iraq, identifying centers of gravity and how to influence them through air power. After briefing his Air Force chain of command, Warden was ready to brief Schwarzkopf himself.[131]

On 10 August, Warden briefed CINCCENT at his headquarters in Tampa, Florida, a mere nine days from the time Warden began unofficial planning—the same amount of time it took to produce AWPD-1, incidentally. The philosophy behind the Instant Thunder campaign was pure *metis*: positioning one's strengths against the opponent's weaknesses. To produce strategic paralysis, and in stark contrast to the AirLand concept, the campaign plan completely ignored the Iraqi forces in Kuwait. Unless those forces moved toward Saudi Arabia, air power would take a more indirect approach and identify target categories in accordance with Warden's theory.[132]

The planners assessed the crucial variable was Saddam Hussein's personal leadership. Removing his C2 abilities would incapacitate his forces, and Warden's intuition was that it could also foment revolt among Iraqis.[133] It was thus important to include as one the objectives "minimize damage to enhance rebuilding (minimize civilian casualties and collateral damage)." The planners foresaw, for example, the use of oil revenue to repay war debts.[134] Clearly, Warden and his team were thinking not just about victory but also about a continuing advantage. The emphases on destroying Iraqi nuclear, biological, and chemical capabilities and leaving Iraq able to defend itself against potential regional competitors also reveal Checkmate's broad, long-term focus.[135]

Two other points are noteworthy for the *metis* they reveal. The first is reliance upon psychological operations, including those aimed at the Iraqi populace and another set intended as a deception plan to hide the offensive air campaign. The other point is a matter of influencing internal audiences through the *techne* of rhetoric. Warden's oratory skills were well known from his first Pentagon tour, but influencing an entire US military response would require another level of skill.[136]

Warden always knew one of his challenges would be the acceptance of an unorthodox strategy. His attempts to convince others often involved, as metic storytellers are apt to do, persuasive metaphors and historical analogies.[137] For example, he described the plan as an aerial Schlieffen Plan "rotated into the third dimension." The implication was clear: to avoid the fatal modification that weakened the German design for invading France in World War I, the crushing blow—from air power, this time—should not be weakened.[138] He was also fond of the metaphor likening the enemy state to a body with the leader as its brain; cut the link between head and hands, and the enemy was just as incapacitated as it would be if destroying the hands.

Last, he also seemed to excite Schwarzkopf with the idea that Instant Thunder could be for Schwarzkopf what the Inchon invasion had been for Gen Douglas MacArthur in the Korean War—a surprise counteroffensive well behind the frontlines.[139] Olsen asserts that, for all of its faults, Warden's model had utility because it effectively did what all stories aim to do: make sense of—and suggest strategies to prevail in—a complex and complicated world.[140]

Even before Warden's complimentary comparison, Schwarzkopf signaled his 100 percent approval of the colonel's approach. It gave CENTCOM new options and, moreover, ones that fit the context. While it would take months to assemble sufficient ground power for a land offensive, CENTAF could execute Warden's air campaign plan in a matter of weeks and with less risk to noncombatants in the area or to US forces.[141] The timeframe to execute the campaign also fit well within Schwarzkopf's geopolitical concerns. According to one eyewitness, the general exclaimed, "By the end of the first week we'll have all kinds of pressure to get out! The [United Nations] Security Council will scream. If we can be done in six days, we can say we're sorry and get out."[142] An air campaign directed at Baghdad also had the advantage of preserving Kuwait. Schwarzkopf concluded, "You have restored my confidence in the United States Air Force. . . . You are the first guys that have been leaning forward. I'm glad to see it. This is exactly what I want!"[143]

In many narratives, what happens next is clear. Warden's team continued to develop the plan until CENTAF was ready to accept planning responsibility. When CENTAF did so, it was with the help of Checkmate personnel and another dynamic individual, Brig Gen Buster C. Glosson.[144] Back at the Pentagon, Warden and the rest of his ad hoc planning team continued to provide support to the Airmen in theater. With Saddam Hussein content to wait in a defensive posture, more coalition forces amassed in the region over the course of five months. When the counteroffensive launched in January 1991, the Instant Thunder air campaign plan was the first phase of Operation Desert Storm. Despite the vast quantitative changes in air power in the intervening period, the air campaign was, in essence, still based on a theory of strategic paralysis, just as when Warden first briefed Schwarzkopf. Thus, the lopsided victory that followed vindicated air power and, moreover, validated the five rings model as well.[145]

In the view of Olsen, historian of military aviation and professional airman, "airpower finally came of age."[146] According to historian Rich-

ard Davis, "air power was the decisive factor in the Coalition's quick and almost bloodless victory."[147] These sentiments are found throughout contemporaneous reports and historical analyses.[148] One active duty Air Force officer, writing a few years after the conflict, called it "the most impressive collection of sound tactics and advanced technologies ever seen on any battlefield."[149] Another Airman argued, "Operation Desert Storm symbolized a fundamental shift in the traditional method of waging mechanized warfare. The stunning performance of coalition airpower symbolized both the maturity of airpower and its dominant position in late twentieth-century warfare." Furthermore, he stated, "Most important, however, victory in the Gulf War symbolized . . . the maturity of airpower, the domination of airpower, and the need for a new paradigm of warfare . . . fulfilling the promises made by the early prophets of airpower."[150] And it was not just air power, but strategic air power in the mold of John Warden.

Edward N. Luttwak, a political scientist noted for his writings on strategy, captures the impression of many who observed Operation Desert Storm and who have studied it since: Warden rescued "the US Air Force from its tactical mentality."[151] In doing so, it seemed as if Warden and his theory of strategic paralysis became the way to organize modern air power for strategic effect. The foreword to one best-selling work, published by Air University Press and written by an Air Force officer, contained this note from a general officer: "Airmen, long uneasy about the lingering inconclusiveness of past applications of their form of military power, now had what they believed to be an example of air power decisiveness so indisputably successful as to close the case forever."[152] The Chief of Staff of the Air Force at the time, Gen Ronald Fogleman, placed that book on his annual professional reading list.

This story is concise. It is coherent. It is also, on multiple counts, incomplete. First, not everyone interpreted the Gulf War as a clear victory for strategic air power. The Iraqi regime was never fully paralyzed, and the degree of disruption is debatable. Iraqi nuclear, chemical, and biological weapons programs were less vulnerable than assumed. Targeting "organic essentials," the second ring, proved to be an inefficient use of air power.[153] Even the official US Air Force assessment of Operation Desert Storm, the *Gulf War Air Power Survey,* qualifies its evaluation of the strategic campaign. More directly, military analyst Norman Friedman concluded in 1991 that the "strategic air war very largely failed to achieve any of its goals."[154] Olsen's in-

depth analysis acknowledges how strategic air power was diverted into other missions but concludes these distractions "do not suggest that a greater operational commitment would have altered the impact on the Iraqi leadership's decision-making. There was simply too little intelligence about precisely how to achieve the paralysis Warden's theory suggested was possible.[155]

Others admit victory but note the circumstances did not truly test Warden's theory, much less US military capabilities. First, CENTAF removed many elements of the Instant Thunder air campaign plan before execution day: there were no psychological operations to encourage rebellion, no more emphasis on targeting individual leaders, and no sense that air power would be decisive.[156] Also, while some see a revolution in warfare and "the most successful campaign in US military history," even the *Gulf War Air Power Survey* noted: "at a distance of two years and after careful scrutiny of the evidence, some aspects of the war that seemed most dramatic at the time appear less so than they did in the immediate afterglow of one of the most lopsided campaigns in military history." The outcome is less surprising in retrospect because, "despite the talk of Iraq possessing the fourth largest army in the world, the fact remains that [a] minor military power found itself confronted by the full weight of the world's sole superpower."[157] In a war that, according to Colin Gray, the United States "could lose only as a result of extraordinarily bad luck or incompetence," the real contribution of air power may not have even been kinetic. A RAND study suggests the most valuable uses of air power were mobility, logistics, and information superiority.[158] Of course, it is hard to evaluate a single concept that is just one piece of a complex, multidimensional, and ever-shifting experience. But this is itself an important point.

Those who interpret Operation Desert Storm as vindication for Warden's ideas commonly exaggerate the independence of Instant Thunder. Schwarzkopf never asked for a decisive air campaign. Warden delivering what was in his mind "war-winning" strategy did not mean CINCENT viewed it as anything more than a "war-fighting" operation.[159] It may be a reflection of airminded thinking to present something so global, so interconnected and far-reaching, but Schwarzkopf needed a viable retaliation option while land power moved into place. Thus, from the earliest stages of planning, he and Powell accepted the Instant Thunder air campaign plan while remaining intent on a multiphased approach.[160] As early as 17 August, CINCENT indicated that Phase I, a strategic air campaign, would not be initiated

proactively until sufficient land power was in place to defend Saudi Ara*bia*. With enough assets, Phase II, in which air power would concentrate on fielded forces, could even start concurrent with Phase I. Phase III would be the assault into Kuwait to liberate it from Iraqi occupation.[161] As these phases suggest, strategic paralysis was not the only air power theory employed in Desert Storm.

The narrative that perceives Operation Desert Storm as a victory by and for air power—Warden's theory of air power, in particular—exaggerates the success of strategic paralysis, overlooks the flaws in Instant Thunder, and fails to fully appreciate the interdependence of the strategic air campaign. The most fundamental error, however, is ignoring how Warden's was not the only air power theory operative in the war. This is crucial to the argument that Airmen select from a menu of air power means, and their choices, regardless of whether or not the individual options reflect metic intelligence, reflect the *metis* inherent in their *technological logos*.

A Menu of Air Power Means

After Schwarzkopf called the Air Staff, Loh notified Alexander, who then notified Warden, that Checkmate had an opportunity to brief a strategic air plan to CENTCOM. Before that call, however, Loh made two other calls. One was to the commander of SAC, who agreed to send planners to support Warden's team. He also called Langley AFB, Virginia, to speak with Gen Robert D. Russ.[162]

Russ was the commander of TAC, the descendent of Arnold's Fighter Command School (cited earlier to demonstrate the variety of air power missions in the World War II era). Russ offered his own planners to produce what CINCCENT requested. He appreciated, as much as those on the Air Staff did, that CENTAF was too overwhelmed with immediate issues to think deeply and creatively. Indeed, until Schwarzkopf departed CENTCOM's stateside headquarters, Horner served as both commander for all Central Command Air Forces and as the acting forward commander for all forces in the theater. Host-nation coordination, deployment planning, and the threat of a large, armored force just hours from his location all competed with his responsibilities as the senior Airman.[163]

The plan TAC produced is often contrasted unfavorably with Warden's, but this historiographical bias is unwarranted.[164] First, TAC's

plan to conduct limited coercive strikes against high value military targets had clear signs of *metis*. The planners at Langley AFB were sensitive to wider contextual issues beyond achieving tactical effects. For example, they discussed geopolitical ramifications, domestic opinion, protocol towards the theater commander, and the cultural and regulatory parameters regarding joint operations. Specifically, their assessment of Instant Thunder was that it involved too much violence, too much *bia* for either the American public or the international community to accept. Not only did this excessive *bia* create too much risk of igniting a regional or global firestorm, but Warden's plan did not integrate any other services.[165] It also failed to account for Powell's objective to curb Iraq's offensive capabilities by attriting its forces in the field. Plus, there are indications the plan the TAC team was developing could have been as equally novel.[166] The TAC plan took advantage of the same air power technologies Warden counted on to achieve target suppression and operational paralysis, albeit in a way more associated with Iraqi army movements. The TAC plan also had more built-in flexibility. In contrast, once Instant Thunder launched, the intent was to let it run its course, even if Saddam Hussein offered to surrender.[167]

If anything, *metis* was most lacking in TAC's reactive stance (hesitant as the TAC staff were to meddle with CENTAF's AOR) and in the battle for the best story. Warden offered a more coherent solution to a complex dilemma and backed up his model with powerful examples that resonated with the right people. Of course, the very reason he had the opportunity to present his story was somewhat a matter of good fortune. Alexander's direct superior, Gen James Adams, was away from the Pentagon in early August, allowing Warden easy access to the CSAF's office. Given Adams's well documented annoyance with Warden's previous initiatives, his presence would have likely impeded the initial promotion of Checkmate's plan.[168] Such serendipity can never be discounted in a wicked world.

The second reason for a more balanced assessment of TAC's alternative to Instant Thunder is the composition of the air campaign executed over the area in 1991. Aerial warfare in the Gulf War was nothing if not an amalgamation of the two air power theories by Checkmate and TAC (not to mention all the other uses of aviation technology). While some, quoted above, saw strategic paralysis as the theme woven throughout the Desert Storm air war, others involved with the operation saw only traces of the original plan.[169] Public intel-

lectual and author Max Boot viewed the air war over Iraq as classic AirLand Battle doctrine. Historian Stephen Biddle reached a similar conclusion in his work *Military Power*.[170] In truth, despite sometimes being portrayed as "almost theologically" opposed, these air power theories were not mutually exclusive.[171] They were different in many important ways, but this only becomes more fodder for *metis*.

Much evidence points to air power strategy in Operation Desert Storm as an exercise in bricolage. Even during the planning stages, TAC planners sent to Checkmate at the Pentagon were able to interject their opinions.[172] When Warden briefed Horner's staff in Riyadh, Saudi Arabia, the director of operations recalled that Instant Thunder was welcomed as another option for CENTAF planners.[173] As soon as Checkmate handed off planning to Glosson, he began to meld the two plans together. His approach aimed for strategic paralysis but did not presume other air power missions would be unnecessary to exploit their advantage.[174] By the time operations began, an enormous fleet of assets made it unnecessary to make hard choices about the allocation of air power. Approximately one-third of the sorties were required to execute what was left of Warden's strategic air campaign.[175] The overall use of coalition air forces mirrored the six tasks laid out for air power in World War II doctrine, and all three combat phases started almost simultaneously.[176]

Air power accumulated effects across the battlefield and beyond, due to what one Airman calls the "air power compromise."[177] This is an oft--overlooked point in the simplified narratives that hold up Warden as the heroic inventor of modern air strategy. What is missing, however, is recovered by applying ideas from the history of technology, specifically by treating air power theory as a form of technological knowledge.

Conclusion

The overarching paradigm guiding Airmen's thinking on using their sacred technology allowed them to select elements from multiple theories. The *metis* within a theory is not the central issue, although it is interesting to note that violence (*bia*) was the dominant criteria by which TAC and Checkmate contrasted themselves. For this argument, however, the main point is that the option to choose a combination of approaches is an opportunity for *metis*. Furthermore, Airmen's strategic wisdom was *technological* because it was informed

by their familiarity with their technical craft of air warfare and cultivated by the very attributes of that technology: range, perspective, and flexibility. The result was a plan appropriate for the context, seeking nonlinear effects in both psychological and physical domains and employing subterfuge and selective violence to create cumulative effects. Airmen writ large did not expect any one theory to mechanically prescribe all aspects of an air strategy but instead remained open to improvisation and strategic playfulness. Those who deny this are those who see only a single theory running through the air power story of Desert Storm—a theory validated by their assessment of that conflict. This has, in fact, become the dominant narrative of air power among Airmen. The result could be called, with apologies to Thomas Kuhn, "normal strategy."

The cycle of technological knowledge shows that periods of destabilizing advancements are followed by periods in which the new model is honed but rarely questioned. *Metis* has no space to emerge and maneuver amid a sense of stability provided, in this case, by the rhetoric of one dominant metanarrative. Changes still occur, though in more evolutionary and incremental ways. This happened to air power theory after World War II. It also happened following the Gulf War. Strategic paralysis became doctrine, and doctrine hardened into dogma. One book, published by Air University Press, contained a foreword from the current CSAF who lamented the kind of air power debates that occurred in Operation Desert Storm. According to General Fogleman, such deliberation "often hinders us from moving on to more current—and, possibly, more important—issues . . . interval divisions and resultant debate proved inefficient . . . [this book] challenges Airmen as well as other strategic thinkers to consider how aerospace power *works best* so as to *preclude, or at least minimize, these 75-year-old debates* when we face the next challenge" [emphasis added].[178]

Warden's reputation as an air power expert and his position as commandant of the Air Command and Staff College (ACSC) at Maxwell AFB from 1992 to 1995 only furthered his influence.[179] US Air Force officers attend ACSC midway through their career. A direct descendant of ACTS, the prestige of this yearlong course waned throughout the Cold War. Warden arrived with a mission to reinvigorate the school and make it relevant.[180] Students comfortable with the technical and tactical aspects of their profession would be challenged with air power theory, military history, and operational planning. The keystone was the newly introduced Air Campaign Course. The

influence of Warden's own ideas was obvious, and some began to refer to ACSC as the "John Warden school of air power." Reflective of residual *metis* in the Airmen's paradigm, however, there was much debate about the soundness of his approach, at least when it was first introduced less than a year after the first air strikes in Desert Storm.[181] Once again, however, debate faded over time.

In the decade following the Gulf War, Airmen sought to "solve the puzzle" of air power using the same general template being taught at ACSC.[182] In this so-called golden decade of air power, Instant Thunder remained its "holy grail."[183] In the words of former NATO Supreme Allied Commander–Europe Gen Wesley K. Clark, Desert Storm was "airpower's persistent reference point" as it conducted operations against Bosnian Serbs (Operation Deliberate Force, 30 August–14 September 1995), against Iraq (Operation Desert Fox, 16–19 December 1998), and against Serbia (Operation Allied Force, 24 March–7 June 1999).[184] Just as one US battalion commander warned during Operation Iraqi Freedom, "beware the majors of Desert Storm" (who were by then the colonels and generals), some note a similar "Iraq syndrome" in Airmen who apply the wrong lessons from Operation Desert Storm to later conflicts.[185]

When Operation Allied Force began against Serbia, the influence of the Iraq war was still palpable even eight years later. Air power was expected to have a similarly decisive impact as it did in 1991. The decisiveness was not predicted on similar contexts—indeed, the two were hardly comparable in terms of enemies, objectives, or geography—but on organizing forces in a similarly rationalistic manner to execute similar doctrinal principles.[186] In accordance with post–Gulf War doctrine, the senior US Air Force commander, Lt Gen Michael Short, preferred to strike immediately and overwhelmingly at strategic targets.[187] Again, as in its other wars, the Air Force's paradigm assumed that this approach could produce an ideal air strategy. However, unlike any of its other wars, the Air Force was forced to muddle through from the very beginning. Even after air strikes began, strategy and objectives remained unclear. Airmen were clearly dissatisfied with the limited ability to conduct their prescriptive approach to strategy.[188]

Short later expressed his frustration to other Airmen, saying, "My hope is that airpower theory has told you that there is a right way to use airpower. . . . That means to me that on the first day or the first night of the war, you attack the enemy with incredible speed and incredible violence. Violence that he could never have imagined. It

should be his worst possible nightmare with an incredible level of destruction . . . [using] every bit of technology that you have to shock him into inaction until he is paralyzed."[189] Not only does this embrace *bia*, but it ignores the inappropriateness of a predetermined strategy as well as all the contextual differences between Kosovo and Operation Desert Storm (the "perfect example of how airpower should be used," per Short). Short's statements, such as "we weren't following the classic air campaign that we'd all learned at Maxwell," reveals how stagnant air power theory had become.[190] Blaming limitations on factors such as political direction also reveals the extent to which Airmen like Short were willing to ignore anomalies.

In the words of Gray, Warden "lit a path from which airpower's practitioners would prove both unable and unwilling to deviate very much" for at least a decade.[191] Even the colonel himself, previously so attuned to "presumptive anomalies," showed less tolerance for theoretical novelties in the years since Desert Storm.[192] By 2008, with major combat operations complete in Iraq and Afghanistan, and an inadequate air power response by Israel's test of Effects Based Operations (EBO), it seemed that the moment was again ripe for a shift in Airmen's thinking.[193] Instead, during this same period that witnessed the ossification of strategic paralysis (later EBO) into dogma, Airmen began to debate another component of the *technological logos* that had lain dormant since the last period of revolutionary thinking—airmindedness. Their discourse only verified that the more dynamic parts of their paradigm, the interrelated images of Dionysius, Icarus, and *Metis*, remained unacknowledged and largely unknown.

Notes

1. 27th Fighter Squadron, Joint Base Langley-Eustis, accessed 25 January 2018, http://www.jble.af.mil/About-Us/Fact-Sheets/Display/Article/257733/27th-fighter-squadron/; and Keith "Squat" Feaga, Col, USAF (ret.), email message to author, 25 January 2018. The author was a member of the squadron from July 2002 to September 2004, and participated in many of the ongoing air defense sorties that began that morning under the name Operation Noble Eagle. Also, the 27th Fighter Squadron was originally the 27th Pursuit Squadron mentioned in chapter 1.

2. "Kamikaze: F-16 Pilots Planned to Ram Flight 93," msnbc.com, 9 September 2011, http://www.nbcnews.com/id/44459345/ns/us_news-9_11_ten_years_later/t/kamikaze-f-pilots-planned-ram-flight/; "Could Fighter Jets Have Stopped 9/11 Attacks?," msnbc.com, 15 June 2004, http://www.nbcnews.com/id/5215957/ns/ us_news-security/t/could-fighter-jets-have-stopped-attacks/; Michael Bronner, "9/11 Live: The NORAD Tapes," The Hive, accessed 25 January 2018, https://www.vanity-

fair.com/news/2006/08/norad200608; and National Commission on Terrorist Attacks, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States Including the Executive Summary* (Baton Rouge, LA: Claitor's Law Books and Publishing, 2004), 465. This led to many conspiracy theories about the US government's foreknowledge of the attacks ("Our Porous Air Defenses on 9/11," *New York Times*, 13 August 2006, WK9, www.nytimes .com/2006/08/13/opinion/ 13sun2.html).

3. National Commission on Terrorist Attacks, *The 9/11 Commission Report*, 14–45. Thomas H. Kean and Lee H. Hamilton, *Without Precedent: The Inside Story of the 9/11 Commission* (New York: Vintage, 2007), 259–62; and "Aircraft Piracy (Hijacking) and Destruction of Derelict Airborne Objects," Chairman of the Joint Chiefs of Staff Instruction J-3 CJCSI 3610.01a, 1 June 2001, A-1.

4. For more on the "Afghan Model," see Stephen Biddle, "Afghanistan and the Future of Warfare," *Foreign Affairs* 82, no. 2 (March–April, 2003): 31–46 or Max Boot, "The New American Way of War." *Foreign Affairs* 82, no. 4 (July–August 2003), 41–58.

5. Charles J. Hanley, "Air Force Must Do More for War, Gates Says," msnbc .com, 21 April 2008, http://www.nbcnews.com/id/24238978/ns/world_newsmideast_n_africa/t/air-force-must-do-more-war-gates-says/ http://www.nbcnews.com /id/24238978/ns/world_news-mideast_n_africa/t/air-force-must-do-morewargates says/#.WlOJOJM-f6A.

6. Office of the Secretary of Defense, "Joint Capability Technology Demonstration: Advanced Concept Technical Demonstration of Theater Effects Based Operations" (February 2010), http://www.dtic.mil/ descriptivesum/Y2011/OSD/stamped /0603648D8Z_PB_2011.pdf; and William M. Arkin, *Divining Victory: Airpower in the 2006 Israel-Hezbollah War* (Maxwell Air Force Base, AL: Air University Press, 2007), xix. "It is my view that EBO has been misapplied and overextended to the point that it actually hinders rather than helps joint operations" (J. N. Mattis, "Memorandum for US Joint Force Command" (Washington D.C., 14 Aug. 2008), 1).

