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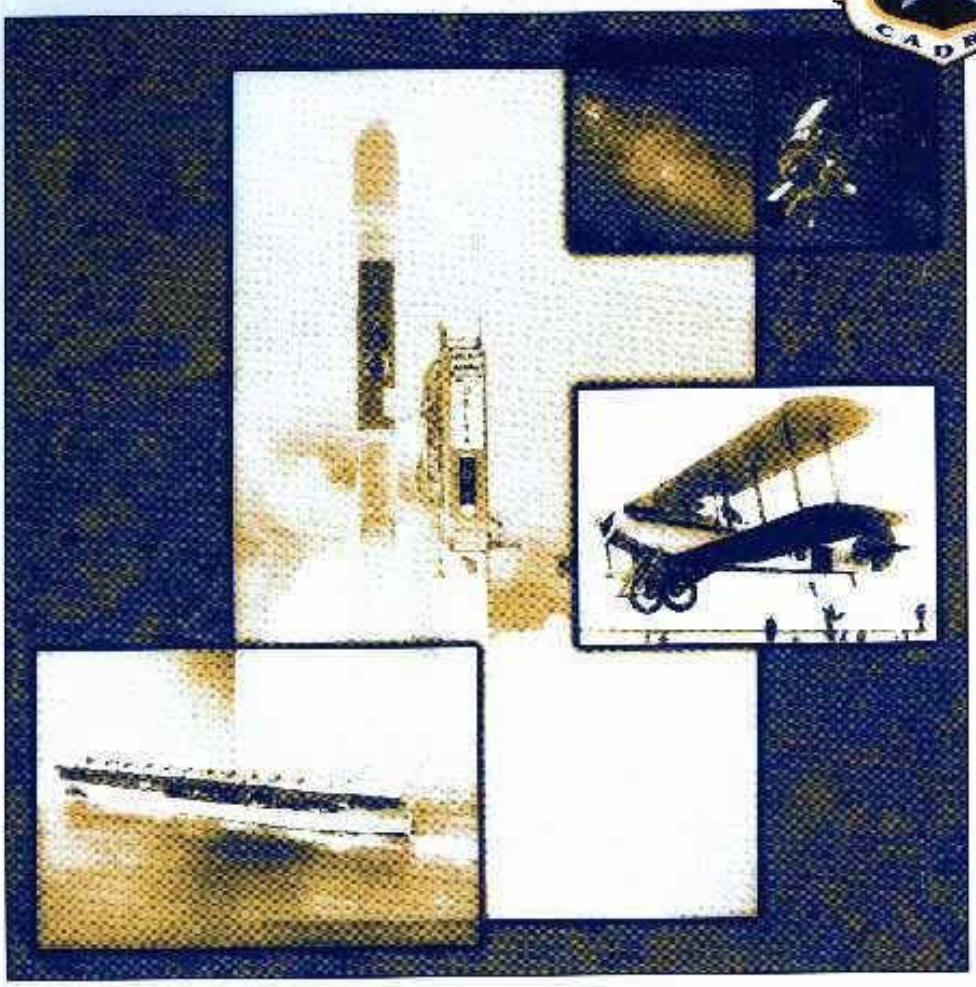

Toward an Air and Space Force

Naval Aviation and the Implications for Space Power

Lt Col Mark P. Jelonek, USAF

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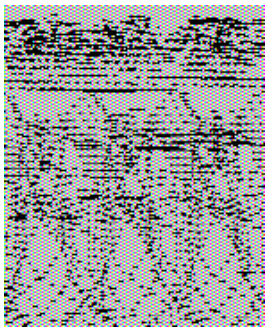

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Foreword

The challenge of transforming the US Air Force into a truly integrated *aerospace* force is a pressing issue for our service. In *Toward an Air and Space Force: Naval Aviation and the Implications for Space Power*, Lt Col Mark P. Jelonek uses the historical analogy of the US Navy's integration of aviation during the interwar period as a possible model for the comprehensive integration of space into the operational Air Force.

Defining integration as "the evolutionary process by which a new technology (aviation in the Navy and space power in the Air Force) becomes an inseparable part of the military service," Colonel Jelonek describes the various policies pursued by the sea service to integrate aviation into the fleet. He contends that five policies proved indispensable to that process:

(1) promoting broad understanding of aviation within the naval establishment;
(2) demonstrating that aviation enhanced rather than threatened the battleship's place as the premier naval weapons system of the day;
(3) creating a career path that allowed aviators to attain senior rank;
(4) ensuring that aviators remained fully conversant with surface operations; and
(5) incorporating aviation into naval war games.

Arguing that similar practices could facilitate metamorphosis of the Air Force into a true air and space force, Jelonek employs the integration policies pursued by the interwar Navy (appropriately rephrased for contemporary airmen) as a device for measuring the Air Force's progress in integrating space into its own operational mainstream. He finds such progress has been uneven at best and cites as major impediments the lack of an official plan for air-space integration, the suspect (to aviators) operational credibility of many space officers, and an institutional tendency to mistake technological adaptation for organizational transformation. The author's proposals for overcoming these difficulties and for promoting the full integration of space power—and space power practitioners—merit serious reflection.

Toward an Air and Space Force originally was written as a master's thesis for Air University's School of Advanced Air-power Studies. The College of Aerospace Doctrine, Research, and Education is pleased to publish Colonel Jelonek's study as a *CADRE Paper* and thereby make it available to wider readership in the Air Force and beyond.

JAMES TITUS
Dean of Research
Air University

About the Author

Mark P. Jelonek

Lt Col Mark P. Jelonek received his commission through the Reserve Officer Training Corps at the Pennsylvania State University in 1985 and was first assigned as a student at the Air Force Institute of Technology at Wright-Patterson Air Force Base (AFB), Ohio. He earned a Master of Science degree in Engineering Physics in 1986 and a Doctorate of Philosophy in Physics in 1989. He was then assigned to the Starfire Optical Range of the Phillips Laboratory at Kirtland AFB, New Mexico, where he was chief of the experiments section for atmospheric compensation experiments for the ground-based laser anti-satellite program from 1989 to 1992. He served as chief of Standardization and Evaluation for the 12th Space Warning Squadron, Thule Air Base, Greenland, from 1993 to 1994. From 1994 to 1996, he was assigned to the 11th Space Warning Squadron, Falcon AFB, Colorado, as the Operations Support Flight Commander. Colonel Jelonek graduated from the School of Advanced Airpower Studies (SAAS) in 1998 and is assigned to the Strategy, Concepts, and Doctrine Division, Deputy Chief of Staff, Air and Space Operations, Headquarters United States Air Force, Washington, D.C.

Acknowledgments

My satisfaction with this work is a reflection of the efforts of the people who devoted their time and effort to make it respectable. First and most important, my research advisor, Dr. David R. Mets, not only provided outstanding guidance but also motivated me to exert a maximum effort. He freely shared his time, wisdom, and even some relevant anecdotes from his marvelously rich career. He treated me as a colleague and a friend more than as a student. Thank you, Dr. Mets, for entrusting me with some of the fire and passion you carry as an Air Force officer and patriot. Lt Col Roy Houchin, my reader, improved my work by sharing his youthful enthusiasm and willingness to talk about space power. Dr. Harold Winton of the SAAS faculty shoved me in the right direction and got me started on this project. It is rare to have the honor of studying under such an accomplished warrior and scholar. Dr. Jeffery Barlow at the Naval Historical Center took time from his schedule to clarify an obscure fact in naval history. Dr. James S. Smith at the US Air Force Academy, Capt Rhonda Carey at Officers Training School, Capt James “Buddy” Holley at the Air and Space Basic Course, Capt Brent Barber at Squadron Officers School, and Capt Michael L. Lakos at the Air Force Wargaming Institute provided information important to this study. I would like to extend a special thanks to Lt Col Gregory Billman at the Air Force Weapons School and Lt Col D. Tom Clark, formerly of the Air War College. Both provided invaluable information that profoundly shaped the conclusions of the study. Cdr Richard Bohner responded to my electronic distress signal to help me understand aviation careers in the US Navy today. I would like to give a special thanks to all my classmates at SAAS who cheerfully answered my endless questions and accepted me as one of them. A few lines of text are completely insufficient to compensate my ever-understanding wife, Linda, for letting me work on this project instead of spending time with her. Finally, thank you, Pipper Dog, for making me play ball even when I was busy and for never saying my ideas were stupid.

Chapter 1

Introduction

"We are now transitioning from an *air* force into an *air and space* force on an evolutionary path to a *space and air* force."[1] Less than two years after announcing this latest vision, the Air Force changed the terminology from "air and space" to "aerospace." The vision is certainly plausible, but there is a tremendous difference between adopting a particularly appealing bumper sticker slogan and implementing a real plan to accomplish the transition to an aerospace force.

This project looks to the history of US naval aviation to determine if the effort to integrate aviation into the Navy from 1921 to 1941 provides a suitable framework for the Air Force to emulate as it integrates space into Air Force operations. The intent of this comparison is to measure the progress of space integration into the Air Force against this historical precedent, to identify areas suggested that would benefit from increased attention, and to recommend improvements that could facilitate the integration of space power into the Air Force.

Global Engagement's call to integrate space into the Air Force is the third such initiative since 1989.[2] That the Air Force began such a course of action again in 1997 implies that it did not fully integrate space during the previous two attempts. Remarks from the most senior levels of the Air Force suggest that the latest integration program is off to a slow start. Early in his tenure as chief of staff of the Air Force, Gen Michael E. Ryan said the concept of becoming a space and air force is a "good road map, a good glide path for us. It's now up to us to go out and execute it."[3] Gen Howell M. Estes III, former commander of Air Force Space Command, said, "I would have to say that the Air Force still has a long way to go in becoming an air and space force, much less a space and air force, and that's not a surprise to anybody."[4] Maj Gen William E. Jones, former Fourteenth Air Force commander (the Air Force's space component), said, "virtually nothing has transpired which indicates that the Air Force is actually serious about moving out on transitioning to an Air and Space

Force."[5] Judging from these cautious endorsements, the Air Force might well benefit from an exploration of the past to help set a course for the future.

The US Navy changed the basic structure of naval operations by integrating aviation into the fleet during the interwar years. Naval aviation emerged from World War I with great promise and great expectations. Many thoughtful proponents of aviation within the Navy patiently wove airpower into the fabric of fleet operations. The triumph of naval airpower and the aircraft carrier over the enemies of the United States in World War II provides powerful evidence attesting to the success of aviation's integration into the Navy. Few could argue against the notion that naval aviation and the aircraft carrier *are* sea power today. If this inextricable connection between airpower and the fleet is the same objective the Air Force envisions for air and space, then a study of the Navy's integration of aviation may well reveal useful trail markers along the Air Force's evolutionary path to a space and air force.

Assumptions

The arguments in this paper stand on four assumptions. The Air Force vision statement from *Global Engagement* admits of two: first, air and space are presently not sufficiently integrated into Air Force operations and, second, space power will not evolve into an independent military service in the near term. The other two assumptions involve naval aviation and historical analogy: first, no effort is made to prove that the US Navy did successfully integrate aviation into naval operations during the interwar years (the record of naval aviation during World War II, Korea, and Vietnam—and the character of the US fleet today—provide their own proof) and, finally, the historical precedent of integrating naval aviation is relevant to the integration of space power into the Air Force.

Limitations

Related to these assumptions are six limitations adopted to focus the research and argument of this project. The paper does not tackle the issue of deploying weapons in space. Whether in naval aviation or in space, a weapon is just one of

several means of exerting power in warfare. There is no judgment on the merits of creating a separate space force. The naval aviation analogy was purposely chosen because airpower in the Navy never evolved into an independent service. The time period for the naval case study spans from the creation of the Bureau of Aeronautics in 1921 to the attack on Pearl Harbor in 1941. The Bureau of Aeronautics gave aviation legitimacy and an institutional permanence that was difficult to marginalize or abolish. Similarly, the paper concentrates on space power from 1991 to the present. This time frame includes Operation Desert Storm, the end of the cold war, and the collapse of the Soviet Union, a period when space power shifted from principally a strategic to a more operational focus. No personality-based inferences or conclusions are drawn, but the intent and validity of the programs sponsored by charismatic people are examined. Finally, the paper emphasizes the role of officers in integration. While an enlisted corps is essential to the success of any military program, the real decision makers, the holders of power and influence, and the ones capable of shaping policy are the officers—especially those holding flag ranks.

Notes

1. Department of the Air Force, *Global Engagement: A Vision for the 21st Century Air Force* (Washington, D.C.: United States Air Force, 1997): 7.

2. The Blue Ribbon Panel on Space Implementation in 1989 and the Blue Ribbon Panel on Space chaired by Lt Gen Thomas S. Moorman Jr. in 1992 made similar recommendations for the integration of space into Air Force operations. These two plans are discussed in greater detail in chap. 4.

3. Quoted in John A. Tirpak, "The Chief Holds Course," *Air Force Magazine* 81, no. 1 (January 1998): 38.

4. Gen Howell M. Estes III, transcript of interview by Bill Scott, *Aviation Week & Space Technology*, 4 December 1997.

5. Maj Gen William E. Jones, commander Fourteenth Air Force, memorandum to Maj Gen David W. McIlvoy, Headquarters USAF/XPX, subject: "White Paper on Space in the USAF," 22 December 1997.

Chapter 2

Propriety of Historical Analogy

From the past, the future. The motto of the United States Air Force School of Advanced Airpower Studies implies that knowledge and understanding of yesterday's events will help influence the actions and policies of tomorrow. Indeed, if there is no utility to the study of history, then that expansive endeavor is nothing more than a hobby—an idle pastime. Nevertheless, there is some justification for using historical analogies to guide policy. To explore this idea, we will summarize some recent thought on using historical analogies and discuss the possible value to be derived from historical comparison. To explore this idea, the discussion will summarize some recent thought on using historical analogies and will determine the possible value to be derived from historical comparison. Then the argument will show that the similarities between naval aviation in the 1920s/1930s and space power in the 1990s are sufficiently compelling to make this comparison an appropriate and instructive historical analogy.

Historical Analogies

Using historical analogies to reinforce an argument is an exercise in the art of persuasion. Analogies allow us to simplify, interpret, and comprehend complex situations by comparing them to better understood and previously analyzed historical examples.[1] New policies are journeys into the unknown. Historical analogies provide maps, charted by previous explorers, that indicate possible courses of action and identify shoals along the way. Analogies help us to assess situations and to provide policy prescriptions. They also aid us in predicting the success of alternative options and in identifying dangers associated with those options.[2]

During the last half of the twentieth century, public officials often relied on historical analogies to guide policy making. President Harry S Truman compared the Communist invasion of South Korea in 1950 to similar aggression by Germany,

Italy, and Japan in the 1930s. Robert Kennedy dissuaded the executive committee from endorsing a preemptive strike on Cuba during the missile crisis of 1962 by labeling such an attack as "a Pearl Harbor in reverse."[3] In an elegant and comprehensive study of decision making in the Johnson administration prior to US entry into Vietnam, Yuen Foong Khong described how references to the Munich Crisis, the Philippine and Greek insurrections, the French defeat at Dien Bien Phu, and the Korean War influenced the perspectives of the cabinet members and essentially determined US intervention policy.[4] Col John Warden, in planning the Instant Thunder air campaign for Operation Desert Storm in 1991, bluntly rejected a reprise of the failed Rolling Thunder campaign employed in Vietnam from 1965 to 1968.[5]

Historical analogies offer policy prescriptions and help evaluate alternatives, but they are accompanied by risk. Inappropriate analogies fail to illuminate a situation and poor analogies emphasize superficial or irrelevant similarities.[6] Risk increases when policy makers neglect important differences between an analogy and the current situation. There is also a strong tendency to adhere to an appealing analogy despite evidence that the analogy is inappropriate.[7] Given these provisions, precedents, and warnings, the planner must determine whether the analogy is suitable for a given set of circumstances.

There are no approved formulae that conclusively determine the propriety of an historical analogy for a particular situation—but there are tests that might uncover shortcomings, limitations, or dissimilarities. The most important step is to determine the nature and context of the problem or situation. The problem presented in chapter 1 is the integration of space power into Air Force operations. There are several potential historical analogies to compare to the integration of space power into the Air Force—the Army Air Corps in the Army, the Marine Corps in the Navy, helicopter aviation in the Army—but this study investigates naval aviation in the interwar Navy. The most convincing step in the assessment process is to list similarities and differences between the historical analogy and the situation under examination.[8] Unfortunately, this process is only persuasive. It does not and cannot prove any particular analogy is more appropriate than another, but comparing

similarities and differences *can* reveal factual mistakes that might unravel potentially misleading analogies.[9] In the end, persuasion depends on the similarities substantially outweighing the differences.

Similarities and Differences

There are striking similarities between the domestic and international political environments of the interwar years and the 1990s. In addition, there are similarities between the military structure, doctrine, and technologies for naval aviation and space power. The following 10 similarities are intended to be persuasive and stimulating rather than exhaustive.

1. US naval aviation endured its first sustained combat test during World War I. Naval aircraft had participated in combat during the Vera Cruz incident in 1914, but that two-day affair was little more than a demonstration for a handful of aircraft. Desert Storm marked a fundamental change in the philosophy of space power. Elements of space power participated in earlier military operations, but most space assets were designed to fight the cold war. After Desert Storm, the focus shifted from cold war to the support of military operations.
2. All nations share the freedom to navigate the world's oceans outside territorial boundaries. President Dwight D. Eisenhower crafted policies to establish and maintain the freedom of space so unarmed military satellites could fly freely over any country.[10] The Vanguard program was designed to place a civilian satellite in orbit and to demonstrate the freedom of space, but the Soviets' launch of *Sputnik I* in October 1957 established the precedent Eisenhower sought.[11] Eisenhower's refusal to deploy weapons in space and the idea of the freedom of space profoundly influence US space policy today.
3. In its democratic and isolationist tradition, the United States government dramatically reduced military spending following World War I. The Navy had to divide its shrinking slice of the defense budget between aviation and surface forces. Following Desert Storm and the sudden end of the

cold war, space power, too, had to compete for its share of the continually contracting defense budget.

4. Democracies generally distrust large standing military forces in peacetime. Following the defeat of Germany in World War I, there was limited public enthusiasm for things military. The resounding victory in the Persian Gulf War, the end of the cold war, an all-volunteer military force, and the ever-elusive promise of a "peace dividend" have all combined to drain public support from the military since the late 1990s.
5. With the defeat of the Kaiser's Germany in 1918, there was no imminent threat to US security or its vital security interests. The imperfect peace with Germany and the rising sun of Japanese imperialism were distant menaces. After the collapse of the Soviet Union in 1991, the most prominent threat to the United States vanished. Iran, Iraq, North Korea, and the People's Republic of China currently pose only indirect threats to vital security interests.
6. In the 1920s, there was a limited commercial market for military aviation products, so the aviation industry depended on government orders for survival. Although the market for space services is growing, current entry-level costs are exorbitant; few organizations other than governments can afford to participate. Like aviation in the 1920s, however, the commercial space market appears to be on the verge of expansion.
7. In the early days of wood and fabric biplanes, naval aviation was principally an auxiliary to the fleet. Aircraft conducted scouting, aerial spotting, and reconnaissance missions in support of battleships. For political rather than technological reasons, space power is an auxiliary to the combat Air Force. Space missions include reconnaissance, warning, communications, and navigation. Neither naval aviation nor space power began as primary means for delivering destructive power to the enemy.
8. Senior naval officers trained and blooded in the battleship Navy held nearly all leadership positions and controlled naval policy. Flying officers hold most of the sen-

ior leadership positions in the Air Force; many saw combat in the air over Vietnam.

9. Aviation was an element of warfare completely alien to the traditional role of the sea service; that is, aircraft could influence the outcome of a surface battle before the opposing fleets ever exchanged gunfire. The fundamental characteristics of warfare in the air (speed, range, flexibility, elevation) are essentially the same as those of space—but the manner in which satellites exploit those characteristics is different from that of aircraft. Somewhat simplistically, satellites accelerate to slow down and do not immediately change direction when they turn. Warfare in space is as alien to airpower as aviation was to war at sea.
10. The last is possibly the most appealing similarity between the two cases. The Navy gradually integrated aviation fully into naval operations over the course of 20 years. Aviation became neither a separate corps within the Navy nor a service independent from the Navy. The Air Force's implicit position, supported by the *Global Engagement* vision statement, is that space will not evolve into either a separate corps or independent service in the near term.

♦ ♦ ♦

Several significant differences distinguish naval aviation in the interwar years from space power at the end of the century. The following discussion illustrates three.

1. The state of naval aviation development in the 1920s was comparatively more immature than the state of space power development in the 1990s. By 1921, man had been flying for less than 18 years. Aircraft could barely haul a 1,000-pound bomb aloft—certainly not from the deck of an aircraft carrier. Naval aircraft could competently perform the scouting, spotting, and reconnaissance missions, but communications between ship and aircraft were primitive. Pilots initially relied on homing pigeons to deliver scouting reports back to the fleet. Despite visionary claims, aircraft were incapable of replacing the battleship as the Navy's primary instru-

ment of power projection. In contrast, space power in 1998 has existed for over 40 years. An intercontinental ballistic missile (ICBM) can hit a target from half a world away with greater accuracy than a B-17 could drop a bomb from 20,000 feet during World War II. Satellites are complex, reliable, and extremely capable military platforms. Politics, not technology, prevents the military from delivering firepower from and through space.

2. During the early years of aviation, there was freedom for individual experimentation and innovation with aircraft and their roles in warfare. Capt Joseph Mason Reeves implemented flight operations on the USS *Langley* that he had discovered in war games at the Naval War College. Jimmy Doolittle performed experiments in instrument flying, Carl Spaatz and Ira C. Eaker demonstrated aerial refueling, and Billy Mitchell conducted the famous bombing tests of the *Ostfriesland*. Today, space platforms continuously perform their operational missions. These precious national assets are carefully managed and controlled. Their value and their remoteness inhibit experimentation except under officially sanctioned and meticulously scrutinized research programs. Innovative airmen may not hop aboard a satellite and make a few test orbits.
3. The battleship admirals were skeptical, if not completely critical, of aviation. The fliers fought a lengthy battle for legitimacy against service resistance. Rear Adm W. L. Rodgers, chairman of the general board in 1922, thought aircraft would interfere with battleship tactics.[12] The chief of the bureau of the budget, Rear Adm Joseph Strauss, believed aviation was not of paramount importance and cut its budget accordingly.[13] Rear Adms William Shoemaker and Richard Leigh refused to consider aviators as any different from other line officers.[14] The space community faces no similar struggle for recognition. The reason might lie in the fact that space power does not yet challenge the flying establishment for preeminence in the Air Force.

It is inefficient to present more than a handful of prominent similarities and differences between naval aviation and space power, and it is probably disingenuous to stack the deck in favor of similarities. Hopefully, the similarities are sufficiently compelling to overcome the differences presented here as well as any others that may exist. Consequently, the reader is the ultimate judge of whether the naval aviation analogy is even appropriate and, if so, whether the derived prescriptions apply to integrating space power into the Air Force. Regardless, the policies and programs employed by the Navy between 1921 and 1941 to integrate aviation into naval operations constitute a compelling case.

Notes

1. Yuen Foong Khong, *Analogies at War: Korea, Munich, Dien Bien Phu, and the Vietnam Decisions of 1965* (Princeton, N.J.: Princeton University Press, 1992), 13.
2. Ibid., 10.
3. Richard E. Neustadt and Ernest R. May, *Thinking in Time: The Uses of History for Decision Makers* (New York: Free Press, 1986), 6.
4. Khong, 133.
5. Richard T. Reynolds, *Heart of the Storm: The Genesis of the Air Campaign against Iraq* (Maxwell Air Force Base [AFB]), Ala.: Air University Press, 1995), 29. Reynolds presents a detailed, if hagiographic, discussion of the development of the Desert Storm air campaign.
6. Khong, 12.
7. Ibid., 221, 223. Khong calls the adherence to inappropriate analogies perseverance.
8. Neustadt and May, 234, 235. These steps in assessing the validity of historical analogies form only a few parts of Neustadt and May's method for using history to assist in determining policy.
9. Ibid., 41, 47, 235.
10. Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program* (Washington, D.C.: Government Printing Office [GPO], 1997), 8.
11. Ibid., 10.
12. Gerald E. Wheeler, *Admiral William Veazie Pratt, U.S. Navy: A Sailor's Life* (Washington, D.C.: GPO, 1974), 202.
13. Archibald D. Turnbull and Clifford L. Lord, *History of United States Naval Aviation* (New Haven: Yale University Press, 1949), 226.
14. William F. Trimble, *Admiral William A. Moffett: Architect of Naval Aviation* (Washington, D.C.: Smithsonian Institution Press, 1994), 198.

Chapter 3

Naval Aviation Integration Policies

The United States Navy, as an institution, understood both the value and the potential of aviation in naval operations early in the development of powered flight. After the end of World War I, the Navy strongly resisted attempts by Brig Gen William "Billy" Mitchell and his followers to absorb naval aviation into a separate and independent air service. An extremely effective defense against such an assault would be to build a naval air service so tightly ingrained and integrated into the Navy that separating aviation would severely and perhaps fatally degrade the combat capabilities of the fleet. Historical evidence suggests that the Navy accomplished exactly that. It fully integrated aviation into fleet operations.

The Integration Process

To integrate means to incorporate, to form or blend into a whole. In this study, integration means the evolutionary process by which a new technology (aviation in the Navy and space power in the Air Force) becomes an inseparable part of the military service. In his study of military innovation, Stephen Rosen defined innovation as a change that forces a primary combat arm of a service to alter its concepts of operation and to abandon or downgrade traditional missions.[1] Integrating a "new way of war"[2] is a logical intermediate stage in Rosen's innovation process, but the principal difference between innovation and integration is that the integration process does not necessarily result in replacing the traditional method of warfare. An integrated technology may help perform existing missions better rather than radically changing them.[3] Therefore, Rosen's ideas on the innovation process can serve as a straw man for integrating new technologies.

Rosen determined that innovation usually proceeds downward from the top of military organizations.[4] Respected senior military officers formulate and implement a strategy for gaining political control over their service on behalf of the new way

of war. Those senior officers champion a new theory of victory that predicts how future wars will be won, and they translate the theory into new tasks that are performed every day in peacetime and in war.[5] For the Navy in the 1920s and 1930s, aviation was the new way of war. Aerial spotting, reconnaissance, air superiority, and, later, surface attack were the tasks by which the Navy measured an officer's effectiveness. As officers skilled in the new way of war ascend in rank and assume positions of command, the distribution of power shifts slowly away from those versed in the old methods (the battleship admirals) toward those proficient in the new technology (the aviators). Only senior military officers hold enough political power within the service to create career paths to senior ranks for officers to learn and practice the new way of war. The protected career path prevents young officers from being shunted into positions that disqualify them from flag rank[6] and provides them positions of influence from which to promote and perpetuate the new method of warfare.

The Navy instituted a number of policies that composed the integration process. For the purpose of this study, a Navy policy is any course of action—whether official, intended, or accidental—that the Navy followed and that affected the integration of aviation into its operations. Some of the policies are those identified by Rosen's innovation process. Others are a collection of recurring initiatives that coalesced into identifiable patterns. All are supported by an abundance of evidence.

Plausible Integration Policies

The Navy Department and the Bureau of Aeronautics pursued a variety of policies that, on the surface, appear as if they aided the integration of aviation into the fleet. Closer examination suggests that those policies probably did not contribute in a vital way to the integration process despite their *prima facie* appeal.

Rear Adm William Adger Moffett was *the* overwhelming personality who championed naval aviation from 1921 until his death in 1933. His particular combination of personality, political acumen, political connections, and leadership dragged the US Navy into the age of airpower.

William A. Moffett was born in Charleston, South Carolina, in 1869, the son of a former captain in the South Carolina infantry.[7] In 1886, Moffett won an appointment to the US Naval Academy. After graduation in 1890 and a two-year apprenticeship at sea, Moffett earned his commission and served in 1893 aboard the USS *Chicago* under the command of Capt Alfred Thayer Mahan.[8] Ensign Moffett saw one-sided combat in the Philippines on the USS *Charleston* during the Spanish-American War in 1898.[9] In 1914, Commander Moffett earned the Medal of Honor for his actions in the Battle of Vera Cruz while skipper of the USS *Chester*.[10] While commanding the Great Lakes Naval Training Center in Illinois, Moffett developed friendships with several prominent members of the Chicago business community—friendships that would serve him well in his later political struggles.[11] Captain Moffett commanded the USS *Mississippi*

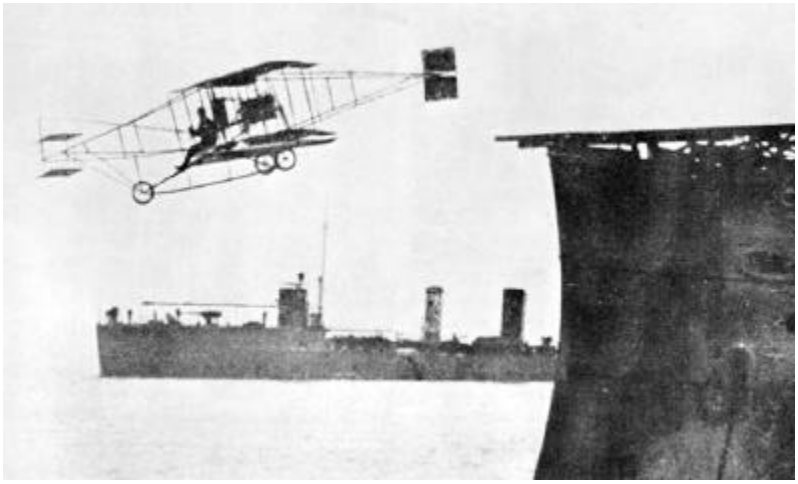
Courtesy: NASA

Rear Admiral William A. Moffett. Admiral Moffett, "Father of Naval Aviation," championed naval aviation from 1921 until his death in 1933.

from 1918 to 1920. In 1921, President Warren G. Harding appointed him chief of the newly created Bureau of Aeronautics with the accompanying rank of rear admiral.[12]

Admiral Moffett was not a complete stranger to naval aviation. He oversaw flight training and aircraft maintenance instruction during World War I while at the Great Lakes Naval Training Center, and he used aerial spotters with great success during gunnery exercises while commanding the *Mississippi*.[13] Moffett was an outstanding naval officer, and he devoted those same considerable abilities to the cause of naval aviation. From 1921 until 1933, he conducted a sustained campaign against traditionalists to convince the naval establishment that airpower was a valuable asset. Moffett sent airpower to sea aboard battleships and cruisers. He pushed the development of fleet aircraft carriers, airships, and the flying-deck cruiser. He fought to protect the careers of aviators, and he instituted the aviation observer program to lure senior officers into the fold of aviation. To win public support, Moffett entered naval aviators into popular air races, sent aircraft and airships on cross-country tours, and conducted exhibitions with aircraft carriers to keep naval aviation in the public eye. Moffett used his political connections to remain in his post as bureau chief for an unprecedented 12 years and to garner congressional support for expanding the nascent aviation program during years of lean budgets.

Not everything Moffett touched turned to gold. The flying-deck cruiser never left the drawing board. Light carriers could not launch enough aircraft to generate the massed attacks necessary for fleet engagements. The rigid airship never developed into a credible combat platform and died a lingering death. Ironically, Admiral Moffett met his end aboard one of the airships he so staunchly defended. He was killed in a thunderstorm on 4 April 1933 when the airship *Akron* crashed at sea off the coast of New Jersey.[14] Nevertheless, the policies and construction programs begun under his leadership created the organization and infrastructure that battled to victory in World War II. In the words of his biographer, “Moffett at the time of his death had already done more than anyone before or since to secure the place of naval aviation in the military establishment.”[15] His well-earned sobriquet as the “Father of Naval

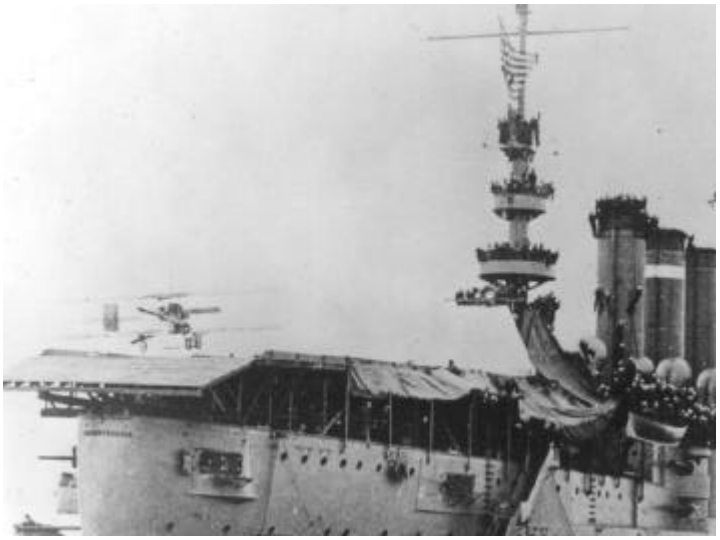


Courtesy: US Navy

Eugene Ely takes off from USS *Birmingham*. On 14 November 1910, Eugene Ely, a civilian pilot, took off from a wooden platform built over the bow of the *Birmingham*.