7. Robert M. Farley's *Grounded: The Case for Abolishing the United States Air Force* (2014).

8. Azar Gat, *War in Human Civilization* (Oxford, UK: Oxford University Press, 2008), 115–117, 124, 135.

9. Victor D. Hanson, *The Western Way of War: Infantry Battle in Classical Greece*, 2nd ed. (Berkeley, CA: University of California Press, 2009), 17, 198.

10. Gat, *War in Human Civilization*, 186.

11. Gat, 185.

12. Robert L. O'Connell, *Of Arms and Men: A History of War, Weapons, and Aggression* (New York: Oxford University Press, 1990), 48. This sentiment is found throughout the history of warfare. For example, French armies of the Middle Ages exhibited what historian A. T. Hatto called a "noble prejudice" against archery, despite repeatedly witnessing its efficacy (quoted in Rick Fields, *The Code of the Warrior in History, Myth, and Everyday Life,* New York: Harpercollins, 1991, 312). McNeill describes a similar bias against the advancements in artillery (William Hardy McNeill, *The Pursuit of Power: Technology, Armed Force, and Society Since A.D. 1000,* Chicago: University of Chicago Press, 1984, chap. 5).

13. Hanson, *The Western War of War*, xi.

14. Quoted in Dominick A. Pisano, Thomas J. Dietz, and Joanne M. Gernstein, *Legend, Memory, and the Great War in the Air* (Seattle, WA: University of Washington Press, 1992), 29). In fact, hundreds of fighter pilots were knighted by their nations (O'Connell, *Of Arms and Men*, 262).

15. Crosby, *Throwing Fire: Projectile Technology through History*, 115–124. Projecting effects over distance may be so fundamental to humanity that we could also be known as *homo hurler*: the throwing animal. There is a theory that human cognition developed from our unique ability to throw projectiles hard enough, and accurately enough, to kill prey and then consume their nutrient-dense organs. Interestingly, the same type of mental representations and forecasting are present in storytelling; both "project" effects across distance. This may be another reason airmen have an aptitude for stories. William H. Calvin, "Did Throwing Stones Shape Hominid Brain Evolution?," *Ethology and Sociobiology* 3, no. 3 (1 January 1982): 115–124; and L.C. Aiello, "Brains and Guts in Human Evolution: The Expensive Tissue Hypothesis," *Brazilian Journal of Genetics* 20, no. 1 (March 1997), 141–148.

16. Freedman, *Strategy: A History*, 42.

17. Freedman, *Strategy, 24.* Gregory Nagy, *The Best of the Achaeans: Concepts of the Hero in Archaic Greek Poetry* (Baltimore, MD: Johns Hopkins University Press, 1998), 47; and Raphals, *Knowing Words*, xii, 193, 213. According to Detienne and Vernant, Homer offers the "first testimony" of *metis*. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 12.

18. Boyd, *On the Origin of Stories*, 260. Alternatively, many cite Book XXIII of *The Iliad*, recounting how a weaker charioteer can overcome his opponents in races despite weaker horses: "It is through *metis* rather than through strength that the woodcutter shows his worth. It is through *metis* that the helmsman guides the speeding vessel over the wine-dark sea despite the wind. It is through *metis* that the charioteer triumphs over his rival" (Homer quoted in Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 11–16).

19. Nagy, *The Best of the Achaeans*, 321. Those familiar with the tale know what happens next and may question this episode as an exemplar of *metis*. Odyssey cannot refrain from revealing his identity once safely away from shore. This allows the Cyclops to call upon his father, Poseidon, to curse the mortal. The subsequent obstacles Odysseus faces adds a decade to his journey and thus seemingly contradicts him as a paragon of *metis*. Homer, however, employs this as the exception that proves the rule. Odysseus's mistake serves as a contrast to the consistent thoughtlessness of many other characters as well as highlighting Odysseus's inner journey of growth. Indeed, he has to show even more restraint upon returning home (Boyd, *On the Origin of Stories*, 261–65).

20. Detienne and Vernant, *Cunning Intelligence in Greek Culture*, 307.

21. The main challenger is Martha C. Nussbaum, but another major voice—though relatively unacknowledged (judged by footnotes in other works)—is Lisa Raphals. Nussbaum, *The Fragility of Goodness*; and Raphals, *Knowing Words*. My interpretation draws heavily from Raphals's work, which is admittedly much larger as she then employs the synthesized version to compare Greek and Chinese ideas of cunning intelligence.

22. Raphals, *Knowing Words*, 207–208, 211, 215, 221, 230; and Nussbaum, *The Fragility of Goodness*, 19–20. For example, "The reunion of Odysseus and Penelope ends not with faithful and rejoicing Penelope falling into the arms of triumphant Odysseus but with her final and unassailable test of his identity. Odysseus comes to the surprising and happy realization that Penelope's *metis* exceeds even his own and that his own attainment is not quite what he thought it was" (Raphals, *Knowing Words*, 211).

23. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 2, 17–18, 307, 313; and Nussbaum, *The Fragility of Goodness*, 20.

24. Jeffrey Barnouw, *Odysseus, Hero of Practical Intelligence: Deliberation and Signs in Homer's Odyssey* (Lanham, MD: University Press of America, 2004), 2–3,

33). Barnouw described this intelligence as being as much "visceral as intellectual," less an "impassive weighing of alternatives" and more a prioritizing of aims or impulses that are most desired. It reflected more "the strength and depth of passion as the work of reason."

25. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 5, 18.

26. Morgan, *Images of Organization*, 343. Experience of the past serves as to equip the playground of the metic mind, not as principles (Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 14). This approach avoids the very Platonic "teleological fallacy," which Taleb describes as "the illusion that you know exactly where you are going, and that you knew exactly where you were going in the past, and that others have succeeded in the past by knowing where they were going" (Nassim Nicholas Taleb, *Antifragile: Things That Gain from Disorder,* New York, NY: Random House Trade Paperbacks, 2014, 169).

27. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 14, 18, 313; Nussbaum, *The Fragility of Goodness*, 82, 300, 310; James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1999), 324, 329, 352; Freedman, *Strategy,* 554–555; and Ian Bogost, *Play Anything: The Pleasure of Limits, the Uses of Boredom, and the Secret of Games* (New York: Basic Books, 2016), 47. Robert Chia and Robin Holt emphasize the idea of vigilance in *metis*: "To be vigilant is to remain alive to vague and diverse and seemingly minor occurrences; it is to look beyond the abstract confines of data-based analysis; it is to absorb contradictions; and all of this is *metis*. It becomes a cultivated art for reversing unfavourable or disorienting or even unrecognized situations into ones replete with potential that involves alertness, sensitivity and a peculiar disposition that is particularly attuned to emerging opportunities contained in unfolding circumstances" (Robert C. H. Chia and Robin Holt, *Strategy without Design: The Silent Efficacy of Indirect Action,* England: Cambridge University Press, 2011, 197). Nussbaum uses phrases such as "wonder and openness," "room for surprise, room for both the cognitive insecurity and the human vulnerability that the Platonic scientific conception is seeking to avoid," "orderly mystery," and yielding to "the tension of distinct and separate beauties" (Nussbaum, *The Fragility of Goodness*, 310, 302, 382). Scott describes bricolage as a stochastic method of trial and error yielding "practical solutions without benefit of scientific method." He also notes, "*Metis*, far from being rigid and monolithic, is plastic, local, and divergent. It is in fact the idiosyncrasies of *metis,* its contextualness, and its fragmentation that make it so permeable, so open to new ideas" (Scott, *Seeing like a State*, 329, 332).

28. Homer, *The Iliad*, trans. Stephen Mitchell (New York: Atria Books, 2012), vix, 307–311. Regarding Dionysius as a metic figure, Detienne and Vernant specifically cite him as lacking in *metis* (Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 279). The image of Greek god used here, however, incorporates a separate tradition in which Dionysius is a more well-rounded character who eventually replaces Zeus: "the Orphic Dionysus indeed represents the total unity of the dispersed, multiple, individualized, shifting world over which he comes to extend . . . of all the Greek deities, his is the only divine career which incorporates this alternating equilibrium, this oscillation between the one and the multiple, the same and the other, between the concentration of the whole and its dispersion" (Detienne and Vernant, 136).

29. Jenny Strauss Clay, *The Wrath of Athena: Gods and Men in The Odyssey* (Lanham, MD: Rowman & Littlefield Publishers, 1996), 96.

30. Plato's "philosopher king" has *techne* regarding the state as a ship (both in terms of constructing and navigating the political structure).

31. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 3–5; and Chia and Holt, *Strategy without Design,* 194. The metic figure "turns up everywhere and yet he is strangely absent, at least from history as we know it. It may well seem paradoxical that a type of intelligence as fundamental and as well represented in a society such as that of ancient Greece should have remained so neglected" (Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 308).

32. Wheeler, *Stratagem and the Vocabulary of Military Trickery*, 26.

33. Again, given the focus here in on fighting, in the spirit of Clausewitz's *On War*, this analysis is not about the flexibility of air power to do many nonkinetic missions. However, the fact that the US Air Force can perform a wide range of tasks, from disaster relief to intelligence gathering to airlift operations, only strengthens the point here.

34. War Department Field Manual (FM) 100–20, *Command and Employment of Air Power* (21 July 1943), 1–2.

35. Air Force Manual (AFM) 1, *Basic Doctrine* (27 February 2015), 35. Note the need for air power to be under the control of an Airman in both. FM 100–20: "Control of available air power must be centralized and command must be exercised through the Air Force commander if this inherent flexibility and ability to deliver a decisive blow are to be fully exploited" (FM 100–20, 2). Likewise, in current US Air Force doctrine: "Because of airpower's unique potential to directly affect the strategic and operational levels of war, it should be controlled by a single Airman who maintains the broad, strategic perspective necessary to balance and prioritize the use of a powerful, highly desired yet limited force. A single air component commander, focused on the broader aspects of an operation, can best balance or mediate urgent demands for tactical support against longer-term strategic and operational requirements. The ability to concentrate the air effort to fulfill the highest priorities for effects and to quickly shift the effort can only be accomplished through centralized control. On the other hand, the flexibility to take advantage of tactical opportunities and to effectively respond to shifting local circumstances can only be achieved through decentralized execution" (AFM 1, 67).

36. This is how Wylie describes the "sequential" approach: "Normally we consider a war as a series of discrete steps or actions, with each one of this series of actions growing naturally out of, and dependent on, the one that preceded it. The total pattern of all the discrete or separate actions makes up, serially, the entire sequence of the war . . . . Each step could be clearly seen by the strategist ahead of time, could be clearly appraised in terms of its expected result" (J. C. Wylie, *Military Strategy: A General Theory of Power Control,* Annapolis, MD: Naval Institute Press, 1989, 22–23).

37. Colin S. Gray, *Airpower for Strategic Effect* (Maxwell Air Force Base, AL: Air University Press, 2012), 77.

38. Colin S. Gray, *Modern Strategy* (New York: Oxford University Press, 1999), 3. Strategist Bernard Brodie's familiar quotation is "above all, strategic theory is a theory for action."

39. Colin S. Gray, "Understanding Airpower: Bonfire of the Fallacies," *Strategic Studies Quarterly* 2, no. 4 (Winter 2008): 54, https://www.airuniversity.af.edu/. Definition of theory by an Airman, Harold R. Winton, "A Black Hole in the Wild Blue Yonder: The Need for a Comprehensive Theory of Airpower," *Air Power History* 39 (Winter 1992), 3.

40. Everett Dolman, *Pure Strategy: Power and Principle in the Space and Information Age* (New York: Routledge, 2005), 6. Dolman argues it is precisely not victory: "Strategy is thus an unending process that can never lead to conclusion. And this is the way it should be: continuation is the goal of strategy—not culmination . . . . The strategist must concentrate less on determining specific actions to be taken and far

more on manipulating the structure within which all actions are determined. . . . Strategy is not about winning . . . victory is but a moment in time, a point of reference in a continuously changing web of history. It is never an end. It is ever a new beginning" (Dolman, 4–5, 9).

41. Gray, *Airpower for Strategic Effect*, 7. Gray is paraphrasing the famous quip, attributed to Sidney Hillman, that "politics is the science of who gets what, when and why."

42. Gray, 31–32.

43. Adopting Clausewitz's focus on fighting (Carl von Clausewitz, *On War*, trans. and ed. Michael Howard and Peter Paret, Princeton, NJ: Princeton University Press, 1989, 128), these operational theories explain how fighting through the air ("air power") will meet the war's purpose. This, of course, is a useful fiction as other air power capabilities (e.g., airlift) and the other domains of "airpower" (i.e., space and cyberspace) are increasingly vital for the employment of aircraft for kinetic effect.

44. This has also been called "inside-out" warfare as it concentrated on the center of the five rings and anticipated effects flowing outward. Strategic paralysis, parallel warfare, or inside-out warfare were all names that came into usage after Operation Desert Storm. Still, however labeled, the impetus was Warden's *The Air Campaign* and the theoretical ideas he continued to develop after its publication (John A. Warden III, *The Air Campaign* (Washington, DC: National Defense University Press, 1988); Edward C. Mann, Thunder and Lightning: Desert Storm and the Airpower Debates, vol. 2, Maxwell Air Force Base, AL: Air University Press, 1995, 35). The focus herein is on the more recent of the two theories. This is due to the availability of primary sources on technological users, and because it is not as mined for intellectual history purposes as interwar strategic bombing theory is. Additionally, it is more useful to Airmen right now since the Air Force culture is still shaped by the repercussions of the Desert Storm story. What is not in this chapter is an evaluation of how well AWPD-1 or Instant Thunder matched their parent theories or if Industrial Web Theory and Strategic Paralysis are actually the same theory of air power (for more on that issue, see James R. Cody, *"AWPD-42 to Instant Thunder: Consistent, Evolutionary Thought or Revolutionary Change?"* [master's thesis, School of Advanced Air and Space Studies, 1996]). Finally, there is no examination into how the operational orders—the tasking of specific forces—matched the theory or the original plan or the overall effectiveness of those operations. Other works appraise these theories in light of the general theory of strategy, including Gray's *Airpower for Strategic Effect* and Olsen's *Strategic Air Power in Desert Storm*. Robert A. Pape's work should only be read when paired with Barry Watt's review of it (Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996); and Barry D. Watts, "Ignoring Reality: Problems of Theory and Evidence in Security Studies," *Security Studies* 7, no. 2 (1 December 1997): 115–171).

45. AWPD-42 is not addressed because it was of the same spirit and occurred after hostilities began. AWPD-1 and the Instant Thunder Air Campaign Plan were developed before US troops were engaged and were constructed by Airmen before they came under the direct influence of other military leaders.

46. These are modern doctrinal terms but are closely related to the concepts of earlier airmen. Of course, this does not even mention sorties without a kinetic mission: cargo, intelligence, and so on. While these were dangerous and equally critical, they were not technically "on fighting" (Note 43).

47. For instance, see David E. Johnson's *Fast Tanks and Heavy Bombers* (1998), Timothy May's *War Machines* (2001), H. Bruce Franklin's chapter " 'Peace is Our Profession': The Bombers Take Over" in *The Airplane in American Culture* (ed. Dom-

inick A. Pisano) and Brad Gladman's "The Development of Tactical Air Doctrine in North Africa, 1940–1943," in *Air Power History* (2002).

48. Phillip S. Meilinger, ed., *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell Air Force Base, AL: Air University Press, 1997), 212; and Peter R. Faber, "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower." For a single representative sample, see "Syllabus, 1938–39," 27 April 1939, AFHRA, Maxwell Air Force Base, AL, file 248.2208B. Meilinger points out that in 1935 there were more periods dedicated to horseback riding than to bombing (Phillip S. Meilinger, *Airpower: Myths and Facts,* Maxwell Air Force Base, AL: Air University Press, 2015, 18).

49. Orvel Cook, transcript of oral history interview by Hugh N. Ahmann and Maj Richard Emmons, 4–5 June and 6–7 August 1974, 101, AFHRA, file no. K239.0512–740.

50. Meilinger, *The Paths of Heaven*, 223; Faber, "Interwar US Army Aviation and the Air Corps Tactical School;" and Futrell, *Ideas, Concepts, Doctrine*, vol. 1, 82–84. In a point that will be addressed in the conclusion, some Airmen seemed resistant to the very notion of theory.

51. Futrell, *Ideas, Concepts, Doctrine*, 67, 69, 79, 80, 101, 132. Tactical airframes outnumbered long-range bombers in various expansion plans approved by the War department between 1933 and 1945, despite the evidence that the larger aircraft had more potential for technological breakthroughs and that bombers were necessary for hemispheric defense.

52. Meilinger, *Airpower,* 21–23.

53. Clodfelter, *Beneficial Bombing*, 38.

54. H. H. Arnold to All Air Force Commanders in Combat Zones, 10 June 1943 (marked "as rewritten by Gen. Arnold"), bombing folder, box 41, Arnold Papers, Library of Congress. This project does not delve into the obvious moral issues surrounding bombing.

55. Futrell, *Ideas, Concepts, Doctrine*, 82. Vocal opponents of strategic bombing, see Futrell (82, 85) or Elwood R. Quesada, "Tactical Air Power," *Air University Quarterly Review* 1, no. 4 (Spring 1948): 44–45.

56. Thomas H. Greer, "The Development of Air Doctrine in the Army Air Arm, 1917–1944," USAF Historical Study 89 (Maxwell Air Force Base, AL: Research Studies Institute, 1955), 60–66.

57. Richard G. Davis, *Carl A. Spaatz and the Air War in Europe* (Washington, DC: Air Force History and Museums Program, 1993), 174–184. This was the lesson internalized by airmen after the failure of air support in North Africa during Operation Torch. In that debacle, aircraft were spread out to various land units in compliance with FM 31–35, *Aviation in Support of Ground Forces* (9 April 1942). This diffusion, along with poor coordination between ground and air forces, precluded the ability to shift air power in relation to the changing battlefield conditions.

58. Capt Laurence S. Kuter, "Operations against Naval Objectives" (lecture, Air Corps Tactical School, Maxwell Field, AL, 2 March 1938). Consider the ACTS motto, *Proficimus More Irretenti* or "We Make Progress Unhindered by Custom" and a 1938 ACTS lecture: "Battles have been won too often by the judicious violation of doctrine."

59. Air Corps Tactical School, Air Force, Part 1, *Air Warfare* (1 February 1938) 1; and Elwood R Quesada, "Tactical Air Power," *Air University Quarterly Review* 1, no. 4 (Spring 1948): 44–45. An ACTS faculty member stated, "The military high command must learn from the fatal mistakes of defense-mindedness and ground-mindedness; the new kind of warfare called for flexible thinking and a high degree of air-mindedness"

(Col Donald Wilson, quoted in Herman S. Wolk, *Cataclysm: General Hap Arnold and the Defeat of Japan,* Denton: University of North Texas Press, 2010, 27).

60. War Department Field Manual 100–20, *Command and Employment of Air Power*, 21 July 1943, 1–2; Report of Air Corps Board, "Modernization of the Organization of the Army," Study 21, 9 January 1936; and AFM 1, *Basic Doctrine*, 27 February 2015, 35, 67.

61. James Parton, *Impact the Army Air Forces' Confidential Picture History of World War II*, vol. 4 (Washington, DC: Air Force Historical Foundation, 1980), v; quote by Haywood S. Hansell Jr., "USAAF Plans and Strategic Effects."

62. Clodfelter, *The Limits of Air Power,* 203–204. Consider Clodfelter's assessment: "a modern vision of air power that focuses on the lethality of its weaponry rather than on that weaponry's effectiveness as a political instrument . . . air power's political efficacy varies according to many diverse elements, and that no specific formula guarantees success . . . this lesson might prove the most difficult of all for air leaders to learn."

63. Futrell, *Ideas, Concepts, Doctrine*, 96–97, 101, 133; Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm*, 1917–1941 (Washington, DC Office of Air Force History, US Air Force, 1985), 116–117. Another study, commissioned in 1941, recommended development of high- and low-altitude interceptors, night fighters, and long-range multiplace fighter escorts (Futrell, *Ideas, Concepts, Doctrine*, 107). Arnold himself wrote: "During daylight in good weather, when pursuit aviation is present in strength in an area, it can pretty nearly bar the air to the bomber" (Henry H. Arnold and Ira C. Eaker, *Winged Warfare*, 176).

64. Futrell, *Ideas, Concepts, Doctrine*, 82–83.

65. One internal analysis during the war estimated that, for the two-dozen radar bombing missions conducted toward the end of 1943 in the European theater, only 5 percent of the bombs landed within one mile of the aim point. The Pacific theater was worse. Precision bombing in the Pacific was constrained by unfamiliar environmental obstacles: cloud coverage often obscured targets and forecasting capabilities were severely limited. High winds at altitude made it difficult to navigate and difficult to accurately calculate fuel requirements. Additionally, the technological limitations of the Norden bombsight made it difficult to compensate for the newly discovered jetstream. Consequently, only 2 percent of aircraft were able to drop payloads within 1,000 feet of their aim point. Furthermore, the B-29s—which were often required to take off overloaded—were plagued with mechanical problems such as engine failures and fires. Last, unlike the detailed analysis of Germany, "strategic air intelligence was simply non-existent" for Japan, whose economy did not fit the industrial web model. Clodfelter, *Beneficial Bombing*, 143, 203, 206; Max Hastings, *Retribution: The Battle for Japan, 1944–45* (New York: Vintage, 2009), 288; and Wolk, *Cataclysm*, 79, 126.

66. E. Bartlett Kerr, *Flames over Tokyo* (New York: Dutton Adult, 1991), 118; and Hansell to Norstad, telecommunication, "Incendiary Attack of City of Nogoya," quote.

67. Quoted in Wolk, *Cataclysm*, 122.

68. Sherry, *The Rise of American Air Power*, 272.

69. Wolk, *Cataclysm*, 132; Sherry, *The Rise of American Air Power*, 282; and Hastings, *Retribution*, 297, 308.

70. R. J. Overy, *The Air War*, 1939–1945, (Washington, DC: Potomac Books Inc, 2005), 6, 204.

71. Clodfelter, *Beneficial Bombing*, 101.

72. Futrell, *Ideas, Concepts, Doctrine*, 157; and David MacIsaac, "Voices from the Central Blue: The Air Power Theorists," in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press,

1986), 636. Also implicit in the selection of multiple "centers of gravity" was the presumption that air power could paralyze Germany's ability to wage war "by the destruction of not more than five or six industries" (quoted in Clodfelter, *Beneficial Bombing,* 125–126). In the section of his book titled "The Sources of Technological Fanaticism," Sherry writes, "Their plans revealed a kind of strategic distance on the consequences of their actions that paralleled and reinforced the distance created by their professional pursuit of technique, by the command and bureaucratic arrangements they made to organize that technique, and by the language and methodology they employed to use it" (Sherry, *The Rise of American Air Power*, 239).

73. Mann, *Thunder and Lightning*, 51; and Maj Gen Emmett O'Donnell quoted in Conrad C. Crane, *American Airpower Strategy in Korea*, 1950–1953 (Lawrence, KS: University Press of Kansas, 2000), 7, 32.

74. Col Philip D. Cole quoted in Futrell, *Ideas, Concepts, Doctrine*, 173; Thomas E. Griffith Jr., *MacArthur's Airman: General George C. Kenney and the War in the Southwest Pacific* (Lawrence: University Press of Kansas, 1998); and Thomas Alexander Hughes, *Overlord: General Pete Quesada and the Triumph of Tactical Air Power in World War II* (New York: Free Press, 2002).