Courtesy: US Navy

Naval aviators T. Gordon Ellyson and John Towers. On 23 December 1910, Lt T. Gordon "Spuds" Ellyson (left) was ordered to report for flight instruction at Glenn Curtiss Aviation Camp, North Island, San Diego. He completed training on 12 April 1911 and became Naval Aviator No. 1. Ellyson is pictured here with Naval Aviator No. 3, Lt John Towers.



Courtesy: US Navy

Eugene Ely lands on USS *Pennsylvania.* On 18 January 1911, Eugene Ely landed a Curtiss pusher on a specially built platform aboard the *Pennsylvania*.

Courtesy: US Navy

Lt Cdr Henry C. Mustin launches from USS *North Carolina*. On 5 November 1915, Lt Cdr Mustin, piloting an AB-2 flying boat, made the first catapult launch from a ship.

Aviation"[16] suggests that Moffett was quite instrumental to the integration of aviation into the Navy. Naval aviation, however, probably would not have floundered or failed without him.

Naval aviation had existed since 1911, when Congress appropriated funds for the Navy to purchase its first aircraft.[17] By 1921, naval aviation had demonstrated its combat capabilities in World War I; many more officers than Admiral Moffett now recognized its utility. Rear Adm William S. Sims, although in the sunset of his career, was an ardent supporter of aviation.[18] Rear Adm William V. Pratt, newly promoted to flag rank in 1921 and member of the Navy's General Board, was a convert to the cause of aviation.[19] Although too junior in 1921, Capt Ernest J. King, Capt Joseph Mason Reeves, and Cdr John H. Towers believed in the future of naval aviation. Any of these men could certainly have substituted for Moffett within the span of a few years. Finally, naval aviation did not founder with Moffett's death in 1933. Moffett may have hauled aviation through its formative years, but he probably was not irreplaceable as chief of the Bureau of Aeronautics.

President Harding appointed a former battleship commander as the first chief of the new aviation bureau. Having a battleship skipper in charge of aeronautical development, however, did not necessarily win members of the "Gun Club" to the cause of naval aviation. By the time Moffett assumed his duties as chief of the Bureau of Aeronautics, he had 30 years of experience in ships and he understood the language of his brother flag officers.[20] But part of the struggle of naval aviation was bureaucratic, and the new Bureau of Aeronautics siphoned manpower and resources away from the established Bureaus of Steam Engineering and Construction and Repair (55 percent of the new Aeronautics staff transferred from the Bureau of Construction and Repair).[21] Moffett's attempts to manage aviation personnel directly challenged the prerogatives of the Navy's powerful Bureau of Navigation.[22] Fraternity among flag officers may have served only to make the turf battles somewhat cordial.

On the opposite side of the fraternity equation, Moffett earned the respect of naval aviators through loyalty and dedication to their cause, but that respect did not transfer to all aviation converts. Younger pilots considered the officers who earned their observer or pilot wings in midcareer as opportunists.[23] Although

Moffett defended these officers (Captains King and Halsey, for example) as expedients to building support among the senior grades, the aviators looked to the promotion of career fliers like John Towers as signals for their own advancement. To them, King, Halsey, Arthur B. Cook, and others were "Johnnie-come-latelies."[24] Apparently, credentials as battleship commanders garnered influence from neither surface nor flying communities.

Admiral Moffett and the Bureau of Aeronautics expended a concerted effort to demonstrate the capabilities and to publicize the exploits of naval aviation. These appeals for public support did little to increase the acceptance of aviation within the line of the Navy. Naval aviators sponsored by the Bureau of Aeronautics entered the all-Navy Curtiss Marine Trophy Race in 1922—and in 1923, won both the Schneider Cup and Pulitzer Trophy Races.[25] During the summer of 1923, the USS *Langley* called on eight northeastern ports, including New York City and Boston, and participated in community celebrations by performing flying demonstrations.[26] Moffett sent the airship *Shenandoah* on similar promotional tours such as the air races in Saint Louis in 1923.[27] The near-disaster of the seaplane flights from California to Hawaii, the crash of the *Shenandoah*, the firestorm ignited by Billy Mitchell's accusations of incompetence and negligence within the Navy, and the admonition from the Morrow Board about publicity flights, all in 1925, demonstrated the risk of pandering to the public. In 1924, Lt Arthur W. Radford (who eventually rose to be chairman of the Joint Chiefs of Staff under President Eisenhower) summarized the impact of Moffett's publicity campaign. The Bureau of Aeronautics had "sold aviation to the public, but not to the Navy as a whole." Flag officers, ship's captains, and gunnery officers needed "tangible evidence" that aviation improved combat performance.[28] Publicity did not demonstrate the value of aviation to the Navy's fighting officers.

Detractors tagged Admiral Moffett as a "political admiral" because of his political connections and his facility in exploiting them to achieve his objectives. Moffett's political maneuvering, however, was not instrumental in integrating aviation into the Navy. While assigned to the Great Lakes Naval Training Station near Chicago, Moffett cultivated relationships with powerful businessmen such as J. Ogden Armour and William Wrigley Jr.

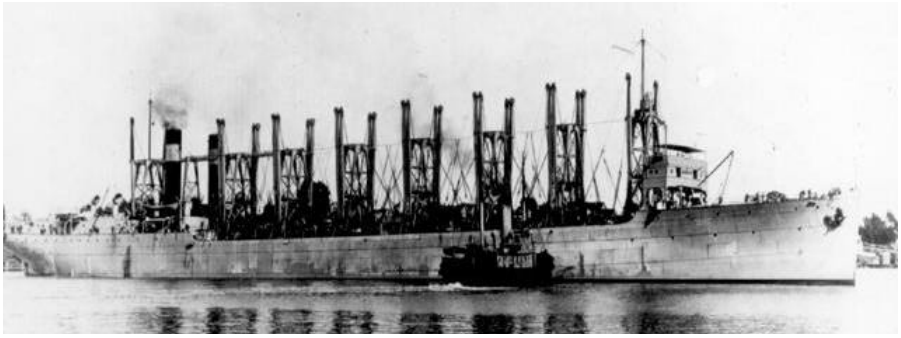
(famous for their meat packing and chewing gum industries, respectively).[29] Moffett appealed to these influential men to intercede on his behalf for his initial appointment as chief of the Bureau of Aeronautics and his reappointment for second and third terms.[30] In a different tack, Moffett sent two of his pilots on a cross-country tour to visit senators and representatives in their hometowns to enlist their support for aviation funding. One result was an enthusiastic endorsement from Senator Miles Poindexter of Washington for a $5,000,000 aviation appropriation.[31] Moffett's deft political strategies secured government support for aviation and kept him in a position to capitalize on that support, but those political strategies did not penetrate into the daily operation of aviation with the fleet. The strategies were external to the integration process.

The Naval Appropriations Act of 1921 established the Bureau of Aeronautics within the Department of the Navy, and the Naval Aircraft Expansion Act of 1926 created an assistant secretary of the Navy for Aeronautics.[32] The existence of a federally mandated Bureau of Aeronautics and civilian representation at the assistant secretary level were not vital to integrating aviation into the Navy. With bureau status, the Bureau of Aeronautics had authority over operational doctrine and aircraft development as well as influence over personnel assignments.[33] Because the bureau chiefs reported directly to the secretary of the Navy, they had less to fear from a hostile chief of Naval Operations.[34]

Organization, though, had not led to successful integration in the case of engineering. Congress established the Engineering Corps in the Navy in 1842 and a Bureau of Steam Engineering in 1862,[35] but the rivalry between the line and the Engineering Corps increased until Secretary of the Navy John D. Long instituted dramatic reforms at the turn of the century. As for civilian representation, the office of the assistant secretary for Aeronautics was vacant from 1932 until 1941.[36] Neither bureau status nor an assistant secretary necessarily guaranteed aviation's integration into the fleet.

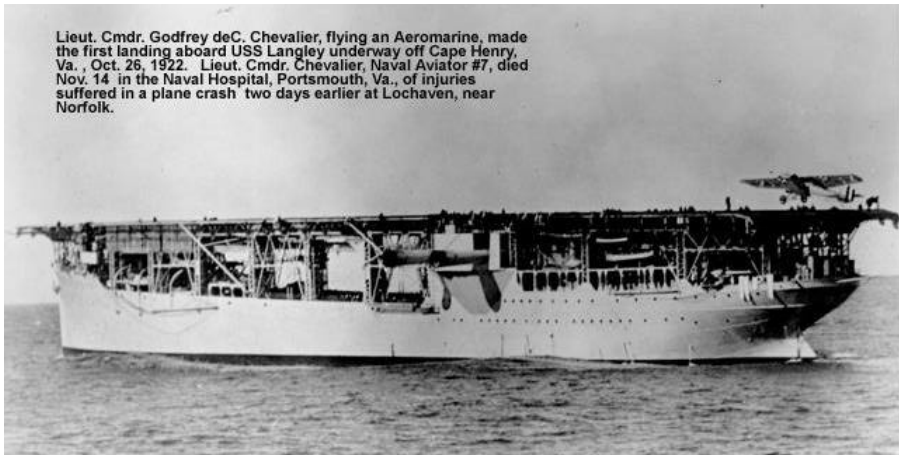
Although the effort expended in these five policy areas contributed little to integrating aviation into naval operations, they did serve a legitimate purpose. All these measures ensured the continuing existence of naval aviation, whose most serious and persistent threat came from outside the Navy. The

political and public support nurtured by Moffett established a formidable bulwark from which to battle Mitchell over a separate air service.[37] Related to this, Moffett remained in his position as bureau chief at a time when naval aviation benefited from his political finesse and clout.[38] Protected from external assault, aviation could pursue the course that would make it indispensable to naval warfare.



Courtesy: US Navy

USS *Jupiter* becomes the aircraft carrier *Langley*. The Naval Appropriations Act for Fiscal Year 1920 provided for converting the collier *Jupiter* into the Navy's first aircraft carrier, later named *Langley*.



Courtesy: US Navy

Lt Cdr Godfrey deC. Chevalier lands on USS *Langley*. On 26 October 1922, Lt Cdr Chevalier, Naval Aviator No. 7, made the first landing aboard the *Langley*. Some three weeks later, on 14 November, Lt Cdr Chevalier died from injuries suffered in a plane crash.

Successful Integration Policies

The champions of naval aviation embarked upon essentially five major collections of policies and programs that facilitated the integration of aviation into the Navy. The categories encompass increasing the understanding of aviation within the Navy, enhancing battleship performance rather than threatening the battleship's existence, providing a career path for aviators to achieve senior rank, maintaining the familiarity of aviators with surface operations, and including aviation in naval war games.

The first, and arguably the most important, integration initiatives were those designed to increase the general knowledge and understanding among naval officers of the capabilities aviation brought to the battle line. In order to achieve this, Admiral Moffett and the Bureau of Aeronautics deployed aircraft with as many fleet units as possible. Moffett confided to Admiral Sims in 1921 that he found no opposition to aviation in the Navy, "but considerable indifference and lack of knowledge on the subject," and was trying "to get aviation afloat by putting planes on everything from submarines to battleships."[39]

In 1922, Moffett submitted a tentative plan to the General Board to get as many airplanes as possible into operation with the fleet. The plan included equipping each battleship, cruiser, and destroyer division with scout and fighter aircraft, and commissioning the aircraft carriers *Lexington* and *Saratoga* by the end of 1924.[40] The General Board agreed with Moffett's plan and proposed that all battleships, modern cruisers, and destroyers be furnished with reconnaissance and fighter aircraft.[41] By the end of 1922, the battleships *Maryland*, *Nevada*, and *Oklahoma* had aircraft catapults; by mid-1925, each *Omaha*-class cruiser and nine more battleships had received catapults.[42] *Lexington* and *Saratoga* joined the fleet in 1927. Both ships possessed the power and speed to operate their 70 aircraft with the battleship fleet.[43] Moffett understood that the Navy was the first line of offense. Aviation was its advanced guard and, to act in the vanguard, it had "to go to sea on the back of the fleet."[44] Equipping the fleet with aircraft was only one of several steps in the education process.

Beginning around 1919 and continuing through the 1920s and 1930s, flying units and, eventually, aircraft carriers, participated in naval gunnery practice and full-scale fleet exercises. During interception exercises off Guantanamo Bay, Cuba, in January 1919, aircraft charted the position, course, and speed of the attacking fleet.[45] Moffett himself had benefited from aviation while captain of the battleship *Mississippi*. With the aid of aerial spotting in the 1920 gunnery exercises, the *Mississippi* achieved scores so high they nearly equaled those of all other battleships combined.[46]

The USS *Langley* shouldered the burden of carrier-based airpower in fleet exercises until the *Lexington* and *Saratoga* joined the fleet. In Fleet Problem I of February 1923, the *Langley* demonstrated the vulnerability of the Panama Canal to air attack[47] and defended the scouting fleet from attacking bombers.[48] Vice Adm Newton A. McCully Jr., commander of the scouting forces of the US Fleet in the Caribbean, commended *Langley*'s performance in a letter to Moffett. McCully stated that the *Langley* had clearly demonstrated her value to the fleet and that her air operations had been "an eye opener for most people."[49] By 1925, the role of aviation in Fleet Problem V had expanded significantly. The fleet exercise in the Pacific included 24 aircraft from the *Langley*, 60 from battleships and cruisers, 26 seaplanes from the scouting fleet, and 14 from the naval air station at Honolulu.[50] Fleet Problem IX in 1929, with *Lexington* and *Saratoga*, finally tested the notions of carrier airpower that had long been mere hypotheses.[51] A rather chaotic attack and defense of the Panama Canal showed the flexibility of carrier airpower, the importance of air superiority, and the inferiority of cruisers to aircraft in the scouting role. The exercise proved carriers occupied a definite place in plans for war at sea as the principal long-range strike element of the fleet.[52]

Formal education complemented practical exposure. The curricula at the US Naval Academy and the Naval War College included aviation courses and flying instruction to familiarize future and senior naval officers with the fundamentals of flight. In 1921, Admiral Sims added aviation studies to the course of instruction at the Naval War College, where the Navy groomed its future admirals.[53] Moffett established aviation

training at the Naval Academy,[54] and the 1925 Eberle Board recommended adding a course in aeronautics; it began in that same year.[55] The four hours of flight training required by the academy grew to 12 hours by 1950.[56] By 1926, half of the academy's graduates were receiving flying instruction.[57] Knowledge brought understanding and understanding brought appreciation and innovation.

Each of these policies, intended to expose naval officers to the possibilities of aviation, provided tangible experience of how aviation improved the capabilities of individual ships and the battle fleet as a whole. Operating in the air was different from maneuvering at sea, and the differences were an impediment to understanding. In space operations, orbital mechanics is different from aerodynamics and the difference creates a similar gulf in understanding between airpower and space power. Furthermore, space capabilities have long been cloaked by the imperatives of national security. Programs analogous to those that educated naval officers on the potential of naval aviation will similarly expose space operations to the flying Air Force.

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Early vocal aviation proponents advertised airpower as a new weapon that made armies and navies obsolete. These attacks threatened the *raison d'être* of a military establishment generally resistant to change. Naval aviators pursued a more subtle and ultimately more digestible course in the 1920s. They promoted the capabilities and possibilities of airpower as enhancements to the battleship Navy rather than as rivals to the premier striking force of the fleet. In reality, early airpower was technologically incapable of replacing the battleship. The aviators' strategy was as wise as it was successful. The abundance of evidence suggests that Moffett and his aviators navigated this course as a considered strategy to integrate aviation into the Navy as well as into the hearts and minds of the Navy leaders. Moffett's strategy comprised both words and deeds.

Rear Admiral Rodgers, chairman of the Navy's General Board, asked Capt Henry C. Mustin, assistant chief of the Bureau of Aeronautics: "Do you contemplate making all naval warfare in support of the air attack?" Mustin, a pre-World War I convert to aviation who had earned his captain's stripes on

battleships during the war, clearly set the tone of aviation for Rodgers: "Our whole aviation program is laid out on the basis that the battleship is the dominant factor in naval warfare, provided it is properly supported by aircraft."[58] Admiral Moffett told the 1924 Eberle Board (chaired by the chief of naval operations, Adm Edward W. Eberle) that it was foolish to think airplanes would minimize the value of the battleship and render it obsolete. Aviation was and would remain an auxiliary arm of the fleet.[59] In testimony before the 1925 Morrow Board, Cdr John H. Towers (naval aviator no. 3) stated, "I am firmly convinced that aviation must remain an integral part of the main fighting organization, and that is the line." Aviation did not *cooperate* with the Navy, it *was* the Navy. "In 10 years it may be one-third of it, and in 20 years it may be all of it."[60]

Moffett also captured the sentiment in writing. In a lecture prepared for the Naval War College, Moffett declared, "the most important Naval function that the aircraft has to perform today [1923] is that of observing gunfire for the main line of ships of the Fleet."[61] In an article published in the U.S. Naval Institute *Proceedings*, Moffett proclaimed that "the fleet and naval aviation are one and inseparable."[62] Aviation belonged with the fleet, and the role of aviation at sea strengthened this conclusion.

As Rosen observed, aviation in the Navy initially supported existing missions.[63] In 1919, the General Board informed the secretary of the Navy that aviation was capable of scouting for the enemy fleet, spotting the fall of friendly gunfire, and engaging enemy aircraft in air-to-air fighting.[64] Aircraft allowed battle fleet commanders to detect the enemy at increased ranges.[65] Once within range, aerial spotting increased the distance at which the long-range guns could engage the enemy and dramatically improved their accuracy.[66] From this, the logic was inescapable. Aerial spotting increased the number of hits, and hits meant destruction of the enemy fleet. The enemy should be denied their spotters and should not be allowed to interfere with friendly spotters. Fighter aircraft protected friendly spotters by winning command of the air from enemy aircraft. Only aircraft carriers could provide sufficient fighter strength to win air control.[67] Initially, aircraft carriers operated close to the fleet to perform scouting, spotting, air control, and antisubmarine patrols. By 1931, as operational experi-

ence grew with *Lexington* and *Saratoga,* the carriers operated as screening, raiding, and striking forces with the battle line or in independent fleet actions.[68] As late as 1941, carrier doctrine was flexible, but aircraft carriers were still a subordinate part of the battle line.[69]

The patient insinuation of naval aviation into the fleet complemented rather than supplanted the surface forces. Aviation gained acceptance among naval officers because it increased the performance of battleships and cruisers without threatening their supremacy. Aviation was a revolutionary weapon system in the 1920s, full of promise but alien to traditional naval equipment and thought. Understandably, it provoked an expected conservative reaction. Space power poses a similar threat to those who have proven themselves in traditional airpower missions. Integration is partly a human struggle, so space advocates could benefit by employing a strategy similar to that of the naval aviators in order to mitigate threats to airpower missions.

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Senior officers dominated naval policy in the 1920s and 1930s (as they do today). Only by earning commensurate rank could aviators amass enough power and respect to influence naval aviation policy. Aviators needed a viable career path that increased their aviation skills without prejudicing their opportunities for command and flag rank.[70] Like aviation itself, this career path had to be integral to that of other line officers to avoid any appearance that it was separate and distinct.

Within the living memory of naval officers in the 1920s, the Navy had overcome a divisive internal conflict between the parallel careers of line officers and engineers. The animosity delayed the full integration of propulsion engineering into the line of the Navy by at least 40 years.[71] In 1842, when Congress created the staff engineer corps, engineers were removed from the promotion path that made them eligible to command ships.[72] In 1859, Secretary of the Navy Isaac Toucey ordered that the staff corps had no military command authority. Consequently, the engineers had no power to control and discipline their own men.[73] As further insult, Vice Adm David D. Porter, a Civil War naval hero who sailed to victory on steam propulsion, downgraded the rank and status of steam engineering in 1869.[74]

The captain was the most skilled sailor aboard his ship, but he depended on his chief engineer to propel and maneuver his ship in battle.[75] Engineers held neither congressional commissions nor naval rank, but they challenged the line officers as the absolute masters of their ships.[76] Before the turn of the century, Secretary of the Navy John D. Long tackled this division. Naval officers were the masters of motive power during the age of sail, so it should be no different in the days of steam. Therefore, they needed to understand the practical application of steam engineering.[77] In 1899, Congress amalgamated engineering into the line. Line officers would learn the rudiments of engineering at the Naval Academy, and engineers were no longer second-class officers forbidden to command ships.[78] Cadets were trained in both deck and engineering assignments, and line officers stood normal tours of duty in the engineering department aboard ship.[79] With this lengthy and traumatic experience as prelude, the Navy was determined not to repeat the mistake with aviation personnel.

Naval aviators, like any other military officers, needed senior ranks and important commands as goals in order to motivate them to excel and to measure the success of their careers. The Naval Appropriation Act of 1921 created the Bureau of Aeronautics and established that 30 percent of the commanders (and above) who were assigned to the bureau had to qualify as aviation observers within one year of assignment.[80] Admiral Moffett understood that there were too few senior officers qualified in aviation to fill senior billets, so he developed the naval observer's course at Pensacola Naval Air Station for commanders and captains to learn the fundamentals of flying. The course existed from 1921 to 1931, when qualified pilots attained sufficient seniority to fill aviation command positions.[81] Some senior officers, like Capt Ernest J. King (1927) and Capt William F. Halsey (1934), entered pilot training in order to command aircraft carriers. They gave naval aviation much-needed rank in the higher Navy echelons.[82] Moffett balanced these "Johnnie-come-latelies" by appointing Cdr Theodore G. "Spuds" Ellyson (naval aviator no. 1) as the head of the Plans Division, Bureau of Aeronautics. Ellyson's assignment was a signal to aviators that Moffett was on their side and

could uphold their interests.[83] These were expedient fixes to a problem that needed a long-term solution.

Moffett defended these personnel policies in testimony before the Morrow Board in 1925. Naval aviation observers—not rapidly promoted aviators—would command aviation units. Younger airmen had to achieve senior rank by the normal selection process.[84] Only time in service could get the aviators what they desired. Nevertheless, the 1925 Eberle Board report recommended that the Navy department establish a definite policy to govern the assignment of aviation personnel to aviation duty.[85] And as an undeniable incentive, the Morrow Board recommended that only qualified commissioned pilots could command aviation shore establishments, seaplane tenders, and aircraft carriers.[86] In an ill-conceived attempt to protect some aviators from going to sea, Congress enacted an exception for "Aeronautical-Engineering-Duty-Only" in 1935.[87] There was already a pervasive uneasiness among aviators that duty involving flying decreased one's chances for promotion and command, so many preferred to remain in the line rather than go into aviation and sacrifice opportunities for becoming battleship commanders.[88] The personnel integration strategy was a slow process—and the pace of success was linked to the pace of promotions.[89] A junior aviator in 1921 would not be eligible for captain for about 20 years, so these fliers did not reach command grade until the midst of World War II.

Officers are measured by their leadership in command positions, and superior performance in command is usually a prerequisite for senior rank. The supreme test, whether appropriate or not, is an officer's ability to lead forces in combat. Aviators needed combat commands to prove themselves to their surface fleet peers, and the aviators had to earn these commands by the same rules and means as other line officers. Any appearance as a privileged, separate, or inferior class would degrade the aviators' legitimacy with the rest of the officer corps and impede their integration. Space operations officers are driven by the same needs for advancement, recognition, prestige, and career fulfillment as were the naval aviators in the 1920s. A viable career path to combat command and flag rank is as necessary for space officers as it was for the naval aviators.

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To unite aviation with surface operations, naval aviators needed to proceed along a career path intimately connected with the ways of the sea. Aviators could best capitalize on their new weapon with a thorough knowledge of the capabilities and doctrine of the battle fleet. To understand the needs and functions of the fleet, naval aviators had to be naval officers first. This meant that despite their resistance, aviators had to perform the same sea duties normal for all naval line officers.

The Department of the Navy resolutely adhered to the policy that naval aviators be qualified as seamen first.[90] The Eberle Board recommended in 1925 that academy graduates could be assigned to aviator training only after two years of sea duty.[91] The Morrow Board supported this policy by concluding that junior officers should perform adequate sea duty for advancement.[92] The Bureau of Navigation, which controlled personnel assignments, strictly enforced this policy under Rear Adms William R. Shoemaker and Richard H. Leigh.[93] Shoemaker believed aviators were no more specialized than other officers and had to do their share of sea duty before receiving aviation assignments.[94] The logic of this position is largely inarguable. Naval aviators had to be naval officers so they could understand how aviation should be used as an instrument of power projection in conjunction with the fleet.[95] Aviation was only one component of a ship's fighting equipment, and aviators were not different from other officers.[96] They had to be indoctrinated into the operations and methods of all naval craft as well as the language of the sea. Unless they were trained with the fleet, by the fleet, they could not properly understand the intentions of the commander in chief.[97] Without obtaining sailing skills, aviators could never command aircraft carriers or become admirals in charge of fleets employing aircraft carriers.[98]

Moffett instituted a duty rotation to ensure that aviators remained proficient in flying *and* developed the sea skills necessary to understand fleet operations. Annapolis graduates went to sea for two years, returned to Pensacola for flight training, performed a tour as a pilot, and then went back to sea duty.[99] Commander Towers told the Morrow Board that serving "general naval duty" at sea would better integrate avia-

tors into the promotion system.[100] While Captain King commanded the *Lexington,* he made aviators stand bridge watch and practice navigation to emphasize that they were naval officers first.[101] Despite his often irascible temperament and careerist ambitions, King understood the symbiotic relationship between aviators and seamen. Naval aviation required more than mere flying. Years of training in navigation, gunnery, engineering, command, strategy, and tactics kept an aviator attuned to the naval profession. Only aviators so trained could fully appreciate the needs of the Navy. "Between the man on the bridge of a surface ship and the man at the controls of a naval airplane, there is complete understanding and, therefore, complete cooperation."[102]

As a result of these policies and attitudes, all naval officers shared a common base of experiences, encountered the same risks, and spoke the same language. The naval aviators understood the primary mission of the Navy, how each component supported the mission, and how aviation could make its maximum contribution to the mission. These basic lessons hold profound implications for the integration of air and space power. There is essentially no overlap in the skills required to fly and employ aircraft and those needed to operate space systems. Such disjunction necessarily impedes a space operator's understanding of the Air Force flying mission and simultaneously makes integrating space power difficult yet critically important. Conversely, the dichotomy also implies that space would benefit enormously from an influx of flying personnel. Without a common "language of the sea," air and space power will continue to be perilously disconnected.

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Early in the development of aviation, the US Navy had neither aircraft carriers nor an experimental fleet air arm. Admiral Sims, president of the Naval War College from 1919 to 1922, introduced aircraft and aircraft carriers into war games at the school to explore the possibilities of naval aviation in the conduct of sea warfare. The war games opened the world of aviation to naval officers and created opportunities for officers to expand the role of aircraft in naval operations.

The Naval War College developed the war game in the 1890s; by 1894, it had become a regular part of the curriculum.[103] War

games served as a tool for officers at the college to analyze and test warship designs produced by the Navy's technical bureaus.[104] Results from the war games influenced procurement programs and fleet battle tactics. In the early 1900s, war games demonstrated the poor cost-effectiveness of the armored cruiser and identified tactical defects in battleships. They were also instrumental in introducing the all-big-gun battleship.[105] Later, war games decided the characteristics of the first purpose-built aircraft carrier *(Ranger)* and eliminated the proposed flying-deck cruiser. The president of the Naval War College was an advisor to the General Board, and the board relied on the college to model and study new technologies through standardized games, which permitted rapid technological progress without waiting for experimental ships.[106]

In regard specifically to naval aviation, the war games produced several tactical innovations. In 1922, Capt Harris Laning, an instructor at the Naval War College, reported to the General Board that aircraft did not dominate war game situations but that they exerted decisive influence in all stages of a campaign, especially the battle stage.[107] Laning noted that the Naval War College students, who initially showed no enthusiasm for aircraft, displayed great interest in the possibilities of air attack and defense as the games progressed.[108] Cdr Roscoe C. MacFall discovered the value of deploying screening ships in a circular formation around the major combatants. MacFall's classmate at the Naval War College, Chester W. Nimitz, introduced the now standard circular formation to the fleet in 1923 while serving under Adm Samuel S. Robison, commander in chief, Battle Fleet.[109] The 1923 games demonstrated the necessity for massing aircraft for strikes.[110] The 1925 war game convinced Capt Joseph M. Reeves that carriers had to carry more aircraft. While commanding the *Langley* in 1926, he tripled her aircraft complement.[111]

There were serendipitous benefits to including aviation in the Naval War College games. The studies exposed the most senior commanders, those presumably destined for commands and admiral's stars, to the prospects of naval aviation. Those officers returned to the fleet with convincing arguments to convert any doubters, which translated into progress for aviation.[112] Finally, the war games permitted great opportunities

for innovation without the substantial cost outlays required for experimental programs.

Space power is even more intangible and more remote to officers today than naval aviation was to officers during its early developmental years. Operational imperatives, inaccessibility, and high costs impair innovation with space systems. War games that realistically include components of space power would substantially increase the knowledge and understanding of space operations while fostering a fertile environment for experimentation and innovation.

The historical survey shows how the Navy implemented a variety of policies that facilitated the integration of aviation into fleet operations. The Navy learned how to deal with personnel issues from its own past of integrating steam engineering. Despite some pockets of institutional resistance, the Navy fought on a unified front to retain aviation as part of the fleet. There were also many companion policies that, while not contributing materially to integration, fended off the zealots demanding a separate air service and ensured the continuing existence of naval aviation.

None of these integration policies is peculiar to the case of naval aviation, and there are many parallels between naval aviation in the 1920s/1930s and space power in the 1990s. If these policies triumphed in the crusade to integrate aviation into the Navy, and if there was nothing particularly unique to aviation in the interwar years, then there is compelling reason to believe that similar policies will be effective in the effort to integrate space power into the Air Force. The task remains to identify contemporary space integration policies and then to measure them against the framework developed from the naval aviation analogy.

Notes

1. Stephen Peter Rosen, "New Ways of War: Understanding Military Innovation," *International Security* 13, no. 1 (Summer 1988): 134. For further discussion on the innovation process, see Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991).
2. Rosen, "New Ways of War: Understanding Military Innovation," 134.
3. Ibid., footnote 1.

4. Ibid., 143.
5. Ibid., 142.
6. Ibid.
7. Most of the biographical information is from William F. Trimble, *Admiral William A. Moffett: Architect of Naval Aviation* (Washington, D.C.: Smithsonian Institution Press, 1984), 21.
8. Ibid., 29.
9. Ibid., 32.
10. Ibid., 47.
11. Ibid., 59.
12. Ibid., 59, 80.
13. Clark G. Reynolds, "William A. Moffett: Steward of the Air Revolution," in *Admirals of the New Steel Navy: Makers of Naval Tradition 1880–1930*, ed. James C. Bradford (Annapolis: Naval Institute Press, 1990), 378.
14. Trimble, 266.
15. Ibid., 276.
16. Reynolds, 374.
17. Archibald D. Turnbull and Clifford L. Lord, *History of United States Naval Aviation* (New Haven: Yale University Press, 1949), 15.
18. David F. Trask, "William Sowden Sims: The Victory Ashore," in *Admirals of the New Steel Navy: Makers of American Naval Tradition 1880–1930*, ed. James C. Bradford (Annapolis: Naval Institute Press, 1990), 246.
19. Gerald E. Wheeler, *Admiral William Veazie Pratt, U.S. Navy: A Sailor's Life* (Washington, D.C.: GPO, 1974), 203.
20. Turnbull and Lord, 206.
21. Trimble, 83.
22. Ibid., 7.
23. Clark G. Reynolds, *Admiral John H. Towers: The Struggle for Naval Air Supremacy* (Annapolis: Naval Institute Press, 1991), 223.
24. Ibid., 284.
25. Trimble, 121; and Turnbull and Lord, 211–12.
26. Trimble, 106.
27. Ibid., 127.
28. Quoted in Turnbull and Lord, 239.
29. Trimble, 55.
30. Ibid., 79, 150–51, 193.
31. J. J. Clark and Clark G. Reynolds, *Carrier Admiral* (New York: David McKay, 1967), 27.
32. Trimble, 177.
33. Norman Friedman, *U.S. Aircraft Carriers: An Illustrated Design History* (Annapolis: Naval Institute Press, 1983), 3.
34. Clark G. Reynolds, *The Fast Carriers: The Forging of an Air Navy* (Huntington, N.Y.: Robert E. Krieger Publishing, 1978), 15.