75. For example, see The Joint Congressional Aviation Policy Board report, Senate, National Aviation Policy (Washington DC: 1954), 3, 10; Lt Col John P. Healy, "Air Power and Foreign Policy," *Air University Quarterly Review* 2, no. 2 (Fall 1948): 15–26; or the Chairman of the Joint Chiefs of Staff statement about the primacy of atomic warfare in House, Mutual Defense Assistance Act of 1949: Hearings before the Committee on Foreign Affairs, 81st Congress, 1st sess., 1949, 1–9, 69–72. As CSAF, Hoyt Vandenburg stated, "To be really effective, we must have an air defense capable of killing enemy air power at its source. We ourselves must strike effectively before much else can be done by anybody. As was the case in the last war it is up to the Air Force to carry the war to the enemy and to gain air superiority before surface operations in force can be successively undertaken" ("Air Force Policies and Planning," quoted in Futrell, *Ideas, Concepts, Doctrine*, 287).

76. Futrell, *Ideas, Concepts, and Doctrine*, 152–153. This was manifested, for example, in shifting focus from industrial targets to the Luftwaffe prior to D-Day (Clodfelter, *Beneficial Bombing*, 132). The 1943 Casablanca Directive established the objective of the Combined Bomber Offensive as "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened" (quoted in Wolk, *Cataclysm*, 107).

77. Sherry, *The Rise of American Air Power*, 154; and Clodfelter, *Beneficial Bombing*, 149. This shift was also evident in Air Interdiction missions: Operation Clarion's attacks against road traffic and small towns, designed to convince the population of their defenselessness, anticipated "over 95 percent" civilian causalities (quoted in Clodfelter, 179).

78. Sherry, *The Rise of American Air Power*, 117, 139, 141, 185, 290; and Hastings, *Retribution*, 317.

79. Annette Simmons, *The Story Factor*, 2nd ed. (New York: Basic Books, 2006), 149–50.

80. Futrell, *Ideas, Concepts, Doctrine*, 146–147. For example, the authors of AWPD-1 left open the possibility of air power forcing Germany's surrender without a land operation. When that did not happen, they could easily point to how bombing resources were diverted from strategic bombing to interdiction missions in preparation for the D-Day invasion (note 139, this chapter).

81. Maj Gen Emmett O'Donnell Jr., testimony to Congress quoted in Crane, *American Airpower Strategy in Korea, 1950–1953,* 185.

82. Clodfelter, *Limits of Air Power*, 51.

83. Kuhn, *The Structure of Scientific Revolutions*, xi–5.

84. Kuhn, *The Structure of Scientific Revolutions*, 122, 154–155, 157.

85. Marc Trachtenberg, *The Craft of International History: A Guide to Method* (Princeton, NJ: Princeton University Press, 2009), 21–22. Feyerabend concludes that "our chances of progress may be obstructed by our desire to be rational" (quoted in Mihai I. Spariosu, *Dionysus Reborn*, 292).

86. Jerome Bruner, *The Culture of Education* (Cambridge, MA: Harvard University Press, 1997), 123–24.

87. For more on why machines and operating manuals do not constitute full technological transfer, see Daniel R. Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism*, 1850–1940 (New York: Oxford University Press, 1988).

88. Edward Constant II, *The Origins of Turbojet Revolution* (Baltimore, MD: The Johns Hopkins University Press, 1980), 15, 138.

89. Edward W. Constant, "Reliable Knowledge and Unreliable Stuff: On the Practical Role of Rational Beliefs," *Technology and Culture* 40, no. 2 (1 April 1999): 324–357. The degree to which technological knowledge is subjectively constructed is itself debated. For example, see the dialogue that played out in the pages of *Technology and Culture* between Constant, Law, Singleton, and Scranton. John Law and Vicky Singleton, "Performing Technology's Stories: On Social Constructivism, Performance, and Performativity," *Technology and Culture* 41, no. 4 (1 October 2000): 765–775; Philip Scranton, "Missing the Target? A Comment on Edward Constant's 'Reliable Knowledge and Unreliable Stuff'," *Technology and Culture* 41, no. 4 (1 October 2000): 752–764; Edward W. Constant, "Performance Is a Moving Target, Reliably," *Technology and Culture* 41, no. 4 (1 October 2000): 776–782.

90. In regard to faith that is necessary when in times of flux, there is less empirical evidence, Gray notes that, "Air power's advocates acquired a belief system that approximated a faith in a revolutionary change in warfare. This faith served their personal career designs, it must be said, as well as the interests of their nation(s) as they believed sincerely. They feared, again sincerely, that airpower was advancing on a broad, invincible front—at least it was advancing on behalf of those polities that properly anticipated modernity" (Gray, *Airpower for Strategic Effect*, 19). Regarding the playful process by which technologists explore combinations of diverse ideas, materials, people, and organizations, note Edwards's description of the process as bricolage, or tinkering: instead of "well-codified methods to well-defined problems," science and engineering "normally proceed" by collage of historically contextual, contingent, heterogeneous materials (practices, symbols, metaphors, research, conventions of discourse), making it similar to "politics, commerce—or war" (Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America,* Cambridge, MA: The MIT Press, 1997, 40–41).

91. Thomas Parke Hughes, "Technological Momentum in History: Hydrogenation in Germany 1898–1933," *Past & Present* 44, no. 1 (1 August 1969): 106–132. Scott writes that certain management practices, such as Taylorization and the CNC manufacturing David Noble analyzes, all hoped for a system that "had designed out *metis*" (Scott, *Seeing like a State*, 337).

92. Starting in 1920, ACTS permitted a formalized mechanism for embedding airmindedness. Similar to the high percentages of senior Airmen who passed through the Chief's office, 261 of the 320 Army Air Force (AAF) general officers in

World War II were graduates of ACTS (Clodfelter, *Beneficial Bombing*, 52). The school was located at Langley Field but eventually moved to Maxwell AFB in Montgomery, Alabama. The move was symbolic of the growing distance between its teachings and the official positions of the War Department.

93. According to the Strategic Bombing Surveys in 1945 and 1946, "control of the air permitted close air support to ground forces . . . effective interdiction . . . [and] destruction by long—range bombing of such of [Japan's] industries and cities as we chose to attack" The *United States Strategic Bombing Surveys*, reprint (Maxwell Air Force Base, AL: Air University Press, October 1987), 109.

94. Amitai Etzioni, "Mixed-Scanning: A 'Third' Approach to Decision-Making," *Public Administration Review* 27, no. 5 (1 December 1967): 385–386. "Rationalistic models are widely held conceptions about how decisions are and ought to be made. An actor becomes aware of a problem, posits a goal, carefully weighs alternative means, and chooses among them according to his estimates of their respective merit." Alternatives to this approach are discussed in the conclusion.

95. Gray, *Airpower for Strategic Effect*, 209. Gray writes, "Warden's conceptual demarche on behalf of conventional airpower in the late 1980s was the first of its kind with logical merit to appear *for more than 40 years*" [emphasis added]. This was partially as a result of the Cold War dichotomy between Strategic Air Command and Tactical Air Command. An obvious exception is John Boyd, but his theoretical writings, though based in the mechanics of air combat tactics, were applied to grand strategy and the nature of warfare, mostly skipping over operational theory (Osinga, *Science, Strategy and War*, 18).

96. David MacIsaac, "Voices from the Central Blue: The Air Power Theorists" (Princeton, NJ: Princeton University Press 1986), 639, 643. In assessing the period of 1945 to 1986, MacIsaac notes the lack of Airmen theorists but writes that air power theory had "become almost an industry unto itself, one heavily populated with game theorists, statistically oriented behavioral scientists, economists, and other social scientists"—and few of them focused on conventional air warfare. I. B. Holley notes that Mitchell was more of a visionary than theorist (I. B. Holley, "Reflections on the Search for Airpower Theory," in *The Paths to Heaven: The Evolution of Air Power Theory*, ed. Phillip S. Meilinger (MaxwellAir Force Base, AL: Air University Press, 1997), 582.

97. "Not only was airpower theory neglected, the people who were now running the Air Force had no roots in the theory" (Carl H. Builder, *The Icarus Syndrome*, 179–80).

98. Whereas the World War II era was clearly "air power" (two words), by Warden's time it was becoming more appropriate to include space and cyberspace and the US Air Force convention changed to "aerospace power" and then "airpower" (one word). Still, the two-word construct is used herein for consistency, because his theory was largely based on air assets and because the use of a singular construct with three parts was not in common usage until after Operation Desert Storm.

99. Others have already written biographical works about Warden (e.g., Olsen's *John Warden and the Renaissance of American Air Power*). What has not been done and what this analysis suggests, however, is the utility of examining Warden in terms familiar to historians of technology, whether in the concept of "heroic inventors" or the notion of the "system builder" or "heterogeneous engineer" (John Law, "Technology and Heterogeneous Engineering" in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology, edited by* Wiebe E. Bijker, Thomas Parke Hughes, and T. J. Pinch (Cambridge, MA: The MIT Press, 2012).

100. John Andreas Olsen, *Strategic Air Power in Desert Storm* (New York, NY: Routledge, 2003), 71; and John Andreas Olsen, *John Warden and the Renaissance of American Air Power* (Washington, DC: Potomac Books, 2007), 33.

101. Richard G. Davis, *On Target: Organizing and Executing the Strategic Air Campaign Against Iraq* (Washington, DC: Air Force History and Museums Program, 2002), 59–61. Senior Air Force leaders decided to disband Checkmate, but Warden convinced them to keep the division as a "think tank" (John A. Warden III, transcript of interview with Lt Col Suzanne B. Gehri, Lt Col Richard T. Reynolds, and Lt Col Edward C. Mann, III, 22 October 1991, 18, *Desert Story Collection*, US Air Force Historical Research Agency, Maxwell Air Force Base, AL).

102. Warden, *The Air Campaign*, 1988. At this point, Warden's ideas were captured in *The Air Campaign* and *"Global Strategy Outline"* essay (May 1988, quoted in Olsen, *John Warden and the Renaissance of American Air Power*). Later, he expanded on his ideas in "The Enemy as a System," *Airpower Journal* 9, no. 1 (1995), 40–55; "Employing Airpower in the Twenty-first Century" in *The Future of Airpower in the Aftermath of the Gulf War*, edited by R. H. Shultz Jr. and R. L. Pfaltzgraff (Maxwell Air Force Base, AL: Air University Press 1992); and the interestingly titled *Winning in FastTime: Harness the Competitive Advantage of Prometheus in Business and Life*, 5th ed. (Montgomery, AL: Venturist Inc., 2001).

103. David R. Tretler, quoted in Davis, *On Target*, 60–61.

104. Charles E. Osgood, *An Alternative to War or Surrender* (Urbana: University of Illinois Press, 1962); and Thomas C. Schelling, *Arms and Influence reprint* (New Haven, CT: Yale University Press, 1966).

105. John A. Tirpak, "Find, Fix, Track, Target, Engage, Assess," *Air Force Magazine* 83, no. 7 (July 2000), 24–29.

106. Mann, *Thunder and Lightning*, 27–28. The dominant narrative of many Airmen today presumes the US Air Force simply acquiesced to the US Army's doctrine. Air Force Manual (AFM) 1–1, *Basic Aerospace Doctrine of the United States Air Force,* 5 January 1984 (2–11 through 2–15, 3–2 through 3–8), shows the Air Force's more expansive sense of conventional air power. Furthermore, AirLand Battle also made all air power missions and assets "newly important" to the ground commanders (Creech quoted in James C. Slife, *Creech Blue: Gen Bill Creech and the Reformation of the Tactical Air Forces, 1978–1984* (Maxwell Air Force Base, AL: Air University Press, 2004), 38–39).

107. Warden, *The Air Campaign*, 7, 44; and Warden, 30 May 1991, 86, *Desert Story Collection*.

108. Olsen, *Strategic Air Power in Desert Storm*, 82–86; Richard T. Reynolds, *Heart of the Storm: The Genesis of the Air Campaign Against Iraq* (Maxwell Air Force Base, AL: Air University Press, 1995), 18; Mann, *Thunder and Lightning*, 73–74; James Blackburn, 21 April 1993, 9–13, *Desert Story Collection*; Deptula, 12 December 1991, 20–22, *Desert Story Collection*; Edward Mann, "One Target, One Bomb: Is the Principle of Mass Dead?," *Airpower Journal* 7, no. 1 (Spring 1993): 35–43; David R. Mets, *The Air Campaign: John Warden and the Classical Airpower Theorists*, Revised (Maxwell Air Force Base, AL: Air University Press, 1999); Warden, *Winning in FastTime,* 112–121; and Davis, *On Target*, 62–63.

109. Scott, *Seeing like a State*, 324.

110. "Warden in many ways presented a concept that most likely would not have been politically acceptable during the Cold War. While TAC's thinking maintained a Cold War mentality, Warden managed to take advantage of the grand strategic changes that were about to manifest themselves. Thus, the 'man and the moment met

and jumped as one' also in geo-political terms" (Olsen, *Strategic Air Power in Desert Storm*, 163).

111. Lt Col Dave Deptula, 11 December 1991, 15–22, *Desert Story Collection*; Davis, *On Target*, 63–64; and Blackburn, 21 April 1993, 9–13. For a sense of the complexity of weaponeering, see *Joint Munitions Effectiveness Manual: Methodology Report,* TH 61A1–3–6 (USAF), 5 November 1974, 2–1 through 3–9. According to Mann, suppression was not a new idea but it was never imagined on the scale Warden did, aiming for tactical paralysis instead of strategic collapse (Mann, *Thunder and Lightning*, 45).

112. Warden, *The Air Campaign,* 115–127. Mets states that airmen had already arrived at this innovation in the interwar period, or what this chapter argues is the first cycle of *metis* (Mets, *The Air Campaign*, 61).

113. Olsen, *John Warden and the Renaissance of American Air Power*, 77–79; and Olsen, *Strategic Air Power in Desert Storm*, 270–271. Gray's evaluation of Warden corroborates Olsen's (Gray, *Airpower for Strategic Effect*, 208).

114. John A. Warden III, "Employing Airpower in the 21st Century" in *The Future of Air Power in the Aftermath of the Gulf War*, edited by Richard H. Shultz and Robert L. Pfaltzgraff (Maxwell Air Force Base, AL: Air University Press, 1992). Note the purported universality of his model when he writes, "Every state and military organization will have centers of gravity—or vulnerabilities. Nevertheless, it is possible create a general model as a starting place for analysis." Also note, in the same essay, a sense of hubris: "what the next revolution [in air warfare] will look like is up to us" (Warden, 64, 81).

115. Olsen, *John Warden and the Renaissance of American Air Power*, 34, 36. Warden's first Pentagon tour expanded his perspective of geopolitics, and he soon disagreed with the focus on Europe as the likely focal point of a NATO–Warsaw Pact clash. His unconventional view was that a confrontation in the Persian Gulf was more likely because the Soviets would assess less risk and greater rewards. He had an opportunity to suggest appropriate force structure changes to the National Security Council based on this assessment while also injecting some of his predictions into the recently created Checkmate unit (which he would eventually have authority over).

116. Reynolds, *Heart of the Storm*, 15, 20.

117. Warden, *Desert Story Collection*, 22 October 1991, 78. Jim Brogan quoted in Mann, *Thunder and Lightning*, 45. Others with firsthand knowledge of the events reported similar assessments in interviews (James Crigger, *Desert Story Collection*, 2–4 December 1991, 16–17; James V. Adams, *Desert Story Collection*, 3 February 1991, 1, 29; Robert M. Alexander, *Desert Story Collection*, 3 June 1992, 1–3; John M. Loh, *Desert Story Collection*, 26 September 1991, 1–6; Jack Chain, *Desert Story Collection*, 12 August 1991, 2).

118. Mann, *Thunder and Lightening*, 43.

119. Reynolds, *Heart of the Storm*, 18. Those around Warden expected as much and were familiar with his penchant for applying chaos theory to his management style, often referencing Tom Peters's *Thriving on Chaos: Handbook for a Management Revolution* (New York: HarperCollins Publishers, 1987). Peters argues that crafting adequate and timely solutions to complex, "real-world" problems required a decentralized approach among a manageably sized team (Reynolds, *Heart of the Storm*, 18). Those in Warden's division described his application of this philosophy as "mentally stimulating" (Wayne Thompson quoted in Olsen, *Strategic Air Power in Desert Storm*, 81).

120. Davis, *On Target,* 61.

121. Bernard Harvey, 7, *Desert Story Collection*; Olsen, *Strategic Air Power in Desert Storm*, 103–4. As a core member of Warden's planning team, Harvey took copious notes throughout the period under discussion. Those writings are part of the same *Desert Story Collection*, held at the US Air Force Historical Research Agency, as the personal interviews cited throughout this chapter. Though the overall document is Secret, information extracted from Harvey's records for this project is unclassified.

122. OPLAN 1002 Air Operations, April 1990, file 19, Gulf War Air Power Survey Collection, US Air Force Historical Research Agency, Maxwell Air Force Base, AL. (Information extracted is unclassified.); Lt Gen Charles A. Horner, 2 December 1991, 8, *Desert Story Collection; Heart of the Storm* 4, 54; and Mann, *Thunder and Lightning*, 28.

123. Horner, *Desert Story Collection*, 2 December 1991, 12–14.

124. Horner, 15. "According to the best statistical simulation models, slugging it out with Hussein's army would produce 17,000 to 30,000 US casualties (Diane T. Putney, "From Instant Thunder to Desert Storm: Developing the Gulf War Air Campaign's Phases," *Air Power History* 41, no. 3 (1994): 45).

125. Department of Defense (DOD), *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, DC: United States Government Printing Office, 1992), 65.

126. Norman Schwarzkopf, *It Doesn't Take a Hero: The Autobiography of General H. Norman Schwarzkopf* (New York: Bantam, 1993), 313 and Davis, *On Target*, 58.

127. John M. Loh, interview, *Desert Story Collection*, 19 September 1991, 4–6, 9. It is important to note that this dialogue is Loh's recollection of the conversation, not Schwarzkopf's.

128. Loh, *Desert Story Collection*, 6.

129. Warden, *Desert Story Collection*, 22 October 1991, 49. Note the similarity with the intent of AWPD-1's authors and Warden in this quote from Olsen's biography: "There is still uncertainty as to whether Schwarzkopf used the term 'strategic air campaign,' but to Warden it did not matter: he was going to present what he believed was the only way forward, whatever the CINC had actually asked for" (Olsen, *Strategic Air Power in Desert Storm*, 113).

130. "This is not your Rolling Thunder. This is real war, and one of the things we want to emphasize right from the beginning is that this is not Vietnam! This is doing it right! This is using air power!" (Warden, *Desert Story Collection*, 22 October 1991, 50–53).

131. Warden, 51. The presumption in this chapter is that this version is the best representation of Warden's air power theory, since his team crafted it before outside influence (either in the form of feedback from those being briefed or sister-service planners sent to assist Checkmate). Still, evidence from later briefs that are in the spirit of the first are still used to explain the theory.

132. Warden, *Desert Story Collection*, 22 October 1991, 52, 56–58; Deptula, *Desert Story Collection*, 12 December 1991, 20–25; and Lt Gen Buster C. Glosson, *Desert Story Collection*, 4 June 1992, 14, 54–55, 110, 115–16.

133. Warden, *Desert Story Collection*, 22 October 1991, 11, 55–58; Ronnie Stanfill, *Desert Story Collection*, 3 June 1991, 29; Deptula, *Desert Story Collection*, 1 November 1990, 2; Eliot A. Cohen and Thomas A. Keaney, *Gulf War Air Power Survey: Summary Repor*t (Air Force History and Museums Program, 2015), 68; Eliot A. Cohen and Thomas A.Keaney, *Gulf War Air Power Survey: Effects and Effectiveness* (Air Force History and Museums Program, 2015), 240–47, 284–85; Anthony H. Cordesman and Abraham Wagner, *The Lessons of Modern War: The Gulf War*, Vol. IV (Boulder, CO: Westview Press, 1996), 499–500; and Karl Mueller, "Strategies of Coercion:

Denial, Punishment, and the Future of Air Power," *Security Studies* 7, no. 3 (1 March 1998): 187; and Harvey, *Desert Story Collection*, 16.

134. Briefing Slides 1–5, Instant Thunder Brief, 24 August 1990 [File No. CK/Deptula Box II Theater Campaign Slide/Brief]. This document is marked "as presented to CSAF-14 Aug; CINC-17 Aug; CENTAF/CC-20 Aug."

135. John A. Warden III, "Desert Storm Air Campaign," presentation to the USAF Air and Space Doctrine Symposium, Maxwell Air Force Base, AL, 6–8 April 1993 (copy in *Desert Story Collection*); and Deptula, *Desert Story Collection;* and DOD, *Conduct of the Persian Gulf War*, 11 December 1991, 5, 129. The last source contains discussions of the US commitment to security and stability in the entire region.

136. Warden's "articulate briefings" and "impressive presentations" were already noted by his supervisors during his first Pentagon tour (Maj Gen Richard B. Goetze Jr., retired, Warden's division chief, and Col William Constantine, Executive Officer to CSAF, both quoted in Olsen, *John Warden and the Renaissance of American Air Power*, 38). One of Warden's goals for the Warfighting Concepts, published in August 1988, was to "develop a coherent theory for employment of air forces . . . [and] explain the theory simply and succinctly to policy makers and public alike" (Warden, "XOXW Goals," memo, 3 August 1988, quoted in Olsen, 106). There is also a hint of Warden as storyteller in Gray: "Warden's book, briefings, and articles not only presented a genuinely operational-level view of airpower's contribution to strategic success, they also offered a grand narrative for kinetic airpower that carried the promise to deliver all of the effect for strategic success that the country would need" (Gray, *Airpower for Strategic Effect*, 209).

137. Olsen, *Strategic Air Power in Desert Storm*, 91. Warden's ability to convince others is even more impressive considering his outsider status within the TAC community that made up the majority of CENTAF's staff and the extreme prejudice against planning outside the theater (Adams, *Desert Story Collection*, 3 February 1992, 6–8, 22; Robert D. Russ, *Desert Story Collection*, 9 December 1991, 19–20, 49; Warden, *Desert Story Collection*, 30 May 1991, 110; Stanfill, *Desert Story Collection*, 3 June 1991, 70; Alexander, *Desert Story Collection*, 30 May 1991, 8; David Halberstam, *War in a Time of Peace: Bush, Clinton, and the Generals* (New York: Simon and Schuster, 2002), 47–49; and Russ, Adams, Charles A. May, Jr., Creech quoted in Olsen, *John Warden and the Renaissance of American Air Power,* 270–272, 280.

138. Warden, *Desert Story Collection*, 22 October 1991, 97; and Harvey, *Desert Story Collection*, 92.

139. Alexander, *Desert Story Collection*, 30 May 1991, 16. Warden was also fond of using the example of the Allied invasion of Europe in World War II. Prior to D-Day, General Dwight D. Eisenhower, the Supreme Allied Commander, reallocated a sizable amount of air power from strategic bombing to air interdiction. In Warden's assessment, this dispersal of effort delayed Allied victory. Applying that lesson to Desert Storm, he argued that Instant Thunder should be executed as a separate, distinct opening phase in order to not dilute the ability to induce strategic paralysis (Davis, *On Target*, 70–71).

140. Olsen, *Strategic Air Power in Desert Storm*, 270–271.

141. Alexander, *Desert Story Collection*, 30 May 1991, 16, 28–30. Putney confirms CINCCENT's sentiment (Putney, "From Instant Thunder to Desert Storm," 42). Warden told CINCCENT and CJCS it would only take one to two weeks to execute Instant Thunder, if the deployment flow was altered. With no changes, Warden thought it could be done around 7 or 8 September 1990 (Warden, *Desert Story Collection,* 22 October 1991, 86, 102). The fact that air combat power arrived rapidly seems to support their assumption. According to DOD's report to Congress, over

200 US Air Force combat aircraft were in theater by 14 August, as well as two aircraft carrier groups on station (not counting the aircraft of our coalition partners) (DOD, *Conduct of the Persian Gulf War*, vol. 2, E-23 through E-24). On 17 August 1990, at his second brief to CINCENT, Warden offered the end of September as an execution date, while CSAF thought a mid-month launch was possible (Harvey, *Desert Story Collection*, 90–92; and Alexander, *Desert Story Collection*, 30 May 1991, 18).

142. Reported by Deptula in Reynolds, *Heart of the Storm*, 109; and Davis, *On Target*, 77. Warden estimated the duration of Instant Thunder to be between six and nine days. Schwarzkopf estimated that after just two days of the operation, debate would erupt in the United Nations, which would take another two days to pass a resolution imposing a cease-fire within two days for a total of six days (Harvey, *Desert Story Collection, 98).*

143. Schwarzkopf figured, "If we invade Kuwait, they will destroy it. This might leave Kuwait intact" (Alexander, *Desert Story Collection,* 30 May 1991, 17, 28–29).

144. These men are also portrayed as metic in Davis's description: "This chapter will show that at crucial times, singularly strong-minded, properly placed individuals—such as Col John A. Warden III, USAF, Lt Col David A. Deptula, USAF, and Brig. Gen. Buster C. Glosson, USAF—can grasp the flow of events, if for an instant, and permanently redirect them, only to merge back into the crowd when the predestined moment has passed" (Davis, *On Target*, 57).

145. Reynolds and the RAND's report (Reynolds, *Heart of the Storm*, 132; and J. A. Winnefeld, *A League of Airmen: U.S. Air Power in the Gulf War* (Santa Monica, CA: RAND Publishing, 1996), 259–60. Likewise, Davis writes, "In most important respects, Phase I of the conflict equates with Colonel Warden's original Instant Thunder concepts," and this theory—plus the way others turned operationalized it—is "the singularly important criterion in assessing the USAF's performance" (Davis, *On Target*, 110). This is corroborated by Deptula, a man intimately tied to Checkmate and the final operational plan (Deptula, *Desert Story Collection*, 22 May 1991, 36–37).

146. John Andreas Olsen, ed., *Airpower Reborn: The Strategic Concepts of John Warden and John Boyd* (Annapolis, MD: Naval Institute Press, 2015), 1.

147. Davis, *On Target*, 320. Sixty-three Coalition members were killed during the Operation Desert Storm land campaign. Stephen T. Hosmer, *Psychological Effects of U.S. Air Operations in Four Wars, 1941–1991: Lessons for U.S. Commanders* (Santa Monica, CA: RAND Corporation, 1996), 155. Contrast this with estimates of ten to twelve thousand Iraqis killed during the air campaign and as many as ten thousand during the ground war; John G. Heidenrich, "The Gulf War: How Many Iraqis Died?" *Foreign Policy* 90 (Spring 1993): 123; and Cohen and Keaney, *Gulf War Air Power Survey,* 2015, 239fn19. Total losses of Iraqi aircraft from all causes was 259, compared to 75 from Coalition air forces ("Air-to-Air Victories in Desert Storm," 4 June 2009, https://web.archive.org/web/20090604224140/http://128.121.102.226/aakill.html, accessed 25 January 2018; "Fast Facts about Operation Desert Shield/Desert Storm," accessed 25 January 2018, https://gulflink.health.mil/timeline/fast_facts.htm, accessed 25 January 2018.

148. RAND's report contains copious examples; Winnefeld, *A League of Airmen*, 276–279. As for Warden himself, after the conflict, he wrote, "in the Gulf war, . . . a revolution took place that we ignore at our peril." Warden, "Employing Air Power in the 21st Century," 81.

149. Mann, *Thunder and Lightning*, 18.

150. Dennis M. Drew, *Recapitalizing the Air Force Intellect: Essays on War, Airpower, and Military Education* (Maxwell Air Force Base, AL: Air University Press, 2008), 159–60.

151. Quoted in Olsen, *Strategic Air Power in Desert Storm*, 270.

152. Gen Charles G. Boyd in Reynolds, *Heart of the Storm*, xi.

153. DOD, *Conduct of the Persian Gulf War*, 168; and Davis, *On Target*, 288, 293, 299, 310. Olsen writes that "the subsequent ability to put down two internal revolts illustrate the fact that the regime's domestic control was far from shattered" (Olsen, *Strategic Air Power in Desert Storm*, 288).

154. Norman Friedman, *Desert Victory: The War for Kuwait* (Annapolis, MD: Naval Institute Press, 1991), 441; and Cohen and Keaney, *Gulf War Air Power Survey*, 99.

155. Davis, *On Target*, 288; and Olsen, *Strategic Air Power in Desert Storm*, 292. See Olsen's in-depth assessment on this issue of analyzing the enemy system in chapters 4 and 5. Davis concurs with this weakness in Warden's planning: "Given the original target list and resources, Instant Thunder would probably not have been as decisive as it claimed" (Davis, *On Target*, 80). For example, some suggest the Republican Guard—part of Warden's least profitable target category—were actually a center of gravity (Winnefeld, *A League of Airmen*, 67, 85–86).

156. Davis, *On Target*, 105,109; Olsen, 166; and DOD *Conduct of the Persian Gulf War,* vol. 1, 126–30.

157. Robert M. Citino, *Blitzkrieg to Desert Storm: The Evolution of Operational Warfare* (Lawrence: University Press of Kansas, 2004), 288; and Cohen and Keaney, *Gulf War Air Power Survey*, 308–9. For more, see Keith L. Shimko's *The Iraq Wars and America's Military Revolution* (2010) or Winnefeld's *A League of Airmen: U.S. Air Power in the Gulf War* (1996).

158. Gray, *Airpower for Strategic Effect*, 210; and Winnefeld, *A League of Airmen*, 261–62.

159. Stanfill, *Desert Story Collection*, 3 June 1991, 33; Rick Atkinson, *Crusade: The Untold Story of the Persian Gulf War* (Boston, MA: Mariner Books, 1994), 60; Alexander, *Desert Story Collection*, 30 May 1991, 36; Horner, *Desert Story Collection*, 2 December 1991, 34–35; and Buster C. Glosson, *Desert Story Collection*, 29 May 1991, 11. At one point, Warden explained, "This plan may win the war. You may not need a ground attack . . . . I think the Iraqis will withdraw from Kuwait as a result of the strategic air campaign" (quoted in Olsen, *Strategic Air Power in Desert Storm*, 101–2). Commenting on his interview with Horner, Olsen noted: "In essence, Schwarzkopf asked for one thing, was presented with something else, and fully appreciated what he received" (Olsen, 113).

160. Warden, *Desert Story Collection*, 30 May 1991, 99; Col James Sutherland, *Desert Story Collection*, 22 October 1991, 112; Reynolds, *Heart of the Storm*, 73; Olsen, *Strategic Air Power in Desert Storm*, 113; and Davis, *On Target*, 74. At the 11 August brief, the CJCS exclaimed: "Good plan! Very fine piece of work!" (reported by Alexander, *Desert Story Collection*, 30 May 1991, 33–34).

161. Davis, *On Target*, 94–95.

162. Loh, *Desert Story Collection*, 26 September 1991, 9–11, 13; and Russ, *Desert Story Collection*, 9 December 1991, 9, 36–37.

163. Steve Wilson, who went into theater before Warden, noted that the combat operations staff in Saudi Arabia was unable to focus on anything but the question of "what if the Iraqis cross the line with tanks" (quoted in Reynolds, *Heart of the Storm*, 120). According to Alexander, those left at CENTAF headquarters in South Carolina were overwhelmed with determining munitions requirements, deployment logistics, aircraft scheduling, and a constant stream of questions from various units (Alexander, *Desert Story Collection*, 30 May 1991, 9). Reynolds also notes this focus (Reynolds, *Heart of the Storm*, 21, 33, 79, 121).

164. See Halberstam, *War in a Time of Peace* 47–49, for examples of Halberstam's bias against TAC. For more moderate examples, see the works cited herein by Reynolds, Mann, and Davis. For a significant reply to the "myths" of the Gulf War and Warden's role in it, see the statements by former TAC commander Gen Wilber L. Creech in Slife and Olsen (Slife, *Creech Blue*; and Olsen, *John Warden and the Renaissance of American Air Power*, 280).

165. Bristow, *Desert Story Collection*, 9 November 1992, 10; Tom Griffith and Alex Bettinger, 26 September 1991, 2–4, *Desert Story Collection*: Cohen, and Keaney, *Gulf War Air Power Survey*, 2015, 23; Stanfill, 3 June 1991, 29, *Desert Story Collection*; and Bristow, *Desert Story Collection*, 9 November 1992, 15, 58. For a more detailed look at Russ's view, see the transcript of his nterview (Russ, *Desert Story Collection*, 9 December 1991, 8–23. Regarding the legitimacy of Warden's planning efforts, Checkmate's efforts had to be legalized by deputizing General Adams as an interim member of the Joint Staff (Davis, *On Target*, 72; and DOD, *Conduct of the Persian Gulf War*, P-65).

166. Interestingly, when Loh called TAC, Russ immediately mentioned the use of long-range bombers for something other than the nuclear role they had come to be associated with during the era of AirLand Battle (Loh, 26 September 1991, 9).

167. Horner, *Desert Story Collection*, 2 December 1991, 12–14 and Russ, *Desert Story Collection*, 9 December 1991, 13. CINCCENT asked how Warden would respond if Iraq surrendered before the completion of Instant Thunder's six to nine days. The Airman used the legendary story of Captain Nelson's order to continue his attack because, having put his blind eye up to the telescope, he could claim he never saw the order to do otherwise (Warden, quoted in Olsen, *Strategic Air Power in Desert Storm*, 101).

168. For example, note the reports of Adam's extreme displeasure with Alexander for not reigning in Warden (Alexander, *Desert Story Collection*, 30 May 1991, 10–14; Wilson, *Desert Story Collection*, 11 December 1991, 6–7, 14–15; and Harvey, *Desert Story Collection*, 31–32).

169. Larry Henry, *Desert Story Collection*, 2 June 1992, 120.

170. Max Boot, *War Made New: Weapons, Warriors, and the Making of the Modern World* (New York, NY: Penguin Group, 2007), 333; and Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, NJ: Princeton University Press, 2006), 140. Others who support this view include Summers, Paquin, and Toffler and Toffler. Harry G. Summers, *On Strategy II: A Critical Analysis of the Gulf War* (New York: Dell, 1992), 157-159; Robert J. Paquin, "Desert Storm: Doctrinal Airland Battle Success or 'The American Way of War?' "(School of Advanced Military Studies, 1999); Alvin Toffler and Heidi Adelaide Toffler, *War and Anti-War: Making Sense of Today's Global Chaos* (New York: Grand Central Publishing, 1995), 86.

171. Olsen, *Strategic Air Power in Desert Storm*, 72; Reynolds, *Heart of the Storm*, 98; and Dag Henriksen, "Airpower: The Need for More Analytical Warriors," in *Conceptualising Modern War*, edited by Karl Erik Haug and Ole Jorgen Maao (London: C. Hurst and Co Publishers Ltd, 2011), 207. As one example of the animosity, Alexander called TAC representatives "spies" (Alexander, *Desert Story Collection*, 3 June 1992, 20) and TAC director of operations, Maj Gen Michael Ryan (future CSAF), gave the Air Staff his opinion of Instant Thunder by saying "I like everything after the last slide" (reported by Alexander, *Desert Story Collection*, 30 May 1991, 10).

172. Bristow, *Desert Story Collection*, 9 November 1992, 43, 46–48.

173. Reynolds, *Heart of the Storm*, 115–117.

174. Glosson, *Desert Story Collection*, 4 June 1992, 5–6; and Glosson, *Desert Story Collection*, 29 May 1991, 2–3.

175. DOD, *Conduct of the Persian Gulf War*, 159; James P. Coyne, *Airpower in the Gulf* (Arlington, VA: Aerospace Education Foundation, 1992), 89; and Davis, *On Target*, 319. This surfeit of resources significantly downgraded the importance of *metis*, given that it is most valuable in times of power disparity.

176. FM 100–20, *Command and Employment of Air Power*, 2; and Mann, *Thunder and Lightning*, 61.

177. Mann, *Thunder and Lightning*, 66.

178. Mann, *Thunder and Lightening*, x. Mann immodestly describes the book's purpose in a way that denies the wicked nature of all human endeavors: to "project the trend line of airpower theory into the future" (Mann, xvi). Henriksen affirms this lack of debate (Henriksen, "Airpower," 210).

179. Dennis Drew, "Air Theory, Air Force, and Low Intensity Conflict," in *The Paths of Heaven*, 344. A member of the ACSC faculty at the time, Professor Richard R. Muller noted Warden's "most lasting impact was on Air Force education, with its potential to shape the thinking of generations of officers" (quoted in Olsen, *John Warden and the Renaissance of American Air Powe*r, 267).

180. *Report of the Task Study Group Alpha* (Maxwell Air Force Base, AL: Air University, 29 June 1974); *Department of Defense Committee on Excellence in Education, The Intermediate Level Staff Colleges: Conclusions and Initiatives* (Washington, DC: Government Printing Office, 1 December 1976); House Armed Services Committee, Panel on Military Education, chaired by Representative Ike Skelton (Washington, DC: Government Printing Office, 21 April 1989; and Builder, *The Icarus Syndrome*. The last example is addressed in chapter 4.

181. Olsen, *John Warden and the Renaissance of American Air Power*, 251–257.

182. Grant T. Hammond quoted in Olsen, 257.

183. Henriksen, "Airpower," 225, 211.

184. Wesley K. Clark, *Waging Modern War: Bosnia, Kosovo, and the Future of Combat* (New York: PublicAffairs, 2002), 430. Indicative of how wide this narrative spread, consider the comment by the US Secretary of State, Madeleine Albright that "air power alone could make a decisive difference" (Madeleine Albright, *Madam Secretary: A Memoir,* New York: Harper Perennial, 2013, 192). Likewise, following Operation Allied Force, military historian John Keegan exclaimed: "a war can be won by airpower alone" (John Keegan, editorial, *The Sunday Telegraph,* 6 June 1999 reprinted in "The Conversion of John Keegan," *Air Force Magazine* 92, no. 12 (December 2009), 72).

185. John Nagl quoted in Greg Jaffe and David Cloud, *The Fourth Star: Four Generals and the Epic Struggle for the Future of the United States Army* (New York: Broadway Books, 2010), 198; and Henriksen, "Airpower," 217. Gray notes how this demonstrates the paradoxical logic of war: "tactical military competence most likely will dig the pit of strategic error ever deeper" (Gray, *Airpower for Strategic Effect*, 204).

186. Dag Henriksen, *NATO's Gamble: Combining Diplomacy and Airpower in the Kosovo Crisis, 1998–1999 (*Annapolis, MD: Naval Institute Press, 2007), 49–50, 52–53.

187. Henriksen, 178.

188. Henriksen, 9, 191.

189. Michael C. Short, "An Airman's Lessons from Kosovo," in *From Manoeuvre Warfare to Kosovo?,* ed. John Andreas Olsen (Norway: The Royal Norwegian Air Force Academy, 2001), 260.

190. Short, 257. Also see J. A. Tirpak, "Short's View of the Air Campaign," in *Air Force Magazine* 82, no. 9 (1999): 43–45. As Henriksen points out, "The challenge in the Kosovo War, however, was not to fight a high-intensity war, but to find a way to incorporate airpower in a politically constrained strategy of coercive diplomacy. In this scenario, for all practical purposes, the use of overwhelming, decisive force—in-

conceivable violence—from the outset was politically unacceptable" (Henriksen, "Airpower," 218).

191. Gray, *Airpower for Strategic Effect,* 210.

192. This assessment is based on presentations made to ACSC in 2012 and 2013 in which the author was present, personal interactions, Warden's *Winning in Fast-Time,* and quotes such as this one by Henriksen: "Asked whether he really believes that his Five Rings Model concept/methodology has universal validity, John A. Warden says he believes it does—adding that when a better methodology comes along, we should use it, but as far as I know, one does not exist now" (Henriksen, "Airpower," 223).

193. Lt Col Dag Henriksen, ed., *Airpower in Afghanistan 2005–10 The Air Commanders' Perspectives*. How EBO grew out of Warden's theory to become the key air power concept for the two decades after Operation Desert Storm.

Chapter 4

Daedalus as Deity: An Imbalanced Force

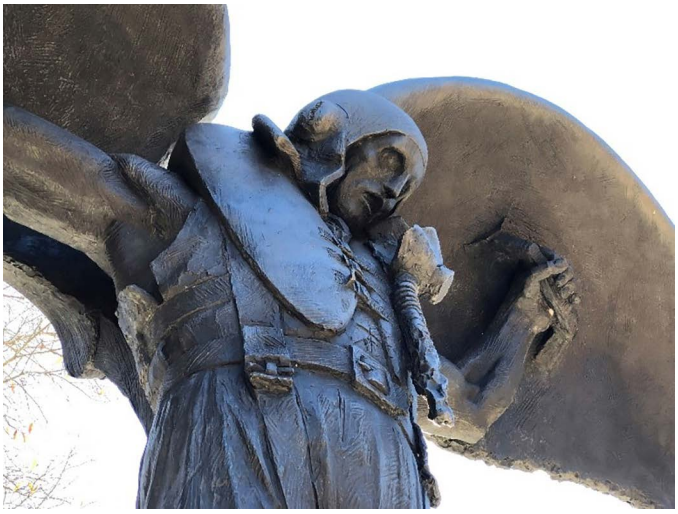

Figure 5. Daedalus sculpture at Maxwell AFB. Dedicated in April 2017, this piece is a recreation of *A Memorial to the Fleet Air Arm* in London by the original artist, James Butler (photo by author).

Early Airmen capitalized on a robust sense of airmindedness. The technical traits of their flying machines—their revolutionary capacity for range, speed, altitude, and flexibility—fostered a culture of strategic intelligence, playfulness, and passion for disruptive innovation. Such creativity was on display, as described in the last chapter, at the bookends of the Cold War era. Today, however, in this period of "normal technology," Airmen are content to graft operational templates proven in past contexts onto novel wicked dilemmas. Symptomatic of this indifference to their more playful, boundary-testing periods,current descriptions of airmindedness are largely restricted to the employment of air operations. This discourse, reflected in the professional and personal writings that form the primary sources for this chapter, is further evidence that the institution fails to capitalize on its full cultural heritage. Without the benefit of the full spectrum of their technological logos, *the USAF neglects a source of wisdom that speaks directly to perennial issues of mo-*

rale, corporate identity, and how to secure a continuing advantage in a world that is wicked once over. This chapter offers reasons why rescuing the reputation of Icarus is helpful and why such a message is not as radical as it may first appear.

Introduction

Interwar airmindedness combined the images of Daedalus and Icarus. Carl Builder later played upon the contrasts between the father and son in his book *The Icarus Syndrome* (1994).

The perceived effectiveness of aerial warfare allowed the US Air Force, like Icarus, to escape its institutional servitude. Later, according to Builder, the Air Force subordinated the ends of air power—strategic effects—to the means of air power—flying airplanes. In the process, he claimed the organization lost sight of the overarching logic that had previously held it together. Air power theory "was like the wax that held together the feathers in the wings of Icarus." When Air Force leaders "abandoned the institution's single unifying theory," it was just as detrimental as flying too close to the sun.[1] The analysis in the last chapter suggests otherwise. What Builder perceived was not an inclination toward the playfulness of Icarus or a lack of captivating theory but the stagnation in the organization's paradigm as its *technological logos* coalesced around a single narrative of air power.[2]

The spirit of Icarus, exemplified in the passion and creativity of Warden and his team, was not a syndrome but a solution. By the time *The Icarus Syndrome* was published, however, the sense of revolutionary potential was gone again. Just as in the US Air Force's first four decades, a theory that was once novel and expressly partial was hardening into dogma. At the same time, that very conviction in a single story of air power conferred a new level of confidence in the institution. Concurrent with the validation taking place in the skies over Iraq, Airmen at Air University were revising the service's basic doctrine to acknowledge their unique view of warfare.[3] The new doctrine, published in 1992, grounded the Airman's perspective—airmindedness—in the organization's heritage by citing General Arnold's 1945 report to Congress. The only place that term is used is the line quoted earlier: "Since military Air Power depends for its existence upon the aviation industry and the air-mindedness of the nation, the Air Force must promote the development of American civil

Air Power in all of its forms, both commercial and private."[4] The citation is accurate, but the interpretation in doctrine is distorted.

In the new version of AFM 1–1, *Basic Aerospace Doctrine*, in all subsequent doctrine, and in the opinions of most Airmen who write about the subject, airmindedness no longer accounted for the idea symbolized by Icarus. Perhaps unsurprisingly, given the state of technological knowledge, there was no sense of play or *metis*. Instead, the perspective is narrowly defined around the ability to conduct aerial operations. In other words, without a menu of theories to choose from, the only choice remaining is how to operationalize the one dominant image of air power. Subsequent Airmen largely echoed those themes in the internal debate over the meaning and import of airmindedness. To them, the concept identifies the Airman's perspective as strategic but defined this quality in terms similar to Warden's air campaign instead of the strategic intelligence of Metis. Thus, instead of embracing Icarus or Dionysius, conversations surrounding airmindedness reveal that modern Airmen treat Daedalus as a deity. The worship of technology frames its story—its *logos*—around the idol of the archetypical technician.

In the mythological accounts, Daedalus's skills are often put to military ends, and statesmen eagerly sought his services. Thus, as a metaphor for airmindedness, Daedalus represents its practical dimension; the rational pursuit of a mechanical instrument and the pragmatic employment of that technology for political purposes. What is missing from this model—and what is missing from Air Force discourse as much as it is missing from the Apollonian image—is the romantic, aspirational energy of his playful son.[5] Gone is the sentiment Leonardo da Vinci expressed when he wrote, "When once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return."[6] Yet, that attitude is necessary for innovation, and it is an inherent, if latent, component of the US Air Force's cultural history. Indeed, the status of airmindedness in popular discourse during the Cold War likely had just as much influence on the military's modern interpretation of the concept as when early Airmen appropriated the idea in the first place.

The Airmindedness in American Culture

Once human flight became a reality, the mythological possibilities of flight—particularly its capacity to alter one's perspective and inspire creative thinking—began to decouple from its technological possibilities.[7] Slowly, the resonance with Dionysius, Icarus, and Metis waned in favor of Apollo, Daedalus, and Bia. The break was palpable by the time Congress authorized the creation of the US Air Force in 1947.

The employment of air power in World War II was largely responsible for the disenchantment of aviation in the public mind. Prophecies of ending warfare, poverty, and inequality, all of which strengthened the link between aviation and religion, waned with the trauma of another global conflict and the image of aircraft delivering devastation in the form of atomic bombs. More prosaically, the dream of aviation for the masses succumbed to realizations that private flying was still dangerous, expensive, and often unrealistic.[8] Instead of "an airplane in every garage," aviation for the masses came from airlines, which had an incentive to portray it as safe and mundane.