35. John D. Long, *The New American Navy*, vol. 1 (New York: Outlook Company, 1903), 78, 105.

36. Paolo E. Colletta, ed., *American Secretaries of the Navy,* vol 2. *1913–1972* (Annapolis: Naval Institute Press, 1980), 648–49; Turnbull and Lord, 312. President Herbert Hoover abolished the assistant secretary of the Navy for Aeronautics as an economy measure. David S. Ingalls resigned from the position in 1932 to run for the governorship of Ohio. President Herbert Hoover left the office vacant as an economy measure. President Franklin D. Roosevelt appointed Artemus L. Gates to the post in 1941.

37. Thomas C. Hone, "Navy Air Leadership: Rear Admiral William A. Moffett as Chief of the Bureau of Aeronautics," in *Air Leadership: Proceedings of a Conference at Bolling Air Force Base, April 12–14, 1984*, ed. Wayne Thompson (Washington, D.C.: Office of Air Force History, 1986).

38. Reynolds, "William A. Moffett: Steward of the Air Revolution," 381.

39. William A. Moffett, chief, Bureau of Aeronautics, to Rear Admiral William S. Sims, president, Naval War College, letter, subject: Naval Aviation, 31 October 1921, Sims Papers, Box 74, Newport, R.I.

40. Trimble, 100.

41. Stephen Roskill, *Naval Policy Between the Wars,* vol.1, *The Period of Anglo-American Antagonism 1919–1929* (London: Collins, 1968), 485.

42. Trimble, 107–8.

43. Ibid., 202–3.

44. William A. Moffett, "Some Aviation Fundamentals," US Naval Institute *Proceedings* 51, no. 10 (October 1925): 1877–1881.

45. Turnbull and Lord, 150.

46. Reynolds, "William A. Moffett: Steward of the Air Revolution," 378.

47. Roskill, 542.

48. Trimble, 107.

49. Ibid.

50. Moffett, "Some Aviation Fundamentals," 1871–1881.

51. Turnbull and Lord, 270.

52. Ibid., 272; and Roskill, 542.

53. Reynolds, *The Fast Carriers: The Forging of an Air Navy* , 14.

54. Reynolds, "William A. Moffett: Steward of the Air Revolution," 380.

55. Hone, 97; and Roskill, 399.

56. Turnbull and Lord, 233. Dr. David Mets, a 1953 graduate of the US Naval Academy, interviewed by author, Maxwell AFB, Ala., February 1998.

57. Roskill, 299.

58. Quoted in Trimble, 101.

59. Ibid., 142.

60. Quoted in Reynolds, *Admiral John H. Towers: The Struggle for Naval Air Supremacy*, 189–190.

61. Lt Cdr B. L. Leighton, "Aircraft in the Navy—Their Use and Limitations," lecture, Naval War College, Newport, R.I., 6 April 1923, Naval History Collectioin, RG 4.

62. Moffett, "Some Aviation Fundamentals," 1877.

63. Rosen, "New Ways of War: Understanding Military Innovation," 136.

64. Charles M. Melhorn, *Two-Block Fox: The Rise of the Aircraft Carrier, 1911–1929* (Annapolis: Naval Institute Press, 1974), 31.

65. Rosen, *Winning the Next War: Innovation and the Modern Military* , 68.

66. Melhorn, 37. Battleships, even with untrained airborne observers, achieved miss errors of less than 64 yards.

67. Ibid., 37–38.

68. Friedman, 8, 9, 80.

69. Reynolds, *The Fast Carriers: The Forging of an Air Navy* , 20.

70. Rosen, "New Ways of War: Understanding Military Innovation," 136.

71. Kenneth J. Hagan, *This People's Navy: The Making of American Sea Power* (New York: Free Press, 1991), 118. Steam engineering had demonstrated its value in propulsion during the American Civil War in the early 1860s. The Navy did not progress significantly down the road to integrating engineering until the Naval Personnel Act of 1899

72. Hagan, 117; Long, 78; and Rosen, *Winning the Next War: Innovation and the Modern Military* , 78.

73. Long, 79.

74. John D. Alden, *The American Steel Navy: A Photographic History of the U.S. Navy from the Introduction of the Steel Hull in 1883 to the Cruise of the Great White Fleet, 1907–1909* (Annapolis: Naval Institute Press, 1972), 251.

75. Hagan, 117–18.

76. Ibid., 118.

77. Long, 89, 64.

78. Hagan, 232.

79. Alden, 252.

80. Turnbull and Lord, 233.

81. Reynolds, "William A. Moffett: Steward of the Air Revolution," 381–82.

82. Friedman, 7; and Reynolds, *The Fast Carriers: The Forging of an Air Navy* , 16.

83. Trimble, 85.

84. Reynolds, *Admiral John H. Towers: The Struggle for Naval Air Supremacy* , 187.

85. Roskill, 399.

86. Turnbull and Lord, 256.

87. Ibid., 293.

88. Melhorn, 97; and Turnbull and Lord, 293.

89. Rosen, *Winning the Next War: Innovation and the Modern Military* , 80.

90. Turnbull and Lord, 228.

91. Hone, 97.

92. Turnbull and Lord, 256.

93. Trimble, 133–34.

94. Ibid., 140.

95. Rosen, "New Ways of War: Understanding Military Innovation," 156.

96. Melhorn, 17.

97. Nearly identical sentiments were expressed by Moffett in “Some Aviation Fundamentals” and Rear Adm William S. Sims, memorandum to Chief of Naval Operations, Washington, D.C., subject: United Air Service, 1 February 1921.

98. Rosen, *Winning the Next War: Innovation and the Modern Military* , 78.

99. Hone, 98.

100. Reynolds, *Admiral John H. Towers: The Struggle for Naval Air Supremacy*, 189.

101. Thomas B. Buell, *Master of Sea Power: A Biography of Fleet Admiral Ernest J. King* (Boston: Little, Brown and Co., 1980), 91.

102. Ernest J. King and Walter Muir Whitehill, *Fleet Admiral King: A Naval Record* (New York: W. W. Norton & Co., 1952), 250.

103. Ronald Spector, *Professors at War: The Naval War College and the Development of the Naval Profession* (Newport, R.I: Naval War College Press, 1977), 74, 78.

104. Ibid., 117.

105. Spector, 114; and Friedman, 33.

106. Friedman, 57.

107. Ibid., 33.

108. Turnbull and Lord, 209.

109. E. B. Potter, *Nimitz* (Annapolis: Naval Institute Press, 1976), 138–39.

110. Rosen, *Winning the Next War: Innovation and the Modern Military* , 69.

111. Hone, 101.

112. Turnbull and Lord, 209.

Chapter 4

Space Integration Policies and the Naval Analogy

The policies and programs derived from the historical analogy of the integration of aviation into the US Navy provide a template against which to measure the progress of the integration of space into the Air Force. The five major integration program areas implemented by the Navy in the 1920s and 1930s encompass all the contemporary space integration policies. The space integration policies, however, do not contribute to all five of the naval integration program areas. A review of the history of space integration itself reinforces the conclusions drawn from the naval aviation analogy and adds further credence to the utility of historical analogy.

"There is a need to integrate all aspects of Air Force space operations into one coherent road map which clearly delineates objectives that are directly tied to the war-fighting requirements of operational commanders."[1] Although this sentence would fit neatly into the current Air Force vision statement, it was written in 1989 by a blue ribbon panel commissioned by Air Force Chief of Staff Larry D. Welch.[2] A second blue ribbon panel in 1992, chaired by Lt Gen Thomas S. Moorman Jr., saw space as "an integral part of the Air Force mission."[3] *Global Engagement* has not declared anything new, and this latest Air Force vision is neither original nor unique. The question is, do any of the policies identified by these previous committees provide some keys to space integration in its most recent manifestation and do they offer warnings of misdirected efforts?

The 1989 Blue Ribbon panel recommended 27 different tasks to integrate space operations into the Air Force. Four of the tasks addressed increasing the knowledge and understanding of space within the Air Force. Three tasks dealt with officer career progression and representation at senior levels by officers with space expertise. One task specifically directed a cross flow of officers between space and air operations assignments. The remaining 19 tasks regarded administrative

issues, internal and external organizational relationships, and the procurement or realignment of space systems.[4] The 1992 Moorman panel suggested that the Air Force make integrated aerospace employment a fundamental principle in all training and education programs. It, too, advocated an officer cross flow between Air Force Space Command and the other operational commands. It recommended integrating space into Red, Blue, and Green flag exercises and called for a stronger operational space presence at Air Force headquarters to make better policy, program, and operational space decisions.[5] These conclusions were nearly identical to those proposed in 1989. In a 1995 study prepared for the Commission on Roles and Missions of the Armed Forces, RAND determined that trust and space literacy were fundamental to integrating space into military operations by gaining the confidence of the war fighters. Integration depended on increasing space awareness among users by encouraging their participation in training and exercises.[6] Except for the explicit inclusion of space in war games, these three investigations described four of the five policy prescriptions drawn from the naval aviation analogy. Although these facts still do not conclusively prove the validity of the case study, they do present compelling evidence regarding the power of historical analogy as a planning and analysis tool. Other conclusions from these three reviews will emerge in the examination of the five categories of space integration programs.

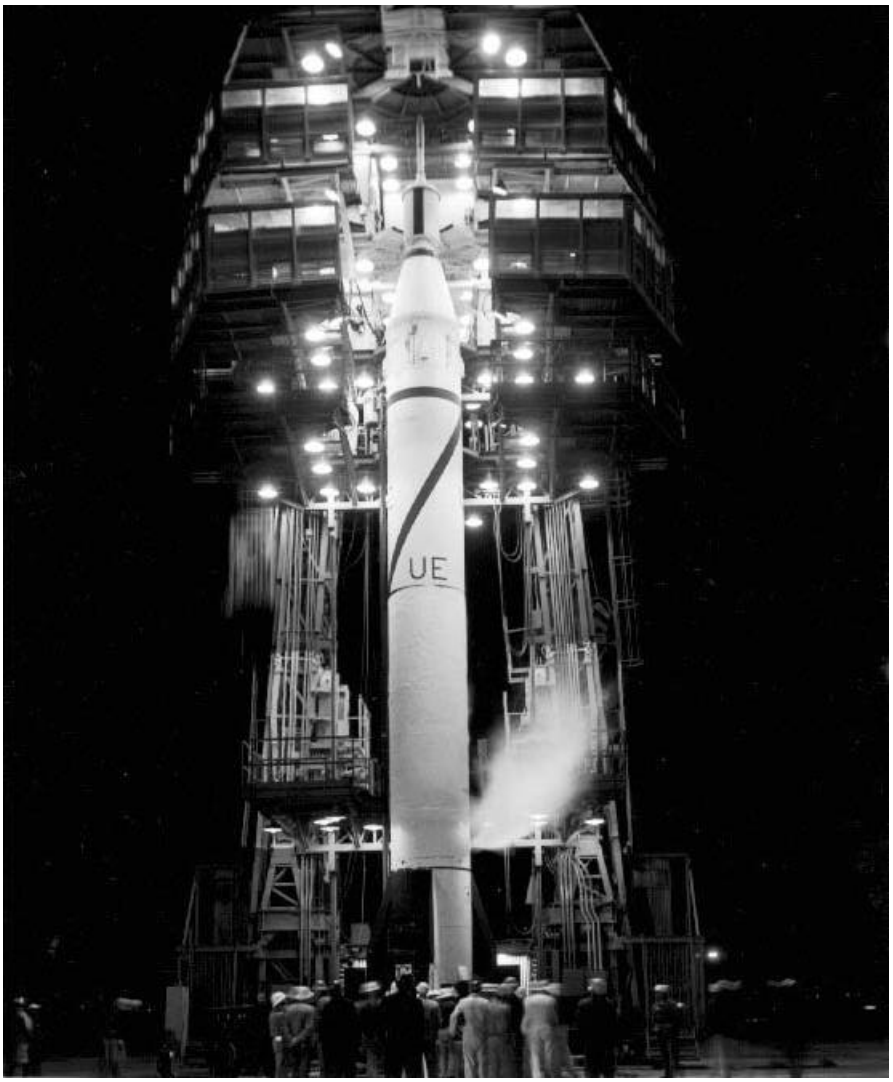
Knowledge and Understanding of Space

Admiral Moffett well understood that the best way to integrate aviation into the fleet was to have ships' captains demand the services provided by aviation. The best way to promote those services was to have aviators demonstrate the capabilities of airpower in the daily performance of naval operations. For identical reasons, the best way to promote space power is to incorporate space capabilities into as many aspects of air operations as possible. Since the end of the Persian Gulf War in 1991, the Air Force and Air Force Space Command have exerted considerable efforts to increase the knowledge and understanding of space capabilities among members of

the flying community. Beginning with the Gulf War, space power has penetrated the cockpit and air operations centers, has been absorbed into education curricula, and has participated in numerous field exercises.

Operation Desert Storm earned the moniker "first space war," but the Persian Gulf War was not the first conflict in which space power played a visible and significant role in air operations.[7] Beginning in 1965, the Defense Meteorological Satellite Program (DMSP) began supplying weather imagery to support the air war in Southeast Asia.[8] Air strikes, air-refueling tracks, close air support, and rescue missions depended on satellite-derived weather predictions. In 1967, Gen William Momyer, commander of Seventh Air Force and the air operations in Southeast Asia, stated, "As far as I am concerned, this [satellite] weather picture is probably the greatest innovation of the war."[9] Satellites provided weather and communications for Operation Urgent Fury in Grenada in 1983 and Operation El Dorado Canyon in Libya in 1986.[10] Land satellite (LANDSAT) imagery, which provided terrain mapping for the Libyan air strike, proved critical to mission planning.[11] Ships and helicopters conducting minesweeping operations during Operation Earnest Will in the Persian Gulf in 1988 relied on the Global Positioning System (GPS) for accurate navigation.[12] For Operation Just Cause in Panama in 1989, satellites again supplied weather support and long-haul communications.[13] None of these examples include the contributions from the guarded history of National Reconnaissance Office satellites. Nevertheless, fliers were not ignorant of space capabilities as they entered the Gulf War.

Even with these successful debuts, it was not until the Persian Gulf War that most space systems were widely integrated into the overall force structure.[14] The Defense Satellite Communications System (DSCS) carried 1,100 voice circuits to 115 ground stations. Satellite links carried 90 percent of the communications traffic into and out of the theater, provided tactical relays for radios limited by line-of-sight, tied deployed units with their home bases, transmitted the daily air tasking order, and connected the theater with US-based intelligence analysts.[15] Although the constellation was incomplete, GPS permitted two-dimensional navigation 22–24 hours per day



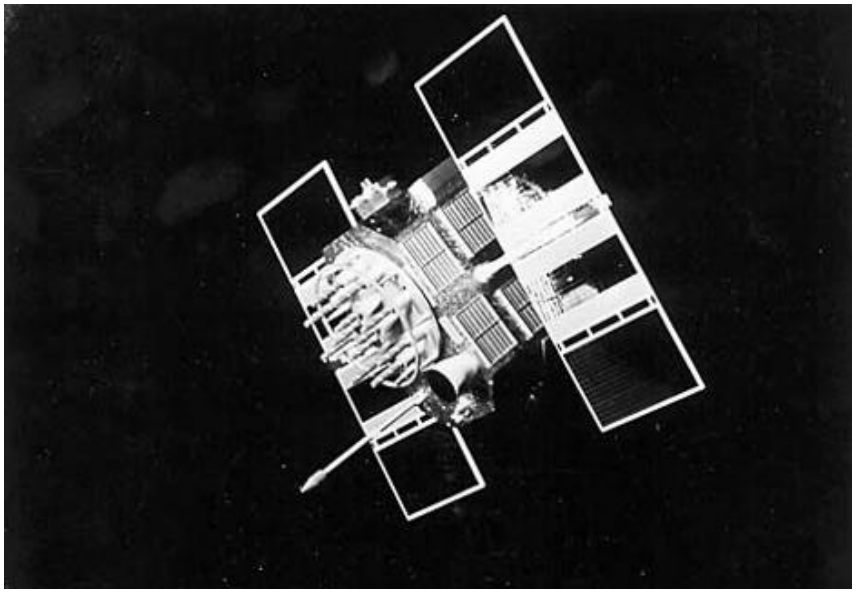
Courtesy: US Air Force

***Explorer I* on launch pad. America's first successful satellite, *Explorer I* was launched aboard a *Jupiter C* booster rocket at 10:48 EST on 31 January 1958.**

and three-dimensional coverage 16–19 hours per day to the 12,000 receivers with coalition forces.[16] The revolutionary satellite system allowed precision navigation in the featureless desert.[17] Air control officers with GPS receivers determined accurate locations of ground targets for GPS-equipped F-16s,

Courtesy: NASA

***Skylab*—America's first space station. On 14 May 1973, a *Saturn V* lifted America's first space station into orbit. Despite a 10-day period during which *Skylab* was beset with problems, the effectiveness of its three crews exceeded expectations.**



Courtesy: US Air Force

Navstar Global Positioning System. A constellation of orbiting satellites, the Navstar Global Positioning System (GPS) provides navigation data to users around the world.

F-111s, and B-52s.[18] GPS gave B-52s an all-weather capability, and F-16s used GPS to calculate the initial points of their bomb runs and to provide targeting information as forward air controllers.[19] Defense Support Program (DSP) missile-warning satellites detected the infrared rocket plumes of Iraqi Scud missiles. Space Command relayed the missile trajectories to Patriot batteries in Saudi Arabia and Israel. The advanced warning alerted soldiers and civilians in the impact areas to seek cover.[20]

Space-based imagery and remote sensing capabilities impacted most air operations. Once again, cloud imagery and moisture data from DMSP enabled the planning and execution of the air campaign. Laser-guided bombs required relatively cloud-free weather for target designation, and the satellites furnished weather forecasts and determined environmental conditions.[21] LANDSAT collected wide-area surveillance of the battlefield not available from national systems and Air Force pilots practiced flying missions using computer-generated terrain maps constructed from the multispectral data. F-111 pilots used this capability to train for the air strike on the Mina al Ahmadi oil complex in Kuwait, which was dumping oil into the Persian Gulf.[22] National reconnaissance systems provided detailed intelligence and bomb damage assessment, thereby reducing the need to send unarmed reconnaissance aircraft over heavily defended targets.[23] All these missions, some demonstrated for the first time in the war, continue today and are augmented by further exploitation of space systems in support of military operations.

After its impressive performance in virtually all areas of combat operations during Desert Storm, space power has become a permanent and growing part of air operations. In 1992, the Moorman Blue Ribbon Panel recommended establishing a Space Warfare Center to rapidly develop and deliver new space capabilities to war fighters.[24] Air Force Space Command formed Forward Space Support Teams in 1993 to provide tailored space support to theater air component commanders.[25] These initiatives opened new aspects of space power to theater war fighters.

In 1994, the Talon Shield program transitioned the first Air Force Tactical Exploitation of National Capabilities (TENCAP)

project to an operational squadron. The 11th Space Warning Squadron, whose mission was to detect and report short-range ballistic missile launches to all theaters of operations, received the Attack and Launch Early Reporting to Theater (ALERT) system. The ALERT system has improved the ballistic missile detection capabilities of Defense Support Program satellites and enabled the broadcast of warning data directly into air operations centers worldwide.[26] The Talon Hook program built the HOOK-112 survival radio that uses GPS to precisely locate downed airmen and transmits the information to search and rescue forces.[27] In 1995, Forward Space Support Teams deployed to Vincenza, Italy, as part of Operation Joint Endeavor in Bosnia. The team wrote the space annex for the peacekeeping operations plans, supplied Space Warfare Center-generated imagery of air drop zones, and showed airlifter squadrons how to predict daily GPS accuracies to improve mission planning.[28] The Space Warfare Center also instituted an Air Operations Center Applications Course in 1997 that teaches the capabilities and limitations of space systems and how to incorporate space assets into air campaign planning to the combat air forces.[29] These documented cases represent a few of the projects intended to better deliver space power directly to the flying community.

Education planted the seeds of aviation in the minds of the young officers at the US Naval Academy as exposure at the Naval War College cultivated the value of airpower in the Navy's senior leaders. The Air Force's Professional Military Education (PME) system is much more comprehensive than that of the Navy in the 1920s and 1930s, and space power is included in all AF PME curricula. The space education programs in the Air Force's three commissioning sources (Air Force Academy, Reserve Officer Training Corps, and Officers Training School) are modest, but that modest training is reinforced when the lieutenants attend the Air and Space Basic Course.

The Air Force Academy's space education program is the best of the three training courses. During their Military Arts and Sciences studies, academy cadets receive three formal lessons on space doctrine, space missions, and space systems. The students learn about the space contribution to the Gulf War in a case study on Operation Desert Storm. They also

explicitly integrate space support into a theater campaign planning exercise. Courses on space policy and space law complement the space employment component of the curriculum. By the summer of 1999, the academy will offer an elective in space operations that will provide hands-on experience with space systems.[30] The Officers Training School has a single one-hour lecture on space missions, space organization, and satellite systems. The Reserve Officers Training Corps program is based on the same material as the Officers Training School, and the space studies are presented in two classes during a cadet's freshman and senior years.[31] After graduates receive their commissions, they attend the Air and Space Basic Course. The course is designed to teach all new officers the fundamentals of air and space power. Four classes totaling approximately seven hours of instruction are dedicated to teaching space history, space doctrine, space missions, and space operations. The curriculum also includes space in the planning and execution of the Blue Thunder capstone war game.[32]

The 1989 Blue Ribbon Panel on Space called for a core space curriculum for Air Force education programs.[33] A 1991 Inspector General review of the implementation plan noted that Squadron Officers School allotted two hours for space instruction.[34] With the advent of the Air and Space Basic Course in 1998, the emphasis on space power in the captain-level Squadron Officers School shrank to one hour, although space is specifically included in its Atlantis tactical war game.[35] In 1991, the Air Command and Staff College implemented a 45-hour space curriculum, but that aggressive program retreated substantially by 1997 to a limited effort of four lessons specifically dedicated to space and others that incorporated aspects of space contributions to intelligence and command and control.[36] The Air War College jumped on the blue ribbon panel's recommendation in 1989 by requiring five hours of space systems lectures coupled with a four-hour space war plan case study.[37] By 1991, these classes had grown to 17 hours. And by 1997, the Air War College's space education curriculum contained eight hours on space force employment; 20 hours on orbital mechanics, space history, space organization, and space support; and three 30-hour electives on space issues, space policy, and space technology.[38]

Some anecdotal evidence suggests that space education at the Air War College may have reached overkill.[39]

Naval aviation demonstrated its role in surface operations during yearly fleet exercises. Like naval aviation, space systems advertise their abilities in air operations by participating in the numerous field exercises sponsored by the Air Force and theater commanders. Gen Howell M. Estes III, former commander of AF Space Command and US Space Command, remarked, "If we don't train with [a space system], we're not going to actually use it when it goes to combat and it'll stay as a stovepipe."[40] In 1995, the Space Training Facility opened at the Air Force Weapons School at Nellis Air Force Base, Nevada. The facility merges ground, air, and space information into a coherent picture transmitted directly to fighter cockpits for Red Flag and Green Flag exercises.[41] Space forces participated in Ulchi Focus Lens in Korea, Cobra Gold in Pacific Command, the JTFEX-95 series and Unified Endeavor in Atlantic Command, Atlantic Resolve in European Command, and Roving Sands in Central Command, all in 1995.[42] Four times a year, the Battle Staff Training School at Hurlburt Field, Florida, holds Blue Flag exercises for numbered air force commanders and their battle staffs. The school injects space power into the exercises with the National Wargaming System model that simulates national reconnaissance assets and generates reports for player analysis.[43] A Space Support Team deployed to Blue Flag 95-4 to support the Eighth Air Force commander. The team provided simulated data for theater missile warning, Satellite Reconnaissance Avoidance Notification (SATRAN), and GPS accuracies for mission planning.[44] Another team supported Keen Edge in Japan in 1996 by filling space positions in the combat plans and combat operations cells.[45] In 1996, the National Reconnaissance Office participated in about 80 exercises supporting users across the joint commands and services.[46]

Whether in the daily interaction between air and space operations, in the curricula across the spectrum of PME, or in exercise participation, the Air Force has dedicated a substantial effort to increase the knowledge and understanding of space throughout the service. These policy areas are as thoroughly developed as those pursued by the Navy during the

interwar years—and progress continues. This knowledge base establishes a solid foundation from which to champion space capabilities to Air Force fliers.

Space Capabilities and the Flying Community

Whatever the naval aviators believed privately, they were careful not to threaten prematurely the primacy of the battleship in what they professed publicly. Battleship admirals held the political power in the US Navy in the 1920s and could have frustrated attempts to expand the fledgling aviation service because of self-preservation concerns. To earn coequal status as warriors, space must contribute credible combat capabilities that enhance air operations rather than threaten the airplane. The tone of the public pronouncements of influential space advocates is one measure of how the leadership promotes space power to the Air Force. An examination of space missions reveals potential areas of competition between air and space officers over roles and influence. In an era of declining budgets, the struggle over funding may decide the ultimate fate of air and space integration.

"The contribution of space systems is not likely to remain simply as additive enhansors [sic] to atmospheric systems but will ultimately compete with them to satisfy strategic, tactical, and mobility tasks."[47] Although space systems have not seriously challenged strategic, tactical, and mobility tasks during the preceding 10 years, the philosophy statement from the 1989 Blue Ribbon Panel on Space hardly engenders a cooperative environment between air and space. Perhaps fortunately, the Persian Gulf War intervened and, afterwards, Gen Charles A. Horner, battle-tested during operation Desert Storm as the Joint Forces Air Component Commander, took the helm of Space Command and charted a less antagonistic course. In 1993, General Horner told *Air Force Magazine*, "We have to make space efficient and responsive to wartime needs. We have to provide space data directly to the forces who are fighting the war."[48] General Horner maintained this emphasis throughout his tenure as the commander of Air Force and US Space Command. Only space-based systems could detect third-world missile systems and reduce warning time from

minutes to seconds. The command had to protect GPS navigation capabilities while preventing the enemy from either exploiting GPS themselves or degrading its effectiveness for US forces. "We must keep our mission sharply in focus—make all space systems responsive to US warfighters."[49]

The Space Command position has begun to swing back toward the 1989 philosophy. General Estes is circumspect when addressing force application from space. He believes the Air Force must develop force application *concepts,* but envisions a day when space power will also represent the ultimate in rapid global mobility and global precision attack. Though these capabilities are obviously some time away, the vision is in place and the plans are being laid to provide credible options for our civilian leadership should the need arise.[50]

These visions pose no immediate threat to the "shooter" Air Force. Space force enhancement missions (communications, weather, navigation, intelligence, surveillance, reconnaissance, spacelift) do not compete against fighter, bomber, and airlift missions. In addition, conventional airpower is largely incapable of engaging satellites and destroying ballistic missiles. The looming battle for legitimacy between air and space forces may never be one of roles and missions; the nature of the intraservice conflict will more likely be over funding.[51]

Many space-power thinkers have called for offensive and defensive weapons in space, but politics and money steer those arguments as much as technology.[52] Exorbitant costs have doomed many military space programs, and expensive space force enhancement systems are competing directly with equally expensive aircraft modernization programs.[53] The Air Force managed to sustain funding for the Space-Based Infrared System (SBIRS), the Evolved Expendable Launch Vehicle (EELV), and the Milstar satellite communications system, as well as the F-22, B-2, joint strike fighter, and the airborne laser, for fiscal year 1998.[54] The F-22, the airborne laser, SBIRS, and the EELV are the top four "inseparable capabilities" rather than priorities.[55] Avoiding explicit prioritization may temporarily assuage concerns over protecting favorite programs, but the Air Force will be forced to choose between programs when there is no blood left in the budget turnip. Furthermore, where will space find allies if, as General Estes

believes, “Space must expand and become a larger part of the Air Force budget every year.”[56] The stark fiscal reality is that some programs get canceled so others may move forward.

Maj Gen William E. Jones, former commander of Fourteenth Air Force, is refreshingly outspoken on this issue. What he calls the 707-based intelligence, surveillance, and reconnaissance fleet (E-3 Airborne Warning and Control System [AWACS], E-8 Joint Surveillance and Target Attack Radar System [JSTARS], and RC-135 [Rivet Joint]), costs billions of dollars to build, maintain, and fly. These systems are essentially tied to the advance of the ground armies and characterize only about one hundred miles of battle space ahead of the front line. Moving these aircraft functions to space will extend the depth of surveillance to the range of airpower, essentially the entire theater of operations. General Jones predicts that AWACS, JSTARS, and Rivet Joint will “head to the boneyard” in order to capitalize on the intelligence, surveillance, and reconnaissance capacity of space.[57] Money liberated from the retirement of these platforms combined with a decreased cost of space launch and satellites will fund the next generation of space systems. The imminent battle over budgets will need influential space advocates within the Air Force—and the advocacy must come from the ranks of senior officers.

Space Officer Career Progression

The Air Force activated Air Force Space Command in 1982, consolidating space missions that had been previously under the management of Strategic Air Command and Air Force Systems Command.[58] In 1993, Space Command received the intercontinental ballistic missile mission from Air Combat Command. Consequently, Air Force Space Command should consist of a mixture of hybrid officers experienced in these technical career fields.

As with the Navy, the senior officers within the Air Force hold the political power that enables them to implement policies that promote the new ways of war. Admiral Moffett created an aviation observer program to prime the senior command pump with ersatz aviators until career aviators could advance through the ranks and qualify for senior commands them-

selves. There are a couple of methods by which to mea-sure the progress of space operations officers within the Air Force. One is to examine the experience of general officers to deter-mine whether or not space operators have achieved the high-est ranks. Another is to study the backgrounds of officers commanding operational space units.

A snapshot of general officers clearly shows that officers with substantial space operations experience have earned all flag ranks, but there are notable anomalies within the senior command structure. To date, only one space operations officer has earned the rank of four-star general. Gen Thomas S. Moorman Jr. served as the vice Chief of Staff of the Air Force from 1994 until his retirement in 1997, but he spent less than half of his career in the space operations field.[59] Lt Gen Rodger G. Dekok, commander of Air Force Materiel Command's Space and Missile Center in 1998, is probably as close to a career space general as there is in the Air Force. He spent more than 80 percent of his career in space operations and staff posi-tions. Maj Gen Robert S. Dickman, formerly the Department of Defense Space Architect, and several current and retired brigadier generals followed space-related careers to the flag officer level.[60] While the space career field does lead to general officer ranks, there has not yet been enough time to breed many pure space operations officers. Consequently, officers with not much space experience must be filling the senior leadership positions.

Despite success in promotions, no senior officer with pre-dominantly space experience held any of the most senior lead-ership and command positions in Air Force Space Command in 1998. The commander of Air Force Space Command was a career fighter pilot who was filling his first space assign-ment.[61] The vice commander of Air Force Space Command was a career missile officer—and his predecessor was a career tanker pilot.[62] Within the Air Force Space Command staff, both the director of operations and the commander of the Space Warfare Center were pilots. The director of plans evenly split his career between missiles and space.[63] The trend was similar at the numbered air forces and space wings in 1998, but the level of space experience was perceptibly greater. Maj Gen Gerald F. Perryman Jr., former Fourteenth Air Force com-

mander, spent more than half of his career as a missile launch officer. His previous three assignments were in space operations.[64] Three of the four wing commanders in Fourteenth Air Force were career missile officers with 10–20 percent of their experience in space; the fourth was a helicopter and airlifter pilot.[65]

In his dated but relevant study, Tom Clark compared the career experience of flag officers in Air Force Space Command with those of Air Mobility Command as of 31 December 1996. His results showed that flag officers in Space Command had spent only 14 percent of their careers in space assignments (39 percent if he included missile assignments) compared to 90 percent in flying assignments for generals in Air Mobility Command. The amalgamated nature of Space Command explains why some general officers in the space career field have experience in a variety of technical career fields, but it does not explain why none of them had experience in operational space units other than as commanders. By contrast, all of the generals in Air Mobility Command filled assignments as flying crew members during their careers.[66] In 1996 and in 1998, Space Command was led by generals with little space experience.