Increasingly militarized, regulated, and routinized, flying eventually lost its cultural cachet as the edge of human aspiration. Aviation's frontier, so evident among World War I flyers, had closed, and flying became too mundane and safe to elicit popular excitement.[9] Simultaneously, the threat of airpower-delivered nuclear holocaust made earlier airminded enthusiasm seem naïve. The twentieth century became the era in which "flight has released us into space and yet may kill not only Icarus but everyone else."[10]

To the degree airmindedness is relegated to enthusiasm for aviation, then the decline in its usage in the mid-twentieth century is logical. Once celebrated as "knights of the air," pilots became less like the mythical heroes they were imagined to be during World War I.[11] Instead, they became more like technicians, operating in an environment striving for safety, reliability, and regulation. Flying was no longer, in the words of one author, a "fusion of sensual and spiritual forces, a tension in which each individual takes part, which is almost invincible."[12]

The ubiquity of aviation meant that the term airmindedness ceased to have purchase around the same time. After World War II, the pervasiveness of air travel, the familiarity with aerial warfare, and the growing aerospace industry made the word superfluous, like "referring to all people as 'bipeds'," as one historian points out.[13] Today, aviation is well established as a critical component of transportation

systems, national defense structures, and modern economies. In this sense, most people living in the industrialized world today are unconsciously airminded, living in a world of "aereality."[14] Any palpable concerns raised are framed in terms of apocalyptic attack, terrorism, environmental degradation, or, more mundanely, the inconveniences of airline travel.[15] As that list implies, the way most Americans interact with aviation in the last few decades is apt to cause only negative emotions such as frustration or fear.

Today we are more familiar with aviation as a field of purposeful activity, defined by poles of constructive or destructive effects. We are less likely to perceive it as a sphere of affects: the psychological impact, be it positive (bliss, joy, rapture) or negative (frustration, fear, anger).[16] Even for the US Air Force, which continues to "worship at the altar of [airpower] technology," there seems to be little acknowledgment of the inspirational component of flying.[17] Airmindedness is merely an issue of growing, managing, and employing airpower's capabilities. Furthermore, histories about and by the US Air Force project this emphasis on pragmatism back into time, underemphasizing the playfulness and spiritual nature originally inherent in flying. The enthrallment of Icarus is seen as a fatal distraction and relegated to a cautionary tale. Thus, it is no wonder that some commentators bemoan too much technological enthusiasm in US Air Force culture, mirroring Hansen's warnings, highlighted in the introduction, regarding the same attitude among aviation historians. It has become cliché to lament Airmen's attentiveness to technology.[18] Airmindedness was thus recast without any sense as a way of thinking about exciting possibilities, as an exhilarating experience of something divine, or as a symbol of humanity's ability to harness technology and re-enchant an industrialized world.[19]

Airmindedness in US Air Force Doctrine

General Arnold published his *Third Report of the Commanding General of the Army Air Forces to the Secretary of War* in 1945. Two years later, the US Air Force earned its organizational autonomy with the National Security Act of 1947. Around this time "airmindedness" began to fall out of common usage for the reasons offered above. The term did not return to official USAF discourse until 1992, with the drastic revision of Air Force Manual (AFM) 1–1, *Basic Aerospace*

Doctrine.[20] By this time, however, the concept had lost much of its heritage and some of its most important dimensions.

Basic Aerospace Doctrine contained two volumes. The first volume defined airmindedness as a three-dimensional mindset and emphasized its distinctiveness. The second volume contained this extended explanation:

> Airmindedness is much harder to convey than the perspectives of soldiers and sailors for several reasons. The viewpoint of the soldier and sailor—bounded by the apparent horizon—is part of everyday life and instinctive understanding; few have ever operated an aircraft or contemplated the problems of aerial warfare; and few popular sources of information reflect an Airman's perspective. Airmen should understand, honor, and apply the various useful views of war resulting from the different operating environments within the profession of arms . . . . Nevertheless, because airmindedness distills the understanding and imperatives unique to Airmen, it is different from surface perspectives.[21]

Both the ideas and the tone in which they are presented are reminiscent of Mitchell and de Seversky. Furthermore, the doctrine explicitly links the concept to Arnold, almost implying that he created the term: "The study of aerospace warfare leads to a particular expertise and a distinctive point of view that Gen Henry H. ('Hap') Arnold termed airmindedness. The perspective of Airmen is necessarily different; it reflects the range, speed, and capabilities of aerospace forces, as well as threats and survival imperatives unique to Airmen."[22] The footnote for this line deserves further examination.

The reference is to Col Dennis Drew's article, "Joint Operations: The World Looks Different from 10,000 Feet." Air University Press, the same organization that produced the doctrine manual and many of the internal assessments of Desert Storm, published his think piece in 1988.[23] Drew's opening argument is that effective joint warfare requires leaders who understand the "different worldviews held by soldiers, sailors, and Airmen . . . over how warfare should be conducted."[24] He explained how the nature of their operating environments shapes the paradigms of the Army, Navy, and Air Force. No one view is inherently better and all three are needed in different combinations to serve different contexts. The relative youth of the USAF means Airmen are less prepared to articulate its unique mindset, the essence of which is perspective. According to Drew, "all other characteristics (speed,

range, flexibility, etc.) are different only in a relative sense." It is altitude that confers a global, strategic perspective upon the Airman, even when air power is used to support limited operational objectives.

The focus on airminded operations is mirrored in AFM 1-1 when air warfare is examined through the lens of the traditional principles of war. Indeed, the discussion of airmindedness was placed in the section on employment and operational art, along with explanations of missions and campaigns.

The next two iterations of AFM 1–1, in 1997 and 2003, did not use airmindedness, seemingly replacing the term with the phrase "the Airman's perspective." Likewise, the doctrine published in 2007, now retitled Air Force Doctrine Document (AFDD) 2, *Operations and Organization,* did not mention airmindedness except for an inset from AFM 1–1, Volume II (1992). The placement of the quote, which reiterates the allusion to Arnold's *Third Report*, implied airmindedness and the Airmen's perspective of war fighting are one and the same. Additionally, the description further solidified the narrower conception of the Airmen's airminded perspective as a functional model:

> Airmen must understand the intellectual foundation behind air and space power and articulate its proper application at the strategic, operational, and tactical levels of war; translate the benefits of air and space power into meaningful objectives and desired effects . . .[using] an effects-based approach to operations . . . . But the differences in range, flexibility, and perspective with respect to surface warfare require a different approach to the application of air and space power. This outlook—the Airman's perspective—demands that Airmen understand and apply the distinctive characteristics of air and space power in a complex joint environment that is experiencing profound technological change.[25]

The 2011 version of AFDD 1, *Basic Doctrine, Organization, and Command,* pulled Arnold's quote into the text and further framed the concept around operations—now combined into one word, "airpower," to signal the inclusion of space and cyberspace:

> The perspective of Airmen is necessarily different; it reflects a unique appreciation of airpower's potential, as well as the threats and survival imperatives unique to Airmen. The study of airpower leads to a particular expertise and a distinctive point of

> view that General Henry H. "Hap" Arnold termed "airmindedness." Airmen normally think of airpower and the application of force from a functional rather than geographical perspective . . . . This approach normally leads to more inclusive and comprehensive perspectives that favor strategic solutions over tactical ones. . . . The flexibility and utility of airpower is best fully exploited by an air-minded Airman.[26]

Besides including space and cyberspace, this passage adds little new to the notion of airmindedness. It is still a way of thinking that is unique, oriented to operational effects, and inherently strategic.[27] And it is still a misrepresentation of Arnold's quote.

The following page in AFDD 1 does expand on the practical application of this perspective to warfare, paralleling the annex discussion in AFM 1–1, Volume II. It is focused on the qualities of airpower and its employment (e.g., the primacy of air superiority; airpower's inherent speed, range, and flexibility; the importance of an Airman in control of airpower). To the degree this is about a different way of thinking, it is only thinking as it relates to warfare; it is not the suggestion of other writers that flying can ignite passionate creativity. Then again, that component of airmindedness has never been explicit within the US Air Force.

Current doctrine offers the same ideas as the 2011 AFDD 1 to describe airmindedness and the Airman's perspective, citing both the 1992 essay in AFM 1–1, Volume II and Colonel Drew's article. In an example of self-referential logic, airmindedness is explicitly—and unhelpfully—defined as what Airmen do.

A paradigmatic (i.e., what Morgan labels theoretical) approach to aerial warfare has always been a component of airmindedness. Yet, it is not the only dimension. Aviation's contributions to the nation—much less to the entire world—and the impact of flying on human imagination are both missing. What remains is a more restricted, and less inspirational, version of airmindedness. There is no resonance with the metaphor of Icarus, and what is left of Daedalus's image is not a project of national import, but only a style of warfare.

Airmindedness in Air Force Discourse

Since 1992, every version of USAF basic doctrine reiterated the words, or at least the spirit, of the original AFM 1–1 representation of

airmindedness. Unsurprisingly, when Airmen write about the concept they tend to hew to that same connotation. For instance, a 1996 Air War College student paper proposed a new Professional Military Education course to remedy the overspecialization and fragmentation highlighted in *The Icarus Syndrome*. Its purpose would be to develop "airminded officers with a firm foundation in the history and doctrine of airpower and an in-depth understanding of the Air Force's core competencies."[28] The paper never defined airmindedness, implying the author relied upon its doctrinal definition. Similarly, a research paper from a student at ACSC examined the World War I Battle of Saint-Mihiel in September 1918. Simply applying the principles of war described in AFM 1-1 (1992) to "America's first operational air campaign," the student further corroborated the more narrow concept of airmindedness as a model of aerial warfare.[29] Finally, retired Lt Gen Robert J. Elder Jr. offered his "confessions of an airpower advocate" in the Fall 2009 issue of the *Air & Space Power Journal*. In an article titled "Air-Mindedness," he posited, "Airmen look at problems differently" and suggested the USAF use that unique perspective to understand how an independent Air Force contributes to joint warfare.[30]

Even when Airmen extend the concept, they tend to do so cautiously, returning to airmindedness as an operational model, as if the defining feature of their paradigm is formal air power theory. For example, five years after the paper on Saint-Mihiel, another ACSC student looked for the origins of an airminded culture in the era before World War I. In professional journals and popular magazines, this first generation of military flyers argued for the unique role aircraft could play on the battlefield. Although the author acknowledged that these Airmen "found a sort of spiritual outlet" among their cohort, felt "personal fascination with flight," and quoted a primary source extolling the need for "imagination" and "prophecy," the paper instead focused on the operational principles they pioneered. The student noted that "flying was clearly moving from the realm of fantasy to that of an accepted science, and enthusiasts were likewise becoming true 'Airmen,' with a corporate sense of their specialized expertise and the particular body of knowledge that it implied."[31] The author did not consider whether the domains of imagination and science could coexist.

Going even further back in his analysis, Maj Dave E. Bonn's thesis from Air University's School of Advanced Air and Space Studies (SAASS) analyzed "Airmindedness and its Antecedents in Union

Cavalry." Titled "Saddled with History," the author admirably clarified airmindedness as "more than the artifact of technology."[32] One could be airminded apart from air power. Nevertheless, he still situated that mindset within context of military operations, using parallels to Civil War cavalry.

Just months after Bonn completed his work, the outgoing SAASS commandant, Col Jeffrey J. Smith, published "Beyond the Horizon: Developing Future Airpower Strategy" in Air University's *Strategic Studies Quarterly.* Smith did not address airmindedness directly, simply defining Airmen as airminded thinkers.[33] There was, however, an interesting connection to Bonn's thesis on cavalry. Smith's article culminated in the claim that the three "fundamental axioms" of air power—access, speed, and "strategic" strike—can exist without aviation. Just as the industrial age applied the term "horsepower" outside an equestrian context, air power could be a meaningful measure of force even without aircraft. Apart from the common equine reference, what is interesting is the extension of air power (in Smith's article) and airmindedness (in Bonn's thesis) to contexts outside of aviation. Both, however, remained firmly within the realm of military operations.

Some Airmen, nevertheless, have offered their own, less doctrinaire ideas about the meaning and utility of the concept. One example is from a short piece published in *Air and Space Journal* by retired USAF colonel and researcher, Dr. Dale L. Hayden, at Air University's Air Force Research Institute. Hayden began with the conventional assertion that what distinguishes Airmen from Soldiers or Sailors is their perspective on the art of warfare, "an attribute we loosely define as airmindedness." Distinct from doctrine or operational art, airmindedness is characterized by a global, offense-oriented mindset "not constrained by geography, distance, location, or time." Furthermore, aerial warfare implies "the ability to influence the links between adversary materiel and moral strength" and "the ability to range over the battlespace rapidly and with relative impunity while surface forces often struggle to advance even short distances."[34] The notions of air power as inherently strategic, offensive, and flexible are standard tenants of the airminded operational model. Hayden, however, also highlighted some of the aspirational and affective qualities of airmindedness. Quoting Mitchell, "'the ability to do something in the air' . . . has sparked innovation." "Like esprit de corps," Hayden concluded, "it binds Airmen together and guides their actions."[35]

Hayden acknowledged that the term is evolving, and at any one time "the notion of air-mindedness probably will not find consensus among either Airmen or their surface partners."[36] Indeed, the concept has sometimes been the subject of debate. For example, in "Shortchanging the Joint Fight?" Maj Gen Charles J. Dunlap, retired, critiqued Field Manual 3–24, *Counterinsurgency (COIN),* for restricting its discussion of airpower to a five-page annex. Even when ground forces are the most suitable for such operations, he argued that:

> The design of even those operations, however, *always* ought to reflect careful consideration of not just the technology and capabilities of the whole joint team but also the unique warfighting perspective each service and component brings to the analysis. . . . A *complete* COIN analysis for implementation in the joint environment must benefit from an *airminded* perspective. That means taking into account the potential of airpower technologies as well as the Airman's distinct approach to resolving issues across the spectrum of conflict [emphasis in original].[37]

While describing what the USAF can contribute to the COIN fight that was then raging in Afghanistan and Iraq, he characterized airminded Airmen as "inherently strategic," "fascinated with innovation," and concerned with the larger geopolitical context.[38] A longer version of this article was later published as a monograph by Air University Press.

Dunlap's writings, which can easily be interpreted as parochial, inspired Lt Col Buck Elton to respond in *Small Wars Journal* the following year. In his article, "Shortchanging the Joint Doctrine Fight: One Airman's Assessment of the Airman's Assessment," Elton retorted that Dunlap's "recommendations only serve to discredit 'airmindedness' as unrealistic." He went on to opine, "perhaps the most disturbing concept discussed by General Dunlap is the statement that only Airmen think strategically or specifically that 'Airmen tend to reason in strategic terms and Soldiers are intellectually disposed to favor close combat and tend to think tactically.'"[39] Elton later seemed to imply that the notion of a unique service mindset toward strategy is itself invalid. In other words, Dunlap did not just misrepresent airmindedness, but there really is no such thing, at least in terms of strategic approaches. Elton explicitly acknowledged the unique *opera-*

tional acumen of Airmen but was unwilling to extend this to strategic habits of mind.

Approximately one year after Elton penned his response, Dunlap's ideas on airmindedness reappeared in his online essay titled, "Do We Need 'Airminded' Options for Afghanistan?" Although this was largely an extension of his earlier argument, he did make some further statements about the unique perspective of Airmen. First, he clarified that "an 'airminded' approach does not equate with 'Air Force,' *per se,* but rather reflects a philosophy that seeks to avoid the bloody close fight. It welcomes the opportunity to create kinetic and nonkinetic effects from afar." Continuing, he declared " 'airmindedness' is more of an attitude that focuses not upon any one dimension of military power, but rather aims to holistically leverage America's technological advantages across multiple domains, especially (but certainly not exclusively) in air, space, and cyberspace. At its core, it unapologetically tries to substitute machines for the bodies of young Americans whenever possible." The notion of technological fascination is present, as well as an emphasis on airmindedness as a style of thinking that can be applied beyond the domain that gives the concept its name. As this chapter shows, Dunlap's extension of airmindedness beyond air warfare is rare.

The insinuation that an air-centric perspective should shape the thinking of all services inspired another Air Force officer to suggest abandoning the term altogether. Lt Col Mark Jacobsen offered two reasons to do so in a 2010 blog post. The first was that the strategic utility of airpower has already been proven (as has the broad strategic view of warfare in general). This presumed airmindedness is mainly about advocating Air Force capabilities. It also presumed an airminded perspective is naturally a strategic perspective, which is also a common claim among air power theorists. "The second reason we should jettison the phrase," according to Jacobsen, "is that nobody is listening. It's a term and concept that only circulates within the ranks of the Air Force . . . . The elitist view of airmindedness will not close the [inter-service] gap."[40] Jacobsen, later a student at SAASS, limited the term's utility based on the premise that airmindedness should resonate with external audiences. Therefore, airmindedness is about promoting airpower operations, and that advocacy is directed outward to joint partners for whom the term itself has no legitimacy. This sentiment is corroborated in an article by Royal Canadian Air Force Brig Gen Christopher J. Coates. In "Airmindedness: An Essen-

tial Element of Air Power," Coates notes "A large number of those interviewed found the existing USAF definition pejorative, 'outdated' or 'archaic.' This negative reaction was not limited to USAF's joint partners, as several very senior USAF officers indicated that, in their opinion, the USAF definition was unhelpful."[41]

Apart from the contributions of Dunlap, Elton, and Jacobsen, three other Airmen have made notable critiques of the doctrinal notion of airmindedness. The earliest example is a 2004 masters thesis from SAASS on "the cognitive origins of airmindedness." The author, Maj Robert Killefer III, presented a continuum of airmindedness, from the practical to the psychological: tactics, operations, strategies, and, finally, a fusion of epistemological and ontological knowledge (i.e., what constitutes a justifiable belief and what constitutes reality). The crux of the argument was how the "worldview" of airmindedness evolved, and continues to evolve, as a result of metaphorical thinking along this spectrum.[42]

Although Killefer's thesis still exhibits the circular logic that has emerged in doctrine and discourse—Airmen think and act in airminded ways; to be airminded is to think and act as an Airman would—it is the deepest investigation yet into airmindedness as a way of thinking. The theory could presumably extend airmindedness to encapsulate the broader notion of the term as it was used in the Golden Age of Flight. It is telling that no other author has referenced this paper when writing about airmindedness, nor was the paper selected for publication, as some SAASS theses are.

In 2012 another SAASS graduate, Lt Col Chris Wachter, published "Air-Mindedness: The Core of Successful Air Enterprise Development" in *Air and Space Power Journal.* A 1925 quote from Mitchell set the tone for his article: "The Air Force is the great developing power in the world today . . . the greatest civilizing element in the future." Wachter claimed "air-minded societies tend to seek progress and freedom."[43] Thus, in his argument for how to nurture the air enterprise in developing nations, he turns explicitly to the interwar concept of airmindedness as an appreciation of what aviation can do for defense and for commerce. In another sentiment that extends airmindedness, he briefly mentioned aviation's psychological elements as an impetus for national development: "the most comprehensive, sustainable approach for our partners involves helping them develop their own attitude of airmindedness. This enables them to reap the tangible benefits of aviation not only militarily but also in a way that

legitimizes their central governments, assures their sovereignty, and encourages improvement in their economy, technology, education, and communications."[44] Still, as this quote highlights, his suggestions focused on the practical aspects of aviation, such as infrastructure, sustainment, and training. He did not strongly tie airmindedness to a creative perspective for framing and solving problems.

Finally, in 2016, Maj Mike Benitez posted "Air-Mindedness 2.0: We Need to Do Better than Fly, Fight, and Win" on the *War on the Rocks* website.[45] Airmindedness, as defined in current Air Force doctrine, is "a perplexing and somewhat odd term that is not as familiar today as it used to be, but it possesses unrealized potential that has been forgotten." Although he cited the current doctrinal definition, Benitez interpreted airmindedness as the character of the Air Force or, alternatively, the strategy for nurturing airpower.[46] Admirably, he not only distinguished airpower operations from the underlying rationale behind its mission, that is, airmindedness; but he also properly situated the mental realization of airpower's potential in relation to the material realization of that potential. Thus, only with an updated version of the organization's character, what he called "airmindedness 2.0," can the US Air Force properly leverage emerging capabilities. This formulation becomes problematic, however, when he then defined the new version of airmindedness in terms of those capabilities, which he labeled "high-dimensional operations:" "In the literal sense, air and space domains reside above the traditional land and sea; figuratively, cyber exists on a higher cognitive level."

Though it is not the same tautology offered in doctrine (wherein the Airman's perspective is airminded because airmindedness is having the perspective of an Airman), this is still another example of circular logic. Moreover, it is indicative of the general conceptual pitfalls surrounding a term that is supposedly central to the institution. Even on a practical basis, Airmen cannot even agree on a spelling convention (i.e., whether it is airmindedness or air-mindedness).

This survey demonstrates that, with some exceptions, Airmen write about airmindedness as a unique interpretation of a military problem first, and secondly as the application of air power to help solve such problems in a joint context. Most are reluctant to apply airmindedness to warfare outside of the air domain. They are even less likely to advocate an airminded approach to nonmilitary problems, such as the economy or education. As demonstrated by Mitchell and Arnold, both notions were common among earlier airminded

officers. Additionally, airmindedness as a way of thinking was previously considered in a much more robust manner. It was not just how to efficiently apply military force to achieve political objectives. It was an outpouring of imagination and creativity, passion and transformation, on individual, national, and global scales. Even if this boldness was seldom expressed by even the earliest airminded Airmen, it does not follow that it did not influence them then—or Airmen today.

Rescuing Icarus

In the early twentieth century, Icarian descriptions were not just employed by artists or cultural commentators. The label was also applied to—and by—flyers. For the historian Robert Wohl, Louis Bleriot was "first to claim the legacy of Icarus" when he crossed the English Channel (the first time an airplane crossed a major body of water). A sculpture of nineteenth century gliding pioneer Otto Lilienthal at the Berlin-Tegel Airport portrays him as Icarus, prostrate after his feathered wings failed him.[47] A mid-century social historian writing about the challenge of reintegrating World War II veterans declared: "The qualities that make the finest combat pilot are qualities that seem to presage his own destruction. Icarus is his prototype and patron."[48] Thomas Wolfe's description of "the Right Stuff" sounds the same refrain. Describing the crop of hotshot pilots bound for the high-stakes world of early flight testing and space travel, Wolfe noted their "ability to go up in a hurtling piece of machinery and put their hides on the line and then have the moxie, the reflexes, the experience, the coolness, to pull it back at the last yawning moment—and then go up again."[49]

Aviators themselves reported similar reactions to the "sweetness of perpetual danger."[50] Lindbergh thought his life was "richer because of its very association with the element of danger . . . . In flying, I tasted a wine of the gods of which [those afraid to fly] could know nothing."[51] Another embraced Icarus explicitly in his 1916 letter expressing his desire to become a military pilot: "I will fly . . . . If I fall, I shall fall mightily. I shall be with Perseus and Icarus, whom I loved . . . . I would happily die in any adventure against [the enemy]."[52] These airminded descendants of Icarus exhibited a passion that willingly sacrificed safety for the mysticism and majesty of flight. Wohl wrote that flying offered "visual excitement . . . often combined with a sense of

awe that merged on mysticism and a feeling of contact with the divine . . . aviation attracted people who sought strong emotions and valued intense experience above long life."[53]

This enthusiasm spilled over into more official policy. In 1940, the Royal Air Force's criteria for selecting trainees for the "art" of flying sounds like a profile of Icarus: "fearlessness, a love of adventure and sport, dogged determination to overcome difficulties, and, perhaps most important . . . a love of the air."[54] In the US, despite a faith in rationalistic procedures, aircrew selection still had an intuitive element. Judgments were based on factors such as athletic skills, familiarity with motorcycles, and interest in fictional stories of adventurous daredevils.[55] Arnold himself, writing in *Winged Warfare* with Eaker, honored Icarus as a pioneering "test pilot." Another coauthored work, this one with a title revealing ties to play, *This Flying Game,* begins with "Flying—what dreams it inspires! What ideas and thoughts it excites in boy and man alike!" Later they insisted that the inspiration of myths like Daedalus and Icarus "played no small part" in achieving actual flight.[56]

The official Air Force song, a project initiated by Arnold, celebrates the dangerous intensity of flight, virtually written as a soundtrack to the myth. The first verse about the "wild blue yonder" exclaims, "we live in fame or go down in flame!" The second verse, referring to aviation pioneers, states, "how they lived, God only knew!" The third verse, a full quarter of the song, is used as a dirge to those who did *not* live. Finally, the fourth verse issues a self-congratulatory warning to others: "if you'd live to be a grey-haired wonder/Keep the nose out of the blue!"[57] Again, these words seem to accept the rehabilitated version of Icarus.