General officers are a fairly fungible resource. Based on the breadth of their assignments, these officers can successfully lead organizations well outside the boundaries of their professional experience. A more detailed measure of the career progression of space operations officers is an examination of the backgrounds of operations group and squadron commanders.[67] Data from five of the six group commanders within Fourteenth Air Force in 1998 showed a mixture of careers between space, missile, and engineering officers.[68] From a flier's perspective, these are all technical career fields. From a space operator's perspective, there are differences between space operators, missileers, and engineers.

Data was available in 1998 for 27 of the 31 operations squadrons under the six groups.[69] Of these, nine commanders were principally career space operations officers. Ten were career missile officers. Four were career navigators or weapon system officers, and four held mixed backgrounds in space, engineering, and acquisition. From the squadron to the major command, space operators were minority shareholders in the

space business. Looking back, the Johnny-come-latelies led the naval air war during World War II. Space Command could be experiencing a similar phenomenon.

There are several interpretations of this data. The first (and least plausible) is that this particular temporal sample was a statistical anomaly and did not represent the normal distribution of commanders' experiences. That may be tenable in regard to squadron commanders, but the fact that there are few general officers with substantial space experience explains why generals from other fields hold senior command positions in Air Force Space Command. It does not explain why none of the space generals held those command positions. A second interpretation is that space operations officers are generally less prepared and less qualified for command than missile and flying officers. A third is that the high number of missile officers in space operations commands is merely a reflection of the successful integration of the space and missile missions. Alternatively, Admiral Moffett and Stephen Rosen may have previously identified the key. The missile career field has existed as a single entity for 40 years whereas the space operations field was fractured until 1982. As a result, Space Command has simply not had enough time to cultivate space officers to command and general officer levels.[70] The career missile officers may be the equivalent of Moffett's aviation observers, giving Space Command rank and advocacy in the senior positions. Regardless of the correct explanation, space operations officers would benefit from an understanding of Air Force flying missions; it would broaden their perspective on air operations.

Space Operations Officers and Air Operations

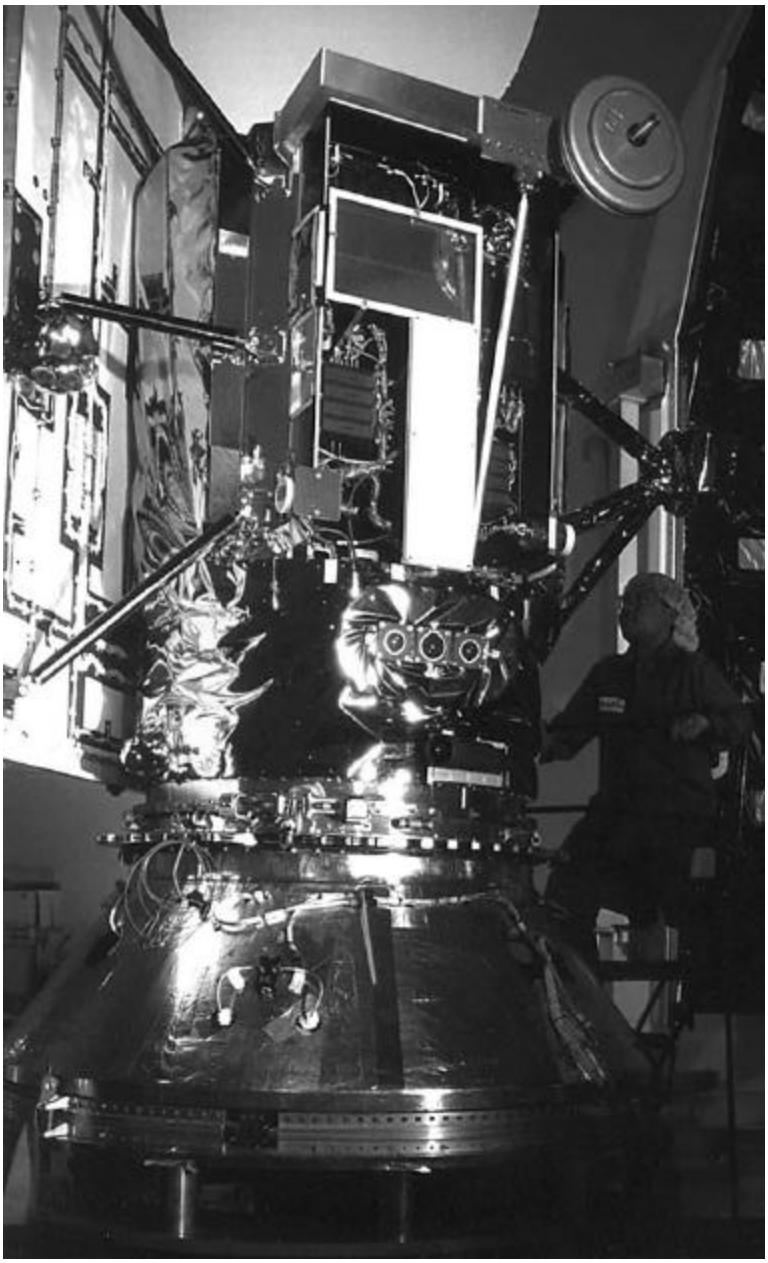
The Navy knew it was critical that all aviators understood naval surface operations before entering flight training and that the aviators maintain and expand that knowledge throughout their careers. As long as the US Air Force remains predominantly an *air* force, space operators should understand the airpower mission in order to maximize the space contribution. With only a few tightly focused programs avail-

able, space operators have meager opportunities to learn, understand, and experience the airpower mission.

The 1989 Blue Ribbon Panel on Space recommended that the Air Force implement a centrally managed officer cross-flow program for assigning space operations officers to air operations commands and assigning fliers to space operations units.[71] The program was already struggling by 1991. The commands had not established formal goals, so the 18 space officers assigned to eight commands were unsure of their duties and felt abandoned by Space Command.[72] The 1992 Moorman Panel made the same recommendation.[73] In 1993, General Horner said space personnel need to be on the staffs of war-fighting commands "to bring an awareness of space to the guys who drop bombs."[74] Gen Joseph W. Ashy said it again in 1996, "That's why we are integrating [at the Air Force Weapons School], so [space operators] can be exposed to our fighter forces, airlift forces, bomber disciplines. . . . We are teams within teams."[75] Maj Gen William E. Jones echoed the same idea in different words in 1997. "Rotation and integration of Air Force space-qualified people must now be viewed as an essential element of Air Force personnel management."[76] Despite these repeated and persistent recommendations and the realization that space operators must understand the airpower experience, the Air Force has instituted precious few avenues through which space operators are exposed to air operations.

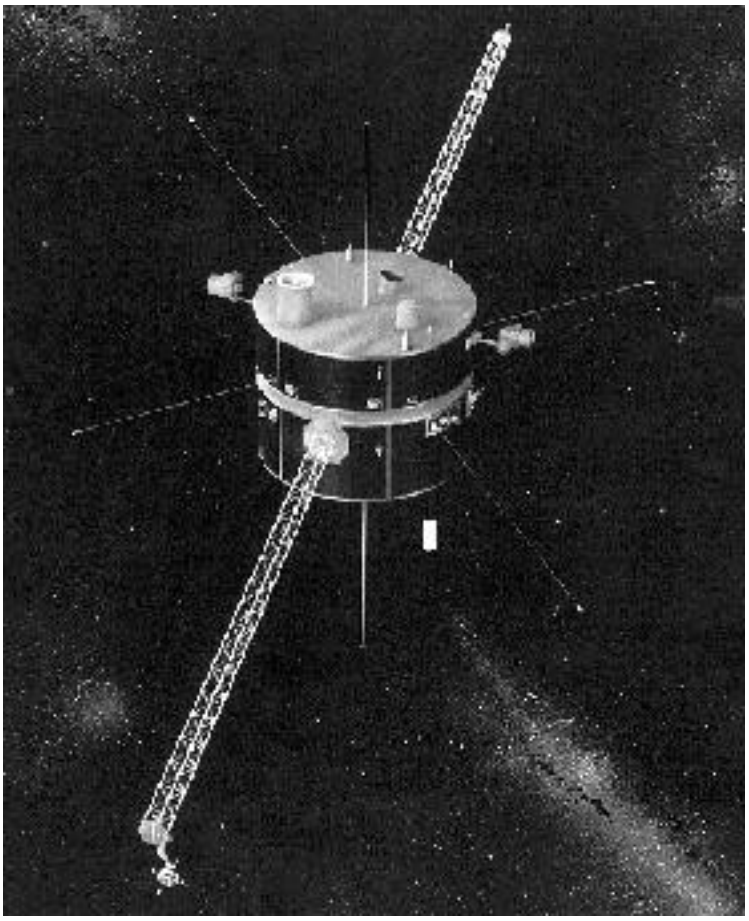
All officers receive measured doses of airpower during PME from commissioning through war college. Theoretically, every officer should understand airpower. The School of Advanced Airpower Studies, the nation's premier airpower strategy school, includes at least one space operator each year. Education, however, does not equate to experience.

The Space Division at the Air Force Weapons School trains approximately 16 space operators per year through a rigorous curriculum heavily laden with airpower studies and flying missions.[77] Space graduates from the Weapons School work in the combat planning and combat operations cells in air operations centers, and Air Force Space Support Teams deploy from Space Command to augment the Weapons School experts during contingencies.[78] So far, feedback from the program has been positive. The numbered air force commanders are re-



Courtesy: US Air Force

Navy's GEOSAT Follow-on. Launched in February 1998 aboard an Orbital Sciences Corporation Taurus-2, Navy's GEOSAT Follow-on studies Pacific Ocean currents and associated weather conditions.



Courtesy: NASA

NASA's WIND. Launched on 1 November 1994, WIND is the first of two NASA spacecraft in the Global Geospace Science initiative. In April 1999, WIND successfully executed a lunar backflip maneuver—the first backflip ever attempted by any mission.

questing more space graduates from the Weapons School to work under their commands.[79]

Assigning Weapons School graduates and deploying Space Support Teams to air operations centers involves a handful of space officers. The initiative satisfies the letter of the cross-flow programs, but it is far too limited to fulfill the spirit. The Navy required *all* aviators to perform sea duty—not just an elite, highly trained few. If the Navy model truly has instructive

and predictive power, then the Air Force must greatly expand the opportunities for space officers to gain experience in air operations.

Space Participation in War Games

In the 1920s, the Navy relied on war games at the Naval War College to educate senior officers about aviation and to test airpower concepts before committing scarce resources. The game environment permitted a variety of officers to freely innovate and test ideas that they might eventually implement in the fleet. In the modern Air Force, war gaming is more pervasive, but games provide opportunities to Air Force officers similar to those provided earlier naval officers.

The Air War College first incorporated space into its war gaming in 1990.[80] In 1998, Air War College and Air Command and Staff College joined to participate in a combined war game that included operational- and strategic-level decision making. A single space cell supported 10 simultaneous and independent war games.[81]

The Air Force Wargaming Institute at Maxwell AFB, Alabama, is the Air Force focal point for PME war games as well as interservice and senior officer-level war gaming. At the institute, inserting space into war games is an education process for conceptual understanding of the role of space in military operations. The Wargaming Institute is incorporating computer-generated visualization tools so participants can view the behavior of satellite constellations and to tie weather, imagery, and intelligence into the air campaign planning process.[82] The Air Force Wargaming Institute conducts the Joint Land Aerospace and Sea Simulation (JLASS) for the six senior service schools.[83] The institute will use a Blue Force space cell connected directly to the Space Operations Center at Fourteenth Air Force for realistic space participation.[84] In 1997, the Wargaming Institute conducted Global Engagement '97, a joint, general-officer war game in strategic decision making. The scenario took place in 2012 and included laser antisatellite weapons and satellite jamming.[85]

These formal war games encourage innovation, but there are few possibilities for officers to return to their operational units

and implement their ideas. The Space Battlelab at the Space Warfare Center in Colorado Springs provides a conduit to translate ideas into operational tests and successful tests into operational capabilities. Air Force Space Command activated the Space Battlelab in mid-1997. Its charter is to develop concepts for space-related Air Force operations based on ideas submitted from across the Air Force. The Battlelab is supposed to facilitate ideas, re-creating the kind of innovation that led to many of the Air Force's historical successes.[86] Institutionalized innovation seems contradictory, but the Battlelab does attempt to manage access to generally inaccessible space systems.

Review and Analysis

At least three times in the last 10 years, the Air Force decided to integrate space into an air and space force. The third iteration implies that the previous two attempts were not completely successful—if not outright failures. Some analysis of the cause of those failures is necessary.

Six of the 27 Blue Ribbon Panel Space Implementation Plan tasks directing, or relating to, major expenditures of funds and to purchases of new weapons systems never made it past the fiscal chopping block.[87] The three funding-based recommendations from the 1992 Moorman Panel have not yet neared fruition.[88] Even the purely administrative tasks of updating policy and doctrine never gained approval.[89] One possible explanation, reinforced by the naval aviation analogy, was that the bulk of the implementation plan was wrong. Integration is not driven by weapons systems, capabilities, or declarative documents; it is accomplished by people, by leaders, by officers who hold positions of power and influence. There were fewer space generals in 1989 and 1992, and younger space operations officers, than today. Perhaps with the passage of time and the accumulation of senior space officers having political power, the Air Force will succeed in integrating space in this third and latest attempt.

When measured against the template constructed from the historical analogy of naval aviation integration in the 1920s and 1930s, the Air Force appears to have a 70 percent solu-

tion—but some space proponents, still enamored with technology, are not focusing on human relationships. The service has made great strides in educating officers about space and incorporating space capabilities into air operations. Field exercises and war games repeatedly expose the vastness of space to the war-fighting community. Leadership is the cornerstone to integration; it requires more than excellence in a single area of expertise. Space operations officers need opportunities to experience flying operations—and only senior leaders can sponsor, protect, and promote officers outside their primary career fields. The Air Force is transitioning to an air and space force, but there are roots and stones in the evolutionary path. Exploiting a few suggestions from history (from both naval aviation and the Air Force) might clear those obstacles and make the third time a charm.

Notes

1. Department of the Air Force, *Blue Ribbon Panel on Space Implementation Plan*, February 1989, task 6.

2. David N. Spires, *Beyond Horizons: A Half Century of Air Force Leadership* (Peterson AFB, Colo.: Air Force Space Command, 1997), 234.

3. Department of the Air Force, *Blue Ribbon Panel of the Air Force in Space in the 21st Century*, executive summary, c. 1993, 4.

4. *Blue Ribbon Panel on Space Implementation Plan*, tasks 3, 16, 17, and 24 called for expanding the knowledge of national reconnaissance systems among Air Force officers, revising the Undergraduate Space Training program, and building a core space curriculum for education in officer Professional Military Education. Tasks 14, 18, and 22 recommended restructuring the space operations officer career field and increasing the number of officers with space expertise on Air Force review committees and on the Air Staff and in the Secretariat. Task 15 directed a centrally managed plan to provide a balanced flow of officers between space and other operational commands. The administrative issues included writing space policy and doctrine. Organizational relationships addressed the interaction between the Air Force and the National Reconnaissance Office, the National Aeronautics and Space Administration, and the other military services. The procurement and realignment of space systems covered antisatellite weapons, space-based radar, space battle management systems, and launch and satellite command and control.

5. The 1992 Blue Ribbon Panel published 18 recommendations (recommendation no. 15 had two parts). Recommendations no. 12 and 15a covered increasing the knowledge and understanding of space in the Air Force, 21–22, 24. Recommendation 15a also suggested including space in

Air Force and joint exercises, 24. Recommendation 15b discussed the officer cross-flow program, 24. Recommendation 16 suggested strengthening space expertise at Air Force headquarters, 25.

6. Dana J. Johnson, Katherine Poehlmann, and Richard Bueneke, *Space Roles, Missions, and Functions: The Challenge of Organizational Reform*, RAND Report, PM-382-CRMAF (Santa Monica, Calif.: RAND, August 1995): 79–80, 92.