Icarus also happens to be the name of the US Air Force Academy magazine of creative writing. Furthermore, for years, Academy cadets have memorized another positive treatment of the Icarian symbol, the poem *High Flight*. Composed by American pilot John Gillespie Magee, it reiterates the themes of escape, playfulness, exclusivity, heightened consciousness, and divinity:

"slipped the surly bonds of Earth,"
"danced the skies on laughter-silvered wings,"
"done a hundred things/You have not dreamed of,"
and finally, "with silent, lifting mind I've trod/
The high untrespassed sanctity of space,/
—Put out my hand, and touched the face of God."

Poignantly, the 19-year-old writer suffered Icarus's fate in a fatal mid-air collision just months after penning those words.[58]

In 1938, the Royal Air Force College composed an anthology of the poetry of flight and titled it *Icarus*. Many were written by flyers, "the successors of Icarus," and all share the same sentiment: "men, driven by the divine urge in them, want to explore, to go on finding things out; and men want to escape from the terrestrial muddle they have made for themselves." The title, the author of the preface notes, "is well chosen . . . [Icarus's] gallant failure has always been the greatest inspiration."[59]

The epilogue to *Icarus* is particularly noteworthy to quote at length:

> [T]he Air has already begun to endow with inspiration true poets of its own. We may well rejoice that this is so in an age when the terrible and increasing power of aerial armament renders it certain that civilisation will perish if that power be not wielded by men vowed to the service of ideals higher than those which hitherto have moved mankind. . . the language of poetry alone affords a medium whereby [Air's ideals] may be discussed and disseminated. Indeed, I have long been convinced that the first need of an Air Force is a poet . . . . We, for whom the Air has opened up a new world of strange experience, seem to come near to a great discovery. Our hands touch, as it were, the very curtain of the shrine, and it seems at times that nothing can prevent us from drawing it aside, so that at last the mystery of life and love will be revealed to mortal eyes. Yet ever there comes unbidden the doubt that perhaps that curtain yields its secret only when we rend it spinning to our final crash. This at the least is clear, that our new world untraversed heretofore gives those who enter it a view transcending far the closed horizon of the two-dimensional race of men. He is dull of soul indeed who does not feel, alone above the clouds, that all the faults, the failures, and the follies of his fellow-men are naught but a faint reflection of his own. . . . Alone in the Air a man can know these matters clearly. For then he can attain true ecstasis, achieving a detachment from the world not otherwise to be experienced.

Written by Austin Hopkinson, this passage is replete with themes addressed throughout this project. There are allusions to verticality in language, a palpable reverence for "Air" (capitalized as a proper noun), and aviation portrayed as an impetus to evolution. The author highlights the

need for a new breed of leaders, wise by virtue of their experience in the privileged domain of the heavens, who can guide humanity through that historical moment. Furthermore, theirs is an exclusive perspective, since "only those who brave its dangers [can] comprehend its mystery."[60] Finally, he makes an explicit plea translating an airminded perspective into words, into the artistic story of a mechanical artifact—and does so with reference to Greek mythology: "it is hard indeed for [Airmen], when on the earth again, to give an account of the vision . . . . Prometheus, bringing fire from heaven to mortals, must be a poet. For poetry is the language of mysticism, and the attempts of mystics throughout the ages to put their gnosis into prose have ever been a sorry failure."[61]

The "past is a foreign country," to which we are strangers.[62] Without such a poet as called for in this epilogue, it is difficult to recapture the sense of airmindedness as Icarus and Daedalus in creative tension. Without that awareness it is even more difficult to see the larger paradigm Airmen operate within and how this *technological logos* invokes these terms beyond their materialistic, technical, logical connotations.

The Icarus Solution

Chapter 2 explained how airmindedness is the awareness of aviation's multidimensional possibilities—physical and psychological; positive and negative; individually, nationally, and globally—as well as the degree that aviation's potential is achieved in practice. While this offers a useful corrective for academia, the last clause of the expanded definition is about realizing those potentials in practice. This is not the job of academics. Rather, the duty to achieve aviation's potentials falls onto airminded professionals in industry, government, public service, education, and, of course, defense. Yet, just because these people may be primarily concerned with aviation's practical benefits at an institutional or national level, they should not neglect the deep-seated power of the aerial view to impact thinking on an individual basis—which should then feed into their primary, pragmatic interests.

Reframing the myth of Icarus and Daedalus into a story of creative tension supplies a model of this dialectic. It is a model that is particularly apt for aviation's military potential. This is precisely what Killefer argued in his thesis on airmindedness. First, metaphorical images play a natural role in our thinking, even if the match is never perfect. As statistician George Box famously quipped, "All models are wrong,

but some are useful."[63] The fallacy in the Icarian myth is that temperature is inversely proportional to altitude; the wax would have hardened, not melted. Yet, Icarus soaring high still serves as a warning against ambition; it still makes sense metaphorically. Far from being inherently pathological—as one Airman wrote—the Air Force's use of analogies has suffered from an inadequate bank of images.[64] Yes, sometimes it is useful to think of war as mechanical, as an industrial science, or as a contest between rational actors seeking to maximize advantages within a set of market rules.[65] These metaphors must be balanced, however, with images that are less common in Air Force discourse: war as messy politics, as a sport, or as an art. These are the subjective orientations, the ones valuing "creativity, intuition, genius, emotion, passion, shared experience, and the importance of the individual," that Killefer proscribed to create a more holistic, more effective airmindedness. "If there is a 'pathology' in airmindedness," he wrote, "it is this: collectively, Airmen have an unbalanced view of reality and knowledge."[66] Remedying this disparity requires new organizational narratives, such as an embrace of Daedalus and Icarus.[67]

Still, Icarus seems like an odd model for Airmen. What value is there in thinking like an ill-fated character from an ancient Greek tale? A modern Air Force has no responsibility for cultivating the human spirit or to inspire artists; the loss of romance may be lamentable, but excusable. There is no room for playfulness with deadly technology.[68] There is no time for forays into the sublime when tasked with the awesome responsibility to help the joint, interagency effort to secure the nation.

Such judgments, however, do not account for a fundamental moral of the myth. Icarus died, yes, and Daedalus survived, but the father became unwilling, unable even to wield his *techne* any further. Ideally, the two could have continued to use their divergent perspectives to fuel creativity. This confluence of imagination and technology, of playfulness and pragmatism, is part of the Icarian, Dionysian paradigm. This is why Singer writes about "the intellectual playfulness of mechanically minded people" and Clive Hart asserts that the greatest impediment to human flight was a lack of imagination as early pioneers held too tightly to the metaphor of flying like a bird.[69]

The role of subjectivity is prevalent in many histories of technology. In *Technology Matters*, Nye quotes a Los Alamos engineer who assisted with the first atomic weapons: "Technology is more closely related to art than to science—not only materially, because art must somehow involve the selection and manipulation of matter, but conceptually as

well, because the technologist, like the artist, must work with unanalyzable complexities."[70] In *Between Reason and Experience: Essays in Technology and Modernity*, Andrew Feenberg discusses the philosopher Miki Kyoshi Zenshu's *The Logic of the Imagination* and his notion of "subjective-objective" technology: the material reality intersects with reason, imagination, and *logos*.[71] Finally, in "Prometheus and The Muses: On Art and Technology," Barry Allen asks "What starker opposition than between the artist and the engineer—the irrational dreamer and the rigorous realist, the indulgent devotee of subjectivity and the austere technician?" He then questions that dualism:

> We tend not to think that engineering might be enhanced by the love of beauty, nor that it is impossible to be a really good engineer without understanding art. Yet we depend on essentially artistic skills in engineers, the capacity to feel technically and construct aesthetically. The invention of a seriously new alternative is an aesthetic moment in art and technology alike. No design is ever determined by calculations or technical necessity. Choice pervades technological design and is made, ultimately, on the basis of aesthetic invention (supplemented, of course, by careful testing). Engineering design is the analytical and imaginative synthesis of perception and technique, which is also the ideal, the point, the idea of art.[72]

Earlier Airmen recognized this interdependence between technology and imagination. In 1909, Giulio Douhet argued that the idea of flight required fantasy in order to rise to its potential. The following year a US Army officer writing about aviation in a professional journal wrote "one must be prepared to use his imagination largely and even touch on the borders of prophecy."[73] Alexander de Seversky argued that industrial capacity was "the lesser half of the job for a machine-age nation like the United States." Instead, "We must outthink and outplan them, in a spirit of creative audacity . . . . All those gifts of mechanical ingenuity, industrial efficiency, and above all, imaginative daring which have made America the first nation of the industrial era must be given full play in American airpower."[74] Finally, retired major general and professor emeritus at Duke University, Irving B. Holley Jr., notes the key role of imagination in many of his seminal essays on the relationship between technology and aerial doctrine.[75] Airmen today still promote disruptive innovation and the aspirational qualities of serving their country by mastering their

technological domains. And they do so without the worst element of the "Icarus Syndrome," the obsession with specific means.

With Icarus and Daedalus viewed as two interrelated dimensions, and not mutually exclusive options on a single continuum, airmindedness can be technical, practical, and political as well as inspirational, creative, and playful. The former strengthens the latter just as the son inspired the father. No longer a syndrome to avoid, Icarus becomes a solution to embrace.

Conclusion

Language evolves and words change meanings. Why, then, demand that modern Airmen pay attention to the airmindedness of the interwar period or to the *techne* and *logos* of two millennia ago? The value is not just for the sake of etymological purity. The older connotations of these concepts highlight elements still present, if inactive. Airmindedness can be playful and pragmatic. *Techne* implies *metis,* and vice versa, and both are linked to storytelling. Technology is both material and mental, a force that is shaped by society as well as a force that shapes society. Technological knowledge advances by faith, imagination, and a mosaic of metaphors, but also by rigorous logic and the (generally valid assumption of) predictability. The paradigm of Airmen, their *logos,* is *technological* because all of these various elements are represented in their overarching story, their technical logic, and their divine inspiration. It is not a weakness to apologize for but a resource to harness.

Acknowledging the robust definitions of these concepts, highlighted by a history of technology approach, helps advance historical scholarship. It would also have been a better way to fulfill Air University's original request to RAND for a manifesto on professional obligations, heritage, and the future of the Air Force. Most important, however, is how this analysis has practical benefits for the USAF's ability to realize the deeper meanings behind its slogans of "aim high" or "above all," and use the full force of its cultural inheritance to prevail in a world that is wicked once over.

Notes

1. Builder, *The Icarus Syndrome*, 36.

2. The remainder of this chapter will use the phrase "air power" to mean the ability to wage war in and through the air. It is narrower than "aviation power," which denotes

the capacity of the entire nation (military plus commercial and private flying). This concept, like Mahan's sea power, captures physical elements (population, aircraft, infrastructure, geography, and resources) and sociopolitical elements (governmental policies and the "character"—or, in this case "mindedness"—of the nation).

3. Interestingly, Warden's division had also offered a new version of the basic doctrine, based on his vision of air power, but the Air Staff deferred to Air University. Olsen offers a succinct description of Warden's proposed revision. Warden's assignment to ACSC was also meant to bolster the school after Builder's scathing critique. Olsen, *John Warden and the Renaissance of American Airpower,* 119–121, 251–253.

4. Arnold, *Third Report of the Commanding General*, 70.

5. Pacey, *Meaning in Technology*, 3. Regarding the use of the word "aspirational," the term as also has a place in the history of technology. Pacey, for example, describes the evolution of his own writings this way: " 'Values' and 'ideals' were almost interchangeable concepts for the early books, in discussion of links between technology practice and individual purpose and experience. However, in this third and final exploration, I prefer to use words such as 'aspiration' and 'meaning,' believing that a person's ideals and values in relation to technology are an outcome of her or his sense of the purpose and meaning of life."

6. Quoted in Roland Flamini, "The Da Vinci Codex: Treasured Sketches of Flight on Rare Display at Smithsonian," *Washington Post*, 12 September 2013, www.washingtontimes.com/news/2013/sep/12/the-da-vinci-codex-treasured-sketches-of-flight-on/. Accessed 17 December 2017. For a threaded discussion for research into the authenticity of this quote, see "Talk:Leonardo Da Vinci - Wikiquote," accessed 22 January 2018, https://en.wikiquote.org/wiki/Talk:Leonardo_da_Vinci.

7. Boitani, *Winged Words*, 44. According to Boitani, this trend began with the 1783 Montgolfier brothers' successful balloon flights: "It is here we begin to notice in the European imagination a distinction between scientific and technological reality on the one hand and the mythical imaginary on the other." Others place the divergence later, during the Industrial Revolution or the world wars of the twentieth century. Singer, however, notes the opposite tendency among writers: "Throughout history, the symbolic use of flight is reinforced the physical perception of actual flight. Achievement feeds the dream, and the dream reinforces that drive toward the heavens. Even when flight or space seems to be merely background for the authors' for the artists' main points, it is not choosing arbitrarily. The heavens have symbolic resonance which gives weight and substance, and flavor, to the discussion," Singer, *Like Sex with Gods*, 79.

8. Many authors address the changing relationship between public opinion and aviation, including Corn, Sherry, Wohl, Call, Courtwright, Pisano, Biddle, Clodfelter, and Vick (see references).

9. Spariosu, *Dionysus Reborn*, 9–11. Spariosu discusses how rationality and playfulness relate to each other, as well as how both relate to the mentalities associated with frontiers and periods of instability.

10. Michael Aytron quoted in Nyenhuis, "Daedalus and Icarus," 233.

11. Bowen, *Knights of the Air*.

12. Kessel, *La Ligne*, quoted in Wohl, *The Spectacle of Flight*, 165.

13. Leigh Edmonds, "How Australians Were Made Airminded," *Continuum: The Australian Journal of Media & Culture* 7, no. 1 (May 1993): 206.

14. Adey, *Aerial Life, 8.* Aereality is also the title of William L. Fox's book on how aerial views are constructed physically (through flight) or via imagination (Fox, *Aereality: On the World).*

15. Author and friend Ken Roach highlighted the particularly egregious nature of the attacks of 11 September 2001, which perverted the wondrous human invention into a weapon of mass destruction (personal correspondence with author).

16. Wohl, the contributors to *Seeing From Above: The Aerial View In Visual Culture*, and, to some extent, Corn are all representative of the types of scholars who address the affective side of airmindedness: art historians, cultural geographers, and those who study visual culture. The tone is often critical, ranging from critiquing strategic bombing or "drone" strikes as ineffectual and immoral to the "oppressive gaze" of a powerful state imposing its will. For example, in his introduction to the edited volume, *From Above*, Peter Adey proclaims, "This book asks difficult questions of this view, as for all its spectacle in beauty, we must be careful not to celebrate it." For Adey and those who contributed to the work, airmindedness is an oppressive imposition of power from above, a forced set of "ideas, beliefs, and behaviors" that define what is acceptable for members of a community (Adey, Whitehead, and Williams, *From Above: War, Violence, and Verticality*, 2. Some counter these ideas by restoring agency to those below (e.g., Weems, *Barnstorming the Prairies*). Contemporaneously, fiction writers were often the earliest to highlight the affects and effects of flight, with more even attention to its promises and pitfalls (e.g., H. G. Wells, who believed airmen were destined to be part of the ruling elite and foresaw the rise of strategic bombing as early as 1908).

17. Builder, *The Masks of War*, 19.

18. For example, Smith's reproach in *Tomorrow's Air Force*. Jeffrey J. Smith, *Tomorrow's Air Force: Tracing the Past, Shaping the Future* (Bloomington, IN: Indiana University Press, 2013).

19. Other air forces also use the term. See the Royal Air Force Joint Doctrine Publication 0–30, UK Air and Space Doctrine, 1–9. For an overview of both the US Air Force and Royal Air Force definitions from the perspective of a Royal Canadian Air Force officer, see Brig Gen Christopher J. Coates, "Airmindedness: An Essential Element of Air Power," *The Royal Canadian Air Force Journal* 3, no. 1 (Winter 2014): 70–84. This project does not evaluate the degree to which airmindedness's past is as foreign to these other air forces as it is to the US Air Force.

20. Coates, "Airmindedness," 71.

21. Air Force Manual (AFM) 1–1, Volume II, *Basic Aerospace Doctrine* (March 1992), 210.

22. AFM 1–1, 210.

23. In fact, Drew worked on AFM 1–1. In a 2012 interview, however, he said he was unable to recall who authored the essay on airmindedness. Drew, however, offered that "perhaps the author of the essay . . . viewed Arnold's use of 'air-mindedness' less literally and much more figuratively as applying broadly to both civil and military aviation" (Coates, "Airmindedness," 72). The full context of Arnold's quote reveals that this "figurative" interpretation was precisely what the commanding general meant, and not the airmindedness that survives in official discourse today in narrower form.

24. Dennis M. Drew, "Joint Operations: The World Looks Different From 10,000 Feet," *Air Power Journal* 2, no. 3 (Fall 1988): 5.

25. Air Force Doctrine Document (AFDD) 2, *Operations and Organization* (3 April 2007), 23.

26. Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine, Organization, and Command* (14 October 2011), 18.

27. This is not perfectly clear, however. Chapter 2 on "Airpower" states, "Accordingly, the following discussion of airpower is intentionally not Service-specific; as-

pects of airpower are used across the joint force and by coalition partners. However, Airmen have a special appreciation for airpower's broader potential" (AFDD 1, 2011, 11). Additionally, the section on "Airman's Perspective," which explains operational principles guiding development and employment of airpower, describes these processes as the "practical application of 'airmindedness," implying airmindedness is not itself practical (AFDD 1, 2011, 19). What else it could be is not part of the doctrinal definition (though it is part of larger usage, as noted in AFDD 1, chap 2).

28. John C. Scherer, "It's Time for the Basic Airpower School" (research paper, Air War College, 1996), 5, 9.

29. Michael J. Taschner, "Examples of Airmindedness from America's First Operational Air Campaign: The St. Mihiel Offensive, 1918" (research paper, Air Command and Staff College, 1997), vi.

30. Robert J. Elder Jr., "Air-Mindedness: Confessions of an Airpower Advocate," *Air & Space Power Journal* 23, no. 3 (September 2009): 11–12.

31. Ronald G. Machoian, "Looking Skyward" (research paper, Air Command and Staff College, 2004), 8, 14, 13, 21.

32. Dave E. Bonn, "Saddled with History: Airmindedness and its Antecedents in Union Cavalry" (master's thesis, School of Advanced Air and Space Studies, 2014), 5. Bonn's thesis does highlight the misuse of Arnold's quote regarding airmindedness, but he incorrectly writes: "In a larger sense, however, the history and evolution of airmindedness as a concept suggests AFM 1–1 still used the term appropriately" (Bonn, 27).

33. Jeffrey J. Smith, "Beyond the Horizon: Developing Future Airpower Strategy" *Strategic Studies Quarterly* 8, no. 2 (Summer 2014): 75.

34. Dale L. Hayden, "Air-Mindedness," *Air and Space Journal* 22, no. 4 (Winter 2008): 44.

35. Hayden, 44–45. In a 2012 interview, Hayden suggested the use of the term airmindedness may serve as a "meta-narrative" that has been accepted, as it served the US Air Force's organizational interests (Coates, "Airmindedness," 12).

36. Hayden, "Air-Mindedness," 45.

37. Charles J. Dunlap, *Shortchanging the Joint Fight: An Airman's Assessment of FM 3–24 and the Case for Developing Truly Joint COIN Doctrine* (Maxwell Air Force Base, AL: Air University Press, 2007), 7–8.

38. Dunlap, 11, 15.

39. Buck Elton, "Shortchanging the Joint Doctrine Fight: One Airman's Assessment of the Airman's Assessment," *Small Wars Journal*, 12 July 2008, http://smallwarsjournal.com/ blog/journal/docs-temp/74-elton.pdf?q=mag/ docs-temp/74-elton.pdf, accessed 27 July 2016.

40. Mark Jacobsen, "The Problem with Air-Mindedness," *Building Peace*, 19 February 2010, http://buildingpeace.net/?s=air-minded, accessed 3 December 2015.

41. Lt Gen Michael C. Short, retired, US Air Force, described it as "chest beating," and Lt Gen Allen G. Peck, retired, US Air Force, indicated that "the term 'airmindedness,' when used in a better-than-thou context by Airmen, can do more harm than good regarding the perception of the Air Force as a coequal partner at the joint force table'" (Coates, "Airmindedness," 74).

42. Robert Killefer III, "A Metaphor Theory of Airmindedness" (master's thesis, School of Advanced Air and Space Studies, 2004), vi. This links to the discussion of metaphors in the introduction and further strengthens the association of airmen with the post-Platonic paradigm.

43. Chris Wachter, "Air-Mindedness: The Core of Successful Air Enterprise Development," *Air and Space Power Journal* 26, no. 1 (January-February 2012): 56.

44. Wachter, 54.

45. Mike Benitez, "Air-Mindedness 2.0: We Need to Do Better than "Fly, Fight, and Win" *War on the Rocks*, 8 August 2016, http://warontherocks.com/2016/08/air-mindedness-2-0-we-need-to-do-better-than-fly-fight-and-win/, accessed 10 August 2016.

46. The second phrase was not explicitly stated as such in the article, but was used in personal correspondence with the author.

47. Lilienthal made significant advancements in glider flight but died as a result of injuries sustained in a flying accident.

48. Dixon Wecter, *When Johnny Comes Marching Home* (Cambridge, MA: Houghton Mifflin Company, 1 January 1944), 520.

49. Wolfe, *The Right Stuff*, 17.

50. Wohl, *The Spectacle of Flight*, 290. Quote by Pierre Weiss, *L'Espace*.

51. Charles A. Lindbergh, *Spirit of St. Louis* (New York: Scribner, 1953), 261–62.

52. Harold Owen and John Bell Owen, *Wilfred Owen: Collected Letters* (London: Oxford University Press, 1967), 408.

53. Wohl, *The Spectacle of Flight*, 290, 4.

54. Adey, *Aerial Life*, 125, quote by F. Warren Morrison. For more on the US policies regarding the ideal profile for aircrew, see the words by Mark K. Wells and David Courtwright (Mark K. Wells, *Courage and Air Warfare: The Allied Aircrew Experience in the Second World War* (Portland, OR: Routledge, 1995), 4–22; and Courtwright, *Sky as Frontier: Adventure, Aviation, and Empire,* 115–118.

55. Wells, 6; and Courtwright, 115.

56. Henry H. Arnold, *Winged Warfare* (New York: Harper & Brothers, 1941), 213; and Arnold, *This Flying Game*, 3, 22.

57. David A. Lande, "Saved by the Wild Blue Yonder," *Air Force Magazine* 93, no. 9 (September 2010), 102–4; and Robert Crawford, "The Air Force Song," Official US Air Force Songs Web Page (January 1997) http://www.afnoa.org/afsong.html, accessed 3 October 2016.

58. Vance, *High Flight: Aviation and the Canadian Imagination*, 268–269. Vance argues the Canadian urge to claim both Magee, who flew with the Royal Canadian Air Force, and his poem is another confluence of airmindedness and nationalism.

59. Rupert De la Bère, ed., *Icarus: An Anthology of the Poetry of Flight* (London: Macmillan, 1938), viii, xi. Interestingly, pace Singer and this chapter, the preface notes that flying will become normal and nobody will write poetry about a such a common activity (De la Bère, x).

60. De la Bère,185–87. Note how this exclusiveness mirrors the points by Mitchell and de Seversky quoted earlier in chapter 2.

61. De la Bère, 187.

62. David Lowenthal, *The Past Is a Foreign Country—Revisited*, 2nd ed. (Cambridge, UK: Cambridge University Press, 2015). Lowenthal took the title from a line in Leslie Poles Hartley's *The Go-Between* (1953): "The past is a foreign country: they do things differently there."

63. George E. P. Box and Norman R. Draper, *Empirical Model-Building and Response Surfaces* (New York: Wiley, 1987), 424.

64. Peter R. Faber, "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower" in *The Paths of Heaven*, edited by Phillip S. Meilinger (Maxwell Air Force Base, AL: Air University Press, 1997), 221.

65. Killefer, "A Metaphor Theory of Airmindedness," 34–41.

66. Killefer, 63, 65, 101.

67. Artist Michael Ayrton, the subject of Nyenhuis's *Myth and the Creative Process*, observes the same combination of Daedalus and Icarus in his drawings, poems, and novel, *The Maze-Maker* (1967).

68. Note the same judgmental tone in Ovid's poetry: "Icarus, stood next to him, and, not realising that he was handling things that would endanger him, caught laughingly at the down that blew in the passing breeze, and softened the yellow bees' wax with his thumb, and, in his play, hindered his father's marvellous work [*sic*]." Ovid, *The Metamorphoses*, trans. A. S. Kline, 2nd ed. (CreateSpace Independent Publishing Platform, 2014), VIII:183–235).

69. Singer, *Like Sex with Gods*, 4; and Hart, *The Prehistory of Flight,* xiii-xiv.

70. David E. Nye, *Technology Matters: Questions to Live With* (Cambridge, MA: The MIT Press, 2007), 9–10. Note the insinuation of "wicked" conditions.

71. Feenberg, *Between Reason and Experience*, 120. For more on how imagination and myth combine to spark creativity, even in the most rationalistic pursuits, see Mary Midgely's *The Myths We Live By* (1995).

72. Barry Allen, "Prometheus and the Muses: On Art and Technology," *Common Knowledge* 12, no. 3 (19 September 2006): 354.

73. Azar Gat, *A History of Military Thought: From the Enlightenment to the Cold War* (New York: Oxford University Press, 2002), 572; and G. L. Townsend, "The Use and Effect of Flying Machines on Military Operations," *Infantry Journal* 8 (September 1910): 245.

74. De Seversky, *Victory Through Air Power*, 5–6.

75. I. B. Holley Jr., "Technology and Doctrine" in *Technology and the Air Force: A Retrospective Assessment*, edited by Jacob Neufeld, George M. Watson Jr., and David Chenoweth (Washington, DC: Air Force History and Museums Program, 1997); and Holley, "Reflections on the Search for Airpower Theory" in *The Paths to Heaven*, edited by Phillip S. Meilinger (Maxwell Air Force Base, AL: Air University Press, 1997).

Chapter 5

Summary

Epilogue \ˈepə-lôg\\ *n.* - 1. a conclusion summarizing a story's meaning, offering a prescriptive coda, or revealing the fate of characters [ancient Greek: *epi-* (prefix: in addition) + *logos* (story)]

Reframing the Narrative

In the introduction to the edited work *Airpower Reborn,* historian, strategist, and airman John Andreas Olsen suggests "the basic facts and the main narrative [of air power] are now in place."[1] Thus, similar to changes in the history of technology field, more scholars are now emphasizing the social, cultural, political, and intellectual dimensions of the story.[2] Still, "no one comes close" to fully capturing the institutional culture of a key air power organization, the United States Air Force.

The conventional narrative offers an intellectual history that is partial and overdue for reframing.[3] This story's leitmotif is the inability of Airmen to decouple the technical and tactical from the theoretical and strategic.[4] Instead, they substitute the logic of technology for the language of war, which is more art than science. Colin Gray claims this fusion creates "a persisting conceptual failure" to situate the practice of air power within an overarching political history.[5] Similarly, Dag Henriksen writes that the fundamental dilemma facing Airmen is their inability to "adapt and establish a sufficiently critical and robust analytical tradition."[6]

Scholars suggest an assortment of reasons for the supposed intellectual failings of Airmen. Some emphasize the inherent difficulty of theorizing about a dynamic technological means, grappling with what Gray labels a history that is short and "necessarily in motion."[7] Others are less sympathetic, suggesting the faults are internal. For example, the radical revision of AFM 1–1 that reintroduced Airmen to airmindedness articulated doctrine in a novel, less superficial, fashion. According to one commentator, "Given this strong dose of intellectual rigor, it is not surprising that the experiment was short-lived." And a more recent critique by a current USAF officer asserts, "When [military] professionals hear the word 'theory,' their eyes tend to glaze over." In *Airmen and Air Theory: A Review of the Sources,*

Philip Meilinger states: "Theory and doctrine deal with the realm of ideas, not operations, and partly because of this, fewer people have been inclined to write about this more esoteric subject. As a result, tracing the history of ideas has proven to be a fairly barren field." "The problem becomes far worse regarding airpower," he writes as he concludes this bleak analysis. "Airmen . . . have seldom been accused of being thinkers."[8] Interestingly, all three quotes are from Airmen, who appear to be performing the very act they claim Airmen avoid. They are certainly not alone in their conclusions.

Many inside and outside the USAF cite Carl Builder's assessment as the reason Airmen fail to produce sufficient theory: the obsession with technology shortcuts any attempt to grapple with the subjective, messy challenge of applying air power to achieve political effects in a wicked world. Dennis Drew, the man associated with the introduction of airmindedness into doctrine, claims that, for many in the USAF, "technology has become virtually the alpha and omega of airpower success—all else seems to be of secondary importance."[9] In the seminal *Makers of Modern Strategy*, David MacIsaac writes that air power theorists are few and "have had only limited influence in a field where the effects of technology and the deeds of practitioners have from the beginning played greater roles than have ideas."[10] "One might conclude, with some distress," he writes later in that essay, "that technology itself may be today's primary air power theorist; that invention may, for the moment, be the mother of application."[11]

In this conventional perspective, Airmen replace strategy with technology, privileging technical mastery as well as a vision of warfare that is overly mechanical, sanitized, rational, and amenable to quick, clean victories through air power.[12] This picture is not only incomplete, conditioned as it is by the same prejudices as Plato; it is seriously flawed. The distortions and omissions can be remedied by reframing the narrative using some of the interrelated, "post-Platonic" shifts occurring throughout academia since the mid-twentieth century. This postmodern movement restores validity to subjectivity, imagination, storytelling, mythology, play, and a chaotic world, all of which are evidenced in the discipline of history and particularly in the history of technology.

How to craft technological histories that integrate the material and the mental is an ongoing project. This present book, an intellectual history of a technological organization, contributes to that endeavor by applying analytical perspectives already identified by historians of technology to subjects that are currently underrepresented in their

field. One example of a new topic viewed from an established approach is the evolution of airmindedness among the last generation of Airmen. Also consider the intuition among members of SHOT to reach back to the poets and philosophers of antiquity to understand the meaning of "technology." This book does the same, and it goes further by dissecting the most commonly cited myth, that of Prometheus, as well as unpacking the concepts of *techne* and *metis* embodied within his character. SHOT articles have also called upon historians to pay attention to users and, separately, to storytelling. There are few works, however, on technological users as storytellers. Last, historians of technology have addressed the nature of technological knowledge for decades, but none have applied it to the example of air power theory (or, for that matter, any military theory).

In this book, novel investigative approaches illuminate well-worn topics just as often as the reverse; instances in which old methods explain new materials.[13] One illustration is the historiography regarding attitudes toward the airplane. The analysis above addresses the same issue, but with the benefit of transdisciplinary concepts from rhetoric, literary theory, and urban planning. It contains stories about flyers and stories from flyers. It addresses closed, tame worlds as useful fictions within a world that is wicked once over. Finally, it compares master plans based on comprehensive, rationalistic approaches and the presumption of overwhelming power with muddling through in improvisational, humble, playful ways. This project, using those disparate sources, even commends artful recombinations of the two.[14] Furthermore, the technical characteristics of Airmen's mechanical artifacts are well known, but this book "tasted the forbidden fruit of technological determinism" by linking the way they think with the technical characteristics of range, speed, and altitude.[15] There are other established topics this project viewed with new approaches. For example, many books address World War I as the birth of airmen, civilian airmindedness in the period following that conflict, or the general theory of air strategy on display in the next war. Few, however, employ the concepts of play and story, which turn out to be central in each of these narratives. Finally, there is no lack of analysis pointing to the US Air Force as an organization with a technological paradigm, but the full dimensions of that adjective go unappreciated. Indeed, a broader definition of "technological" expands the implications of that judgment significantly—and contradicts its implicit condemnation.

Unusual perspectives of familiar topics combined with familiar perspectives of unusual topics yields a synthesis that is unique among histories of air power. This new narrative offers insight into how Airmen relate technology to strategy, illustrates how technological knowledge evolves, and—adapting the plea to situate air power in context—offers a broader picture of its human, "internalist" dimensions.[16] That is, the problems and possibilities of military aviation are not just matters of politics or physics; understanding the culture of a technological organization must account for other essential aspects of *homo sapiens*. We are not just the thinking animal, but also *homo faber* (the making animal), *homo ludens* (the playing animal), and *homo narrans* (the storytelling animal). When the intellectual history of the US Air Force is viewed from these perspectives, the analysis points to a paradigm that is aptly labeled a *technological logos*.

Unpacking *Technological Logos*

Any organization's culture is manifested in official policies, operational procedures, and social practices.[17] These tangible elements, however, are all consequences of a deeper set of shared assumptions. For Airmen, this collective mindset, or paradigm, is a *technological logos*. That such a complex phenomenon as organizational culture could be represented in just two words is only possible because of the multiple meanings embedded within each.

First, consider *logos*. As explained in chapter 1, most modern English speakers associate the word with logic. This is part of Plato's legacy. Before the philosopher redefined it as reason and logic, *logos* represented all forms of human communication, including stories. Another translation uses the term as an ontological narrative describing the nature of reality. In this sense, *logos* closely aligns with Morgan's definition of paradigm. Moreover, this worldview often implied a supernatural, divine origin, which is why Christian theologians appropriated the term to represent Christ as the preexistent, immanent "word of God." In all cases—whether as logic, a story, an overarching principle that unifies knowledge, or a focus for sacred worship—*logos* makes sense for Airmen.

In addition to substituting *logos* for "paradigm," metaphorically and literally, it is also fitting to describe Airmen's worldview as a *logos*. Airmen, by virtue of the tempo of warfare described in chapter 1 and by

the airmindedness described in chapter 2, have a penchant for telling stories about flight. Indeed, the only way to adequately understand and convey the use of technology in a wicked world is through storytelling; to guide a warrior's *techne*, *metis* is communicated through rhetoric that is itself a unique combination of *techne* and *metis*. Chapter 3 illustrated this process through the use of operational theory, which is just another form of story (i.e., "a type of narrative, with implications for the audience, conveying why and how one or more characters struggle in order to prevail in a particular setting").[18] Of course, *logos* as logic is also appropriate. Airmen undoubtedly appreciate and encourage a system built on rigorous mechanical reasoning. Such an approach shapes the research and development of their artifacts, as well as how they are trained to operate them. Last, as often noted, the affinity of Airmen for those flying machines approaches the level of reverence. This "worship" of technology is not necessarily as pathological as some claim.[19] Technology has multiple dimensions that cannot be fully appreciated without an intellectual history approach that appreciates narrative intelligence, the Greek origins of "technology," and the nature of technological knowledge.

The most obvious way in which the *logos* of Airmen is *technological*, and the most superficial sense in which their paradigm is defined by technology, is the fact that the airplane is at the heart of their social practices, their theories of air warfare, and their fight for organizational autonomy. This is as self-evident as it is necessary. It is, after all, the way in which Airmen have traditionally fulfilled their central responsibility to the nation. No wonder then that one of the founders of USAF organizational culture, "Hap" Arnold, imbued the institution with close connections to the military-industrial-university complex.[20] Being attuned to technological advances was critically important, especially in an age of rapid change.[21] Gray points out that a focus on the technical and tactical aspects of aerial warfare is "inevitable, necessary, and desirable" so long as it does not distract from the larger strategic purpose.[22] Regrettably, this distraction does happen—but not always, and this relates to another connotation of technological.

Knowledge that is technological is not just know-how of technical matters. It also describes the way in which such knowledge evolves: from periods of "normal" puzzle-solving activities to phases in which old ideas are challenged. In those periods of flux, the play of imagination and serendipity creates an opening for creative minds to reframe the dominant way of thinking before the cycle repeats itself. Air

power theory, as a species of technological knowledge, has undergone this process at least twice in its short history, as explained in chapter 3: the period around World War II and then again around Operation Desert Storm.

Finally, there is a meaning of "technology" not as it is used in popular culture today to convey technical, artifactual systems, but as revealed by its origins in antiquity. Prometheus, the character who gifted craftsmanship to humanity and who is literally named "pro-*metis*," best conveys this sophisticated interpretation of the concept.[23] It is technology as it was linked to both *techne* and *metis* before Plato's biased narrative gained widespread purchase. Yet it is more than the idea, prevalent in Greek culture, that *metis* guides *techne*. The even bolder claim supported by this argument is that characteristics of aviation *techne* can encourage—that is, both cultivate and ennoble—*metis*. This corroborates Gray's assessment that "it can be claimed that airpower theorists should be all but uniquely able to think strategically, such being a gift from their military specialty . . . . The mobility, and hence range, reach, and temporal compression, enabled by airpower ought to encourage a somewhat matching width, breadth, and generously contextualized view of the strategic world."[24] Yet, this metic quality is unacknowledged in analyses of USAF culture, mirroring the absence of *metis* in Airmen's vocabulary.

In sum, Airmen inhabit what historian Paul Edwards calls a technologically constructed social world.[25] Their organizational culture is *about* technology, its overarching philosophy can be *like* technology in the sense of *techne* as it was understood both before and after Plato, and its theories are a *form* of technological knowledge. When that know-how of air power enters a phase of dogmatic standardization, it becomes all too easy to worship their technological means. In such periods of intellectual stasis, Airmen treat the artifact itself as the defining feature of their trade. They assume their organizational paradigm is defined by formal air power theory and not the worldview that produces a specific theoretical approach. When Airmen embody "technological" in the pejorative, narrow sense, they conceptualize technology as a technical solution to a closed world problem, without the guidance of an executive supervision supplied by metic intelligence. This was the moral of the chapter 4 case story about modern definitions of airmindedness. If, however, Airmen take the full measure of technology, as recent historians in that field have done, the accusation they substitute technology for strategy becomes nonsensi-

cal. The technological can, and should, be just as intertwined with the strategic as society and technology. When it is not, unfortunately, Airmen confirm the standard critique of their intellectual acumen.

Codas: Narratives for Strategic Effect

This book contains arguments designed to produce two different codas. One is academic, attempting to fulfill various calls made in historical scholarship and encourage others to adopt and adapt such approaches: the focus on the lived experience of technology-in-use, attention to technological tales, analysis of how technology shapes organizational culture, and the use of transdisciplinary approaches. It redefines airmindedness in a way that captures its multiple dimensions. It anchors one of the most modern technical artifacts using metaphors and meanings from antiquity, hoping to make flight "more meaningful in the overall record of human existence," as James Hansen calls for in "Aviation History in the Wider View."[26] Most ambitiously, perhaps this project will do for "playfulness" in military history what Detienne and Vernant did for *metis* in Greek history: to identify an idea that is as pervasive as it is unacknowledged. The other coda is directed to Airmen, but its explanation also sheds light on the style, logic, and presentation of the book's argument.

The epilogue to *Icarus*, the 1938 Royal Air Force anthology of poetry, contains an appeal for a poet to capture the majesty, mysticism, and meanings of air power.[27] Perchance, however, Airmen already have one. The person need not have practical experience with flight, as the description of airmindedness in chapter 2 makes clear. It is more helpful, perhaps, for the poet laureate to be more familiar with mythological forms of flight, or simply mythology writ large. Indeed, Bayla Singer notes, "The deep symbolic meanings of flight have been expanded and enriched . . . [and] still contribute to our motivations and experiences. This is true not only of flight, but of our other dreams and drives as well. Those who look for the wellspring of creativity . . . would do well to give more than superficial lip service to ancient longings. Old dreams do not fade away, they merely adapt to current social realities."[28] Of course, Plato—who disbanded the poets, denigrated *techne*, redefined *logos,* and denied *metis*—is not a viable candidate, but possibly there is another ancient Greek writer.[29]

Perhaps, as hinted throughout these chapters, Airmen can better perceive their *technological logos* through the poetry of Homer. First, he contributes heavily to the corpus of literature that describes the pantheon of characters used herein for their contrasting tendencies. Additionally, his works display exemplars who balance those creative tensions.

Odysseus is the "unifying element" for Greek notions of *metis* and the only character Homer describes as poly-*metis,* "[knowing] all the ways of guile and cunning strategies."[30] Zeus exclaims that Odysseus is "beyond all other men in mind," and he is not the only god favoring the sidetracked traveler.[31] On his journey home, Odysseus is aided by Athena, another deity highly associated with both *techne* and *metis*.[32] This is why the goddess of wisdom, craft, and war is fit to serve as Odysseus's patron throughout his journey home and could vouch that he is "far the best of all mortals in thought and word."[33] And since Homer's sense of *metis* is bound up with *techne*, it is not surprising to find the two melding into the single character of Odysseus.

Not only is Odysseus poly-*metis*; he also displays a variety of technical skills. First, *The Iliad* demonstrates his gift as a battlefield tactician.[34] Next, *The Odyssey* showcases many of his maritime navigational skills, a common metaphor for the way-making nature of both *metis* and *techne.* His abilities as a carpenter are demonstrated when he constructs the Trojan Horse that ends the war and the raft that ends his exile on a remote island.[35] Finally, as he melded reason and passion, words were often his weapon of choice.[36] Athena states Odysseus is "far the best of all mortal men for counsel and stories."[37] He validates this compliment when he expertly recounts the Cyclops story for others.[38] Great storytelling is, in fact, a manifestation of both *techne* and *metis*.

To reiterate earlier points, *metis* is a strategic intelligence: pragmatic, political, and particularly apt for war. The inclination towards organized violence makes the world doubly wicked as it adds danger to the disorder. Warfare is perhaps the most wicked activity humans participate in and therefore the one in which *metis* matters the most.[39] As the innate link between strategy and war implies, *metis* is not just about ruses or what Sun Tzu called the acme of strategy: winning without fighting.[40]

Military strategy is fundamentally about the use of violence to secure an advantage. Indeed, Odysseus himself, the paragon of *metis*, uses force deftly when required.[41] He is attuned, however, to the range of potential consequences of his actions, whether those actions are forceful or cunning, and the limits to what can be known.[42] Regardless of which approach he takes, and whether it is even cooperative

and constructive instead of competitive and destructive, the goal of this strategic intelligence is always to realize a continuing advantage in a world that is wicked once over.

Odysseus, therefore, exemplifies the following two descriptions of strategy, the first about its environment and the second about its functions therein: "strategy is a process, a constant adaptation to shifting conditions and circumstances in a world where chance, uncertainty, and ambiguity dominate"[43] and "the realm of strategy is one of bargaining and persuasion as well as threats and pressure, psychological as well as physical effects, and words as well as deeds."[44] The latter definition highlights an important dimension to *metis,* which is unavailable to the non-human examples offered by Detienne and Vernant (e.g., octopi or ivy).

Odysseus crafts a way out of his predicaments, but he is also deft at doing what proficient strategists do: "putting ideas into words."[45] This is not the *logos* of Plato but the rhetorical skill of the sophist. It is, essentially, the application of metic intelligence into two domains. First, a plan must be crafted. Second, that plan, that "theory of victory," must be communicated in a coherent, persuasive fashion.[46] While some elements may remain tacit and intuitive—after all, any domain in which universal rules are explicable is, by definition, not a field of metic activity—the strategist is still able to employ words to achieve an advantage. And often stories and metaphors are the most effective type of narrative despite (or perhaps because of) the fact that they are always perishable and partial. Again, consider the definition of stories and how it resonates with the function of strategies: narratives that convey why and how to prevail in a particular context.[47]

Airmen have, at times, been adept at crafting innovative theories of aerial warfare in moments of instability. As Effects Based Operations falls out of favor, low-intensity conflicts not amenable to air power continue to fester around the world, and the USAF's position as preeminent air force is challenged by rising states, many authors perceive another such moment will arise in the next quarter century, if not before. What Airmen need, however, is not merely another theory to guide air power operations. They need a better story of what it means to be Airmen.

Organizational theorists have long asserted the need for compelling stories to incite and sustain cultural change. Likewise, modern USAF doctrine itself lists "telling the Air Force story" as one of the organizational competencies required at the highest echelons of command.[48]

Finally, the links between strategy and storytelling are at least as old as Homer.[49] What is needed, then, is for airminded strategists to turn their skills inward and craft a compelling organizational narrative, one that will cultivate an environment of continuous innovation.

This task is, at first glance, paradoxical. Culture is the accumulated wisdom of solutions that worked or have been perceived as a success. Culture is thus based on stability. Unremitting innovation contradicts the continuity organizations naturally crave. The crux is reframing expectations. Enduring resolutions for wicked dilemmas will not come from the level of theory, which is inevitably only a partial, perishable approach. Instead, the ability to continuously "re-solve" complex and complicated problems, which never have a final solution, can only emerge at the level of paradigms. It is not any one design or school of thought, but the process of constantly generating and experimenting with a menu of options. It is a meta-strategy that embraces playfulness, whether as storytelling, exploring metaphorical possibilities, or iterative approaches; that opts for incomplete theories over single unified, universal explanations; that expects experiments to be indecisive; that privileges contingencies and contexts; and that not only accepts, but leverages, the fact that a wicked world often requires synthesis instead of analysis, empathy instead of objectivity, reflection over Platonic rationality, complexity and ambiguity instead of order and convention.

Thankfully, the paradigm of Airmen, their *technological logos,* already responds in this way when the organization perceives a period of flux. Therefore, it is not so much a matter of replacing the institution's culture as it is a matter of cultivating the creative tension between continuity and change that happens at that point in the cycle of technological knowledge when *metis* is most operative. Maintaining a sense of perpetual flux will not be easy, but strategists can ease the psychological burden by rebalancing Airmen's paradigm back towards the images of Icarus, Dionysius, and Metis. It may be surprising, but they are a natural part of USAF culture, paradoxically, by virtue of the culture's relationship with Apollo, Daedalus, and Bia.

Epilogue

Around the turn of the century, the US Air Force unveiled "No one comes close" as a recruiting slogan and service motto. It captured both the physical altitude of the domains they operated in (sky and space)

and conveyed a sense of operational dominance. The saying also applies to the distinctive way the institution is shaped by technology. When it comes to descriptions of this culture, the same line is suitable: no one has come close to fully appreciating what it means for Airmen to have a technological mindset. This included the author of this book, as well.

The research and writing for this project did not start with the conclusion in mind. If anything, the intent was to join the chorus of voices lamenting the lack of rigorous thinking among Airmen. Examples would have revolved around quotes from flyers about how " 'unmanly' it is to develop one's intellect" or how a former general officer bluntly stated, "I am a professional fighter pilot, and getting a PhD is a nice thing to do, but it has nothing to do with flying and fighting."[50] There was no expectation to find periods of anything but exaggerated emphasis on techno-scientific rationality, bureaucratic self-interest, and obsession with technological artifacts. Likewise, Greek mythological metaphors were initially meant as literary flourish, not the principles to organize the argument. Storytelling was meant to be an example of fallacious logic, not a central mode of human cognition.

As it turned out, playfulness, storytelling, and unconventional connections guided the style of this work as much as its substance. It became a narrative about technological stories and those who tell them, whether ancients or Airmen, as well as a story itself. It is, after all, written by an Airman with three decades of experience in airminded organizations, acculturated to the *technological logos,* doing what Airmen naturally aspire to do: break barriers, tell stories, challenge conventions, and tinker with metaphors, all the while trying to achieve mastery with their machines. Perhaps, if we get closer to understanding this as our cultural heritage, maybe no one really will ever "come close" to matching the performance and prestige of the US Air Force.

Notes

1. Olsen, *Airpower Reborn*. Meilinger writes, "Olsen is one of the dominant voices in airpower history and operations in the world today. His books should be required reading for everyone in uniform." Phillip S. Meilinger, "Book Essay: Airpower Writings of John Andreas Olsen," *Strategic Studies Quarterly* 8, no. 1 (Spring 2014): 147.

2. Sebastian Cox and Peter Gray, *Air Power History: Turning Points from Kitty Hawk to Kosovo* (Portland, OR: Routledge, 2002), xi.

3. Introduction, note 2, and chap 2, note 86.

4. This seems to be a problem among historians, as well. "To make air power comprehensible," Olsen writes, "many have tended to focus on the scientific aspects rather

than to view it in its wider context" (Olsen, *Global Air Power*, xv). This is precisely the criticism levied in Hansen's article (Hansen, "Aviation History in the Wider View").

5. Gray, *Airpower for Strategic Effect*, 199. The rest of the quote is interesting for its connections to other points made in this book: "One suspects that the sheer wonder of airpower has much for which to answer. So great has been that wonder that many of airpower's active advocates have had difficulty accepting, if they even comprehended, the titanium logic that requires airpower to be subordinate to strategy as well as to the character of particular conflicts" (Gray, 199).

6. Henriksen, "Airpower: The Need for More Analytical Warriors," 206.

7. Gray, *Airpower for Strategic Effect*, 11–12. One Airman expressed a similar sentiment, writing, the central "obstacle to writing Air Force doctrine in the past was the rapidity of the development of air power"(Evaluation Division, Air University, staff study, "To Analyze the USAF Publications System for Producing Manuals," 13 July 1948). A 1951 Air War College study noted the same (Air War College, "Command and Employment of Air Forces, World War II and Korea," 1951, 43–44).

8. Harold Winton, "An Imperfect Jewel: Military Theory and the Military Profession," reprinted in *Strategy: Context and Adaptation from Archidamus to Airpower,* edited by Richard Bailey, James W. Forsyth Jr., and Mark O. Yeisley (Annapolis, MD: Naval Institute Press, 2016), 54; Rich Ganske, "Theory Properly Constructed," 27 May 2014, https://medium.com/@richganske/theory-properly-constructed-c7826e65f6, accessed 17 September 2017; Phillip S. Meilinger, *Airmen and Air Theory: A Review of the Sources* (Maxwell Air Force Base, AL: Air University Press, 2001), 97. Certainly, the US Air Force is not the only service that receives such criticism. Another Airman writes, "As an institution, the military largely discourages independent thought and critical inquiry. This is an unfortunate, self-defeating contradiction for a profession whose raison d'etre is closely tied to outwitting adversaries and grappling with uncertainty" (Gregory D Foster, "Reading, Writing, and the Mind of the Strategist," *Joint Force Quarterly* [Spring 1996]: 112). Nor is this a recent indictment: "The Air Force has never boasted a high percentage of scholars . . . . Air activities have most often attracted men of active rather than literary leanings, and the more methodical minds have been needed for technological application" according to another Airmen in 1947 (Noel F. Parrish, "New Responsibilities of Air Force Officers," *Air University Quarterly Review* 1, no. 1 [Spring 1947]: 29–41). In contrast to these critiques, many of the ideas throughout this book came from the writings of airmen.

9. Drew, *Recapitalizing the Air Force Intellect*, 62.

10. MacIsaac, "Voices from the Central Blue," 624. Of course, there is a narrative that this apolitical techno-rationalism and a "scientific way of war" define the strategic culture of the entire US defense establishment (Antoine J. Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity,* New York: Columbia University Press, 2009, 2–3; Thomas G. Mahnken, *Technology and the American Way of War Since 1945,* New York: Columbia University Press, 2010, 5; Hughes, *American Genesis*, 97; Milan Vego, "On Military Theory," *Joint Forces Quarterly* 62, no. 3 [July 2011]: 59; and Ralph Sanders, "Technology in Military Strategy: A Realistic Assessment," *Technology in Society* 5, no. 2 [1 January 1983]: 147). In 1958, an Airmen and former commandant of the Air Command and Staff College stated, "We try to make our doctrine and strategy conform to glamorous hardware, instead of studying modern conflict to find acceptable solutions from which to establish the hardware requirements we need" (Lloyd P. Hopwood quoted in Futrell, *Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force 1907–1960*, vol. 1, 9.

11. MacIsaac, "Voices from the Central Blue," 647.

12. Robin D. S. Higham, *Air Power: A Concise History*, Enl., 2nd ed. (Manhattan, KS: Sunflower University Press, 1984), 233; and Harris, *America, Technology and Strategic Culture*, 2. Harris writes that the most extreme example of strategy replaced by technology is Network-Centric Warfare (NCW)/Effects Based Operations (EBO) and "the fundamental problem with the NCW/EBO—and, indeed, with America's defence transformation writ large—is that it centres on technology at the expense of other dynamics, most noteworthy the human dynamic" (Harris, 2).

13. Laudan, *The Nature of Technological Knowledge*, 12. When, in 1984, Lauden points to the need for an understanding of how technology shapes organizational culture, she stipulates that such an approach requires "unconventional" historical analysis. Likewise, Edwards, Detienne, and Vernant all capture the tacitness and pliability of their subject matter—respectively, closed world metaphors in Airmen's Cold War discourse and *metis* in Greek culture—by infusing their explanations with the same style as their subjects (Edwards, *The Closed World*, 27–41; Chia and Holt, *Strategy without Design,* 194). As explained later in this conclusion, this author attempts the same, to some degree.

14. Lindblom, "The Science of 'Muddling Through,'" 80–81. According to Charles Lindblom, "muddling through" is the preferred alternative to the rationalistic approach The short-term perspective and incremental nature of "muddling through," however, make it equally inappropriate as a way to execute military strategy. Instead, strategists should consider Etzioni's "mixed-scanning" model that, in the words of political scientist Robert Jervis, advances "towards goals indirectly with multiple policies" and should expect surprises along the way (Etzioni, "Mixed-Scanning: A 'Third' Approach to Decision-Making," 385–386 and Jervis, "Complexity and the Analysis of Political and Social Life," 586–587, 592).

15. Williams, "Opening the Big Box," 104.

16. Olsen writes, "To think clearly about the future, we need to know where air power came from and how it developed into what it is today," and, elsewhere, airmen need "a framework for thinking about air power in a sociocultural context" (Olsen, *Global Air Power*, xviii; and Olsen, *Strategic Air Power in Desert Storm*, 272). Gray expresses the same sentiment (Gray, *Airpower for Strategic Effect*, xv).

17. According to organizational theorist Edger Schein, culture can be defined as "a pattern of shared basic assumptions learned by a group, as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems." It exists on a spectrum from the overt to the covert and Schein divides this into three levels of increasing depth. The first is the "Artifact" level, which contains visible phenomena such as behaviors, products, statements, and symbols. "Espoused Beliefs and Values" are the "ideas, goals, values, aspirations; ideologies; [and] rationalizations," which are less tangible than superficial artifacts but more explicit than the deepest level, "Basic Underlying Assumptions." This is the category containing implicit solutions, broad paradigms that cannot be easily confronted, and pervasive cognitive frameworks not subjected to debate. Schein, *Organizational Culture and Leadership*, 14–18, 23–28). *Technological logos* describes all three levels in the US Air Force.

18. Jason M. Trew, "Fiction in Military Education: Ender's Game as a Case for Fiction in PME" (master's thesis, School of Advanced Air and Space Studies, 2015), 65.

19. Such critics believe military historian Martin van Crevald's assessment obtains: "Technology does not just represent an assemblage of hardware but a philosophical system. As such, technology affects not only the way war is conducted and how victory is sought, but the very framework that we use for thinking about it."

Martin Van Creveld, *Technology and War: From 2000 B.C. to the Present* (New York: Touchstone, 1991), 233.

20. Neil Sheehan, *A Fiery Peace in a Cold War: Bernard Schriever and the Ultimate Weapon* (New York: Vintage Books, 2010), xv–xviii; and Futrell, *Ideas, Concepts, Doctrine*, 205. In a line that resonates with Joseph Corn's idea of the "winged gospel," Sheehan called Arnold "the evangelist of technology" (Sheehan, xvi).

21. Consider the astounding differences between the Wright Flyer and four-engine, high-altitude bombers with cutting-edge targeting systems, able to navigate visually and electronically over long ranges. Pursuit aircraft were also evolving rapidly, getting faster, more durable, more maneuverable, with more firepower and better ability to communicate within their formations and with ground forces.

22. Gray, *Airpower for Strategic Effect*, 298. He goes on to write that, "It is not inevitable that air forces must err in this way, but the theory of airpower should alert air persons to the inalienable danger" (Gray, 298). This book is meant to add depth to this warning.

23. Atwill, *Rhetoric Reclaimed*, 103–4, 114. The myth of fire and technology he bestowed on humanity highlights a final linkage to the notion of *metis* and the post-Platonic paradigm, as some authors describe *metis's* polymorphism and power using the metaphor of fire (which earlier provided an image of technology). In the case of Detienne and Vernant, they use the ubiquitous role of fire in Greek myth as an analogy to the ubiquitous role of *metis* (Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 281).

24. Gray, *Airpower for Strategic Effect*, 291.

25. Edwards, *The Closed World*, 34.

26. Hansen, "Aviation History in the Wider View," 644.

27. De la Bère, *Icarus: An Anthology of the Poetry of Flight*, 187.

28. Singer, *Like Sex with Gods*, 183. Likewise, aviation historian Richard Hallion observes that "from the dawn of time people around the globe have expressed the dream of flight, emphasizing the incredible and depicting aerial powers as an element of religion, mythology or war" (Hallion, *Taking Flight: Inventing the Aerial Age*, 3). Laufer warns against the denigration of aviation's "mythological and legendary period," noting "and what, after all, is the difference whether the Daedalus story is true or not? It is not the gray, cold, naked objective truth that counts in the history of mankind and will advance the cause of civilization, but it is the flight of human imagination, the impulses and visions of a genius, very often his errors and miscalculations, which have stimulated inventions and progress. Ever since Daedalus' alleged or real flight men in Europe have tried and died until finally success was insured" (Laufer, The Prehistory of Aviation, 8, 63). Another line is interesting given this book's use of *The Iliad* and *The Odyssey*: "No historian's pen has preserved a record of the Trojan War, but Homer has sung it in the form of epic poetry which has been enjoyed by a hundred generations and which has been more often read than any accurate report of a war published by the competent staff of any war ministry . . . it is just man's ingrained love for the fabulous and fanciful, for the wondrous and extraordinary to which we are indebted for the preservation of ancient records of flight" (Laufer, The Prehistory of Aviation, 10).

29. Greeks are an obvious place to start, according to political scientist Christopher Coker, (Christopher Coker, *Waging War Without Warriors?: The Changing Culture of Military Conflict,* Boulder, CO: Lynne Rienner Pub, 2002, 16.) References are not just frequent in Western culture, but specifically mentioned in US Air Force history. Some examples include Project Aphrodite, the Atlas missile, C-130 Hercules, Gorgon Stare sensor system, Air University Press monograph title *Apollo's Warriors*,

and the name of USAF Academy Cadet Squadron 03, Cerberus. Lawrence Freedman identifies ancient Greek culture as the key source for the art of strategy and, in fact, a book by SAASS faculty reflects this in both its subtitle and in James Tucci's chapter presenting strategic education in terms of Plato's dialogues (Freedman, *Strategy: A History*, 22; and Bailey, Forsyth, and Yeisley, *Strategy: Context and Adaptation from Archidamus to Airpower*, 75–96). Of course, throughout world history there are corollaries to the Greek ideas discussed herein (see Mitcham, *Thinking through Technology*, 117; Freedman, *Strategy*; Mumford, *Technics and Civilization*, 46; Hodgson, *The History of Aeronautics in Great Britain*, 53–58; Laufer, The Prehistory of Aviation, 11–14; "Theft of Fire," *Wikipedia*, 27 August 2017, https://en.wikipedia.org/w/index.php?title= Theft_of_fire&oldid=797541994, accessed 30 January 2018; and Raphals, *Knowing Words*.

30. Wheeler, *Stratagem and the Vocabulary of Military Trickery*, 51; and Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 93.

31. Homer, *The Odyssey*, quoted in Brian Boyd, *On the Origin of Stories*, 277.

32. Detienne and Vernant, *Cunning Intelligence in Greek Culture and Society*, 177–85. There is abundant literature on Athena's connections to technology, war, *metis,* and two aforementioned characters, Prometheus and Hephaestus (Detienne and Vernant, 179, 180, 183; Raphals, *Knowing Word*s, 217; "Athena—Greek Goddess of Wisdom, War & Crafts," Theoi Greek Mythology, accessed 30 January 2018, http://www.theoi.com/Olympios/Athena.html).

33. Homer, *The Odyssey*, quoted in Freedman, *Strategy, 24.*

34. Homer, *The Iliad*, 2.270–3.

35. Homer, *The Odyssey*, trans. Samuel Butler (MIT Classics, 2014), http://classics.mit.edu/Homer/ odyssey.html, 8.493–4, 5.234–57. Lisa Raphal points out that the notion of "following straight along a line," is a technical term in navigation and in shipbuilding that also applies to archery, the *techne* Odysseus employs in his final victory over the suitors who invaded his home during his absence (Raphals, *Knowing Words*, 193).

36. According to Barnouw, Odysseus's *metis* was as much "visceral as intellectual"; not merely an "impassive weighing of alternatives," but a strategic arrangement of ways and means to secure an advantage (Barnouw, *Odysseus, Hero of Practical Intelligenc*, 2, 33.)

37. Homer, *The Odyssey*, quoted in Boyd, *On the Origin of Stories*, 276.

38. Boyd, 252.

39. Many authors corroborate this assertion (Scott, *Seeing like a State*, 315; Wheeler, *Stratagem and the Vocabulary of Military Trickery*, 25; Raphals, *Knowing Words*, xiii; Creveld, *Technology and War*, 77, 310, 316; Jacob W. Kipp and Lester Grau, "Military Theory, Strategy, and Praxis," *Military Review* (March–April 2011), 20; Trew, "Fiction in Military Education," 28–9; Gray, *Airpower for Strategic Effect*, 37; and Freedman, *Strategy*, 43. Bousquet writes, "The most effective forms of warfare have therefore always included recognition of the inherent unpredictability that accompanies the use of military force and built into military organization a tolerance to uncertainty and even a capacity to profit from it" (Bousquet, *The Scientific Way for Warfare*, 242).

40. Sun Tzu, *The Illustrated Art of War: The Definitive English Translation by Samuel B. Griffith* (New York: Oxford University Press, 2005), 9. The author is aware of the extension of *metis* beyond the typical association with duplicity, deceit, and disguise. Such denotations often place *bia* and *metis* as polar opposites, whereas the argument herein is about how wisdom should sit over and direct forces (just as it guides technique, or as subjectivity guides the objective).

41. Raphals, *Knowing Words*, 192. In *The Iliad*, it is Odysseus, in fact, who pleads for what their forces most need at that moment, which is the violence of Achilles (Gregory Nagy, *The Best of the Achaeans*, 48). Furthermore, upon returning home, Odysseus shows his own might as the only one among the suitors who can restring his bow, which he then uses to kill them (Nagy, 317).

42. Freedman, *Strategy*, 28. In one sense, *The Odyssey* is not just a physical journey but the main character's journey towards greater humility—indeed, his hubris with the Cyclops is what delays his return by a decade but also what gives him time to develop his "character."

43. Williamson Murray and Mark Grimsley, "Introduction: On Strategy," in *The Making of Strategy: Rulers, States, and War*, edited by Murray, MacGregor Knox, and Alvin Bernstein (Cambridge, 1994), 1.

44. Freedman, *Strategy*, xii.

45. Tadd Sholtis, *Military Strategy as Public Discourse: America's War in Afghanistan* (New York: Routledge, 2013), 5.

46. Eliot A. Cohen, *Supreme Command: Soldiers, Statesmen, and Leadership in Wartime* (New York: Free Press, 2002), 33. Although not addressed in this book, this should also include the use of communication externally (Emile Simpson, *War From the Ground Up: Twenty-First Century Combat as Politics,* New York: Oxford University Press, 2012).

47. Everett Dolman's line makes strategists sound like storytellers: "the strategist makes sense of the world in terms of abstract causal relationships and aggregate perceptions" (Everett Dolman, *Pure Strategy*, 14). Lest the reader forget, there is the underlying *metis* of Homer himself (Raphals, *Knowing Words*, 211).

48. Air Force Doctrine Document (AFDD) 1–1, *Leadership and Force Development* (8 November 2011), 59. Arnold himself promoted the officer's duty to "tell the story," and retired four-star Gen William Momyer wrote in 1978 that "an extremely high premium must be placed on the Airman's ability to articulate options thoroughly and clearly" (Arnold quoted in Futrell, *Ideas, Concepts, Doctrine*, 138; and William W. Momyer, *Airpower in Three Wars* [Maxwell Air Force Base, AL: Air University Press, 1978], 379).

49. For a modern example David Culkin states: "A strategist, then, links policy to operational planning. He or she attempts this by effectively merging creative methods from literary theory with conceptual models to formulate meaningful narratives. The story must describe how the ends-ways-means outlined will produce the desired effects in time and space. Linking these conceptual frameworks to realistic application requires developing and personally selling the *strategic narrative* that describes how the ways and means accomplish the ends . . . . Strategists must link policy narratives to strategic narratives by writing fiction where intelligence and guidance fall short" (David Culkin, "Discerning the Role of the Narrative in Strategy Development," *Military Review* [January–February 2013]: 62–63). This and many other examples are in Trew, "Fiction in Military Education."

50. Edward C. Mann, *Thunder and Lightning*, 194; and Olsen, *John Warden and the Renaissance of American Air Power*, 118.

Abbreviations

ACSC	Air Command and Staff College
AFIT	Air Force Institute of Technology
AFM	Air Force Manual
AOR	Area of Responsibility
AS	Aero Aquadron or Air Superiority
ATO	Air Tasking Order
AWPD	Air War Plans Division
C2	Command and Control
CAS	Close Air Support
CENTCOM	Central Command
CENTAF	Central Command Air Forces
CINCCENT	Commander-in-Chief Central Command
COIN	Counterinsurgency
CSAF	Chief of Ctaff of the Air Force
EBO	Effects-Based Operations
FM	Field Manual
FS	Fighter Squadron
OPLAN	Operation Plan
ODS	Operation Desert Storm
RAF	Royal Air Force
RFC	Royal Flying Corps
SAASS	School of Advanced Air and Space Studies
SAC	Strategic Air Command
SCOT	Social Construction of Technology
SHOT	Society for the History of Technology
SIOP	Single Integrated Operational Plan
TAC	Tactical Air Command

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Index

JASON M. TREW, PHD

Col Jason "TOGA" Trew grew up in the New Orleans area, watching airliners fly in and out of the Louis Armstrong International Airport. Enthralled by the F-15 Eagles from the local Air National Guard unit and the dream of flying them himself one day, he eagerly joined Civil Air Patrol (CAP) at 11 years old. He was promptly issued an Aerospace Education textbook, which contained the story of Icarus and Daedalus on the opening page. He later won a scholarship—named after the mythological father—that provided flying lessons (even before he was licensed to drive) and a good excuse to (sometimes) skip school. Despite some moments too close to the sun, Colonel Trew was accepted into the United States Air Force Academy then managed to graduate in 1999. His military career includes flying the F-15C and the T-6, teaching at Air University, and leadership positions in the organizations mentioned in this book: Air Command and Staff College, Squadron Officer School, and the School of Advanced Air and Space Studies. He earned a history PhD from Auburn University with a focus on the history of technology. Colonel Trew currently lives in Pike Road, Alabama, with his wife and their three sons.

With the powerful imagination and precise intellect of a true Airman, fighter pilot and strategist Dr. Jason "TOGA" Trew takes us from "syndrome to solution" by drawing out the essence of Airmindedness…how the incredible physical and psychological effects of Airpower are brought about by Airmen whose technical mastery and love of machines are inextricably paired with a masterful imagination born from the love of slipping "the surly bonds of Earth," breaking through limits, and doing "a hundred things you have not dreamed of"…to win!

- Maj. Gen. Brook J. Leonard, Chief of Staff, United States Space Command, Peterson Air Force Base, CO

The US Air Force has for decades struggled to define itself and its Airmen, opening the service to critiques that it is too enamored with and beholden to its individual technologies. In The Icarus Solution, *Trew confronts these aspersions directly and offers a fresh perspective to help the service escape from its Daedalian maze. Relying on the Airmen's own stories, Trew skillfully and entertainingly interweaves different historiographical approaches, including etymology and the history of science and technology, organizational theory, and Greek mythology to reveal the dominant paradigm that has and continues to define American Airmen*—technological logos. *Rather than continuing to search for a rational, objective, and universal theory of airpower, Trew instead urges the US Air Force to embrace the underlying creative and playful tendencies that for centuries drove men and women toward the heavens. For Trew, Icarus is not a syndrome of service ineffectiveness, but a key solution to reinvigorate an airminded culture that stands ready and able to adapt to any future challenge.*

Current and future airpower leaders would be well-served to read and heed his call.

- Col Steven Fino, PhD, USAF, Ret., author of *Tiger Check: Automating the US Air Force Fighter Pilot in Air-to-Air Combat, 1950-1980.*

The Icarus Solution *is a compelling book for anyone interested in the nexus of culture, technology, and strategy in the development of Airmen. Dr. Trew demonstrates how the story of Icarus flying too close to the sun has become an outdated trope throughout the Air Force. He explores the new complexities of educating officers and the pressing need to develop a mindset that views innovation as more than just emerging technology. In the process, Dr. Trew gives us a way forward and rehabilitates the metaphor of Icarus.*

- Jeff Degaff, Professor, Ross School of Business, University of Michigan

The Icarus Solution *offers a fascinating perspective on the world of aviation: interweaving mythology, philosophy, history, strategy, and play. Not only that, but for me, Colonel Trew's observations about the legitimacy of play in serious pursuits have resonance in many other realms as well."*

- Alison James, Professor Emerita, University of Winchester, Author *The Value of Play in HE: A Study* (2022)

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