7. Peter Anson and Dennis Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," *Royal United Services Institute (RUSI) for Defence Studies Journal* 135, no. 4 (Winter 1991): 45; William A. Dougherty, "Storm from Space," US Naval Institute *Proceedings* 118/8/1074 (August 1992): 48; Steven Lambakis, "The United States in Lilliput: The Tragedy of Fleeting Space Power," *Strategic Review* 24, no. 1 (Winter 1996): 33; Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program* (Washington, D.C: GPO,1997), 73; Craig Covault, "Desert Storm Reinforces Military Space Direction," *Aviation Week and Space Technology* (8 April 1991): 42–47. A number of authors called Desert Storm the "first space war."

8. Spires, 170.

9. Peebles, 53. The mission impact of weather is described on page 52.

10. Spires, 244; and Peebles, 55.

11. Dougherty, 48. LANDSAT is a commercially owned, multispectral, environmental sensing satellite.

12. Spires, 244; and Dougherty, 48.

13. Spires, 244; and Dougherty, 48.

14. Dougherty, 48.

15. Anson and Cummings, 46; and Spires, 246, 256.

16. Anson and Cummings, 50; and Spires, 249. The two sources disagree over the exact numbers, but the hours of coverage are sufficient for descriptive purposes.

17. Dougherty, 50.

18. Anson and Cummings, 50.

19. Spires, 257.

20. Anson and Cummings, 51.

21. Ibid., 52; and Spires, 251, 258.

22. Spires, 252, 258; and Dougherty, 51.

23. Spires, 259.

24. *Blue Ribbon Panel of the Air Force in Space in the 21st Century*, recommendation no. 12, 21.

25. Larry Gedemer, "Forward Space Support," *Space Tactics Bulletin* 1, Issue 1 (June 1994): 4; and Robert J. Feldman, "FSST Training—It's Not Just for FSST Teams Anymore," *Space Tactics Bulletin* 1, Issue 1 (June 1994): 4–5.

26. Sean D. McClung, "Talon Shield Declares Victory," *Space Tactics Bulletin* 2, Issue 1 (November 1994): 3–4.

27. Jack Fry, "Progress Report—Getting 'Space' to Warfighters," *Space Tactics Bulletin* 3, Issue 2 (Spring 1996): 3.

28. Steven R. Serie and Mark Lester, "Air Force Space Support Team Keeping Peace as Part of Joint Endeavor," *Space Tactics Bulletin* 3, Issue 2 (Spring 1996): 9–10.

29. John Bystroff, "Space Warfare Center (SWC) Offers Course for Air Operations Centers," *Space Tactics Bulletin* 4, Issue 4 (Winter 1997–1998): 6–7.

30. Dr. James Smith, assistant course director, Military Arts and Sciences Department, US Air Force Academy, interviewed by the author, 17 March 1998.

31. Capt Rhonda Carey, Defense Studies Curriculum Area Manager for Officer Training School (OTS) and Reserve Officers Training Corps (ROTC), Maxwell AFB, Ala., interviewed by author, 23 March 1998. The OTS Defense Studies block consists of 27 hours. ROTC classes are spread out over four years of college.

32. Capt James "Buddy" Holley, Curriculum Area Manager for Operations and Doctrine, Air and Space Basic Course, Maxwell AFB, Ala., interviewed by author, 19 March 1998. The Air and Space Basic Course lasts for seven weeks.

33. *Blue Ribbon Panel on Space Implementation Plan*, task 17.

34. The Inspector General of the United States Air Force, "Report on Special Management Review of Integration of Space Operations and Capabilities Throughout the Air Force," *TIG Report* PN 91-600, 24 October 1991, 37.

35. Capt Brent Barber, Operations Officer for Curriculum, Squadron Officers School (SOS), Maxwell AFB, Ala., interviewed by the author, 18 March 1998.

36. *TIG Report*, 37; "Final Report on Operational Needs Analysis for Senior Service and Command and Staff College Space Education," performed under contract to US Space Command by SY Technology, 22 January 1998, 34–35. The SY Technology report further indicated that the military command and staff colleges across the services lacked a comprehensive and integrated space curriculum.

37. Col Eric Sundberg, Air University Space Command Chair, memorandum to the Air War College Commander, subject: Development of Enhanced Core Space Curriculum, AU/CS ltr, 5 October 1989.

38. *TIG Report*, 37; SY Technology Final Report, 9, 16.

39. During lectures at the Air War College and conversations with several students, the author noted a moderate amount of groaning and complaining about the number of classes taught on space.

40. Gen Howell M. Estes III, transcript of interview by Bill Scott, *Aviation Week and Space Technology*, 4 December 1997. A military "stovepipe" is a system or program whose products and functions are generally self-contained and available to a limited group of users. For example, before the Persian Gulf War, intelligence specialists received imagery from the

national satellites. Pilots flying combat missions rarely saw the imagery from which their targets were identified.

41. Chris Kinnan and Joanna Sobieski, "Space in the Air Operations Center: The Quest for Seamless Integration of Space in Warfighter Operations," *Space Tactics Bulletin* 2, Issue 4 (Fall 1995): 4–7; and Karen M. Giacalone, "Space Shooters: Space Systems Hit the Cockpit at the 'Home of the Fighter Pilot,'" *Space Tactics Bulletin* 2, Issue 4 (Fall 1995): 18–19.

42. Mark Davis, "Space Support to the Warfighting Community—From a Unified Action Officer Perspective," *Space Tactics Bulletin* 2, Issue 3 (Summer 1995): 9–10; and T. Robinson, "Joint Space Support Teams at Work Around the World," *Space Tactics Bulletin* 2, Issue 4 (Fall 1995): 15.

43. US Air Force Battle Staff Training School, Primary Blue Flag Exercise Models, n.p.; on-line, Internet, 18 March 1998, available from http://nova.agos.hurlburt.af.mil/Exercise/models.htm.

44. Duane R. Cozadd, "Air Force Space Support Teams," *Space Tactics Bulletin* 2, Issue 4 (Fall 1995): 15–17.

45. Michael Stroud, "Keen Edge 96," *Space Tactics Bulletin* 3, Issue 2 (Spring 1999): 11–12.

46. Brig Gen David Baker, interviewed by Pat Cooper, *Air Force Times*, no. 9, 30 September 1996, 29.

47. *Blue Ribbon Panel on Space Implementation Plan*, Philosophy Statement.

48. James Canan, "Space Support for Shooting Wars," *Air Force Magazine* 76, no. 4 (April 1993): 30–34.

49. Charles A. Horner, "Space Systems Pivotal to Modern Warfare," *Defense 94*, Issue 4 (1994): 22, 25, 27, 28.

50. Howell M. Estes III, "Sustaining the Strategic Space Advantage," *Defense Issues* 12, no. 13 (13 March 1997): 1–10; Howell M. Estes III, "National Security: The Space Dimension," *Defense Issues* 12, no. 52 (14 November 1997): 1–6; Howell M. Estes III, "The Promise of Space Potential for the Future," *Defense Issues* 12, no. 20 (3 April 1997): 1–4; Howell M. Estes III, "Space and Joint Space Doctrine," *Joint Forces Quarterly*, no. 14 (Winter 1996–97): 60–63; and Jim Wolffe, "Toward the Air and Space Force," *Air Force Times*, no. 40 (5 May 1997): 10. General Estes' public pronouncements are more notable for what they do not say. He rarely mentions space-based weapons, and when he does, the remarks are within the context of the political constraints. His near-term visions are to continue to migrate intelligence, surveillance, and reconnaissance missions to space.

51. This idea was first brought to the author's attention by Lt Col Roy Houchin, faculty member at the School of Advanced Airpower Studies, Maxwell AFB, Ala., interviewed by the author, 19 March 1998.

52. Lambakis, 35, 38; James Hackett, "Space, the Critical Defense Frontier," *Washington Times National Weekly Edition*, 22 March 1998, 34; and Peter Grier, "The Arena of Space," *Air Force Magazine* 79, no. 9 (September 1996): 44–47. The Grier article is a summary of some of the

recommendations from the New World Vistas study by the US Air Force Scientific Advisory Board.

53. Peebles, 21, 26, 68–69, 78. Cost sank the Dyna-Soar/X-20 program in 1963, the Manned Orbiting Laboratory in 1969, and the Follow-on Early Warning System in 1993. Funding, politics, technology, and the demise of the Soviet Union in 1991 reduced the Strategic Defense Initiative to the much smaller Ballistic Missile Defense Office.

54. Estes, "National Security: The Space Dimension," 41–46.

55. F. Whitten Peters, Acting Secretary of the Air Force, "Meeting Today's Challenges: Flight Path to the 21st Century," address to the Air Force Association Air Warfare Symposium, Orlando, Fla., 27 February 1998.

56. Estes, "National Security: The Space Dimension," 3.

57. Maj Gen William E. Jones, USAF, Retired, lecture, Air War College, Maxwell AFB, Ala., 25 March 1998.

58. Spires, 274, 296–97. See Spires, Appendix 6-1 for a list of space systems transferred from Strategic Air Command to Air Force Space Command in 1982 and 1983. Air Force Space Command did not gain complete control of satellite command and control and space launch until 1993.

59. The biographies of all current and some recently retired Air Force general officers are available through the Internet on the US Air Force Home Page, on-line, Internet, 17 March 1998, available from http://www.af.mil/cgi-bin/multigate/retrieve?u=z3950r://dtics11:1024. To determine the percentage of officer's experience in particular career fields, the author used the same method developed by Tom Clark, "The Transition to a Space and Air Force: Proposed Solutions to the Dilemma," Research Report no. 97–04 (Maxwell AFB, Ala.: Air War College, April 1997), 23. Lt Col Tom Clark counted the years spent in operational units, commands, and staff positions directly related to a specific mission area as experience in a career field.

60. Maj Gen Dickman spent about 50 percent of his career in space operations and another 40 percent in space acquisition and engineering. Brig Gen Thomas J. Scanlan Jr., a former Director of Operations for US Space Command (now retired) and Brig Gen Robert E. Larned, Director of Imagery Systems, Acquisition, and operations for the National Reconnaissance Office also spent most of their careers in space operations and space systems acquisition.

61. General Estes is an F-4 pilot. His two immediate predecessors, Gen Joseph W. Ashy (1994–1996) and Gen Charles A. Horner (1992–1994) were also career pilots holding their only space assignments as commanders of US and Air Force Space Command.

62. For the purpose of this discussion, career missile officers are not considered space operations officers. Lt Gen Lance W. Lord spent approximately 80 percent of his assignments in missiles and 17 percent in space. Lt Gen Patrick P. Caruana held two space assignments as vice

commander of Air Force Space Command and commander of Fourteenth Air Force.

63. Brig Gen Robert C. Hinson, Air Force Space Command Director of Operations, is a B-52 pilot. Brig Gen Glen W. Moorehead III, at the Space Warfare Center, is a fighter pilot. Brig Gen John S. Boone, Air Force Space Command Director of Plans, spent his first 13 years in missiles and his last 15 in space.

64. Major General Perryman has been commander of the 21st Space Wing (1995–1996), Director of Operations for Air Force Space Command (1996–1997), and commander of Fourteenth Air Force (1997-present). His predecessors at Fourteenth Air Force, Lt Gen David L. Vesely (1995–1997) also commanded the Space Warfare Center (1994–1995) but is a career pilot, and Major General Jones (1994–1995) filled assignments in air control, ground-launched cruise missiles, and space. Although not treated explicitly in this study, Twentieth Air Force commander and in command of the ICBM forces, Maj Gen Donald G. Cook spent 80 percent of his career as a B-52 pilot, about 10 percent in space, and 5 percent in missiles.

65. Brig Gen Franklin J. Blaisdell, 21st Space Wing; Col C. Robert Kehler, 30th Space Wing; and Col Elwood C. Tircuit, 50th Space Wing, are missile officers. The commander of the 45th Space Wing, Brig Gen F. Randall Starbuck, is a pilot.

66. Clark, 21, 24–25.

67. This information is available from the Internet home pages of each of the space wings: 21st Space Wing, on-line, Internet, 17 March 1998, available from http://www.spacecom.af.mil/21sw/21og.htm; 30th Space Wing, on-line, Internet, 17 March 1998, available from http://www.vafb.af.mil/orgs/30swcc.htm; 45th Space Wing, on-line, Internet, 17 March 1998, available from http://www.pafb.af.mil/people; and 50th Space Wing, on-line, Internet, 17 March 1998, available from http://www.fafb.af.mil/biographies.

68. Twenty-first Operations Group, 50 percent space, 50 percent engineering; 821st Space Group, 76 percent space, 24 percent missile; 45th Operations Group, 95 percent missiles, 5 percent space; 50th Operations Group, 68 percent space, 23 percent missiles; and 750th Operations Group, 19 percent engineering, 68 percent space. The 30th Operations Group data was unavailable.

69. Twenty-first Space Wing: 2d, 5th, 6th, 7th, 10th, 11th, 12th, and 13th Space Warning Squadrons; 3d Satellite Communications Squadron; 3d, 4th, 18th, and 20th Space Surveillance Squadrons; and 1st, 2d, and 3d Command and Control Squadrons. The 5th Space Surveillance Squadron was unavailable. Thirtieth Space Wing: 2d and 4th Space Launch Squadrons were unavailable. Forty-fifth Space Wing: 1st, 3d, and 5th Space Launch Squadrons. Fiftieth Space Wing: 1st, 2d, 3d, 4th, 21st, 22d, and 23d Space Operations Squadrons. The 5th Space Operations Squadron was unavailable.

70. Rosen, *Winning the Next War*, 80. Rosen said success in the integration of aviation in the Navy was linked to the pace of promotions.

71. *Blue Ribbon Panel on Space Implementation Plan*, task 15.

72. *TIG Report*, 33.

73. *Blue Ribbon Panel of the Air Force on Space in the 21st Century*, recommendation no. 15b and 24.

74. Canan, 34.

75. Joseph W. Ashy, "Putting Space in the USAF Weapons School," speech to the graduates of the Space Tactics School printed in *USAF Weapons Review* 44, no. 2 (Summer 1996): 2–4.

76. William E. Jones, "White Paper on Space in the USAF," to Maj Gen David W. McIlvoy, Headquarters USAF/XPX, Washington, D.C., 22 December 1997, 17.

77. The Space Warfare Center started a Space Tactics School in 1994 that migrated to the Air Force Weapons School in 1996. Approximately 20 percent of the 560 hours of academics during the six-month course is dedicated to airpower. Students are required to fly three missions and shadow other students during mission planning. The space officers can also ride on any airplane that has an open seat. Lt Col Gregory Billman, USAF Weapons School Space Division Commander, letter to the author, 18 March 1998; Lt Col Gregory Billman, USAF Weapons School Space Division Commander, letter to the author, 19 March 1998; USAF Weapons Instructor Course Syllabus for Space, USAF Weapons School, Nellis AFB, Nev., January 1997, 16–31.

78. Michael Perales, "Integrating Space into the Fight," *USAF Weapons Review* 4, no. 44 (Winter 1996): 18–21.

79. Billman, 18 March 1998.

80. Theodore C. Hailes, Chairman, Department of Regional and Warfare Studies, Air War College, to Air University XPO, letter, subject: Final Report: Special Management Review (SMR) about Integration of Space Operations and Capabilities Throughout the Air Force, 9 December 1991.

81. Capt Michael L. Lakos, Exercise Wargame Director, Air Force Wargaming Institute, Maxwell AFB, Ala., interviewed by author, 19 March 1998.

82. Lakos interview. Two commercial satellite visualization computer programs the Air Force Wargaming Institute is testing are Satellite Tool Kit and Satellite Missile Analysis Tool.

83. James C. Hyde and Michael W. Everett, "Educating Future Leaders in Strategic and Operational Art," *Joint Forces Quarterly*, no. 12, Summer 1996, 29–33.

84. Lakos interview. The Fourteenth Air Force Space Operations Center at Vandenburg AFB, Calif., is the 24-hour support center that manages all requests relating to USAF space systems.

85. Ibid.

86. Cliff D. Ozmun, "Air Force Space Command Establishes First Space Battlelab," *Program Manager* 26, no. 5 (September–October 1997): 81–82.

87. *TIG Report*, 13, 17, 19, 22, 24, 47. *Blue Ribbon Panel on Space Immplementation Plan,* task 5: antisatellite weapons and battle management; task 7: common-user on-orbit support; task 8: space-based wide-area surveillance; task 9: cost-sharing in satellite communications; task 10: battle management for strategic defense; and task 24: expanding Air Force TENCAP—all had lost funding by 1991.

88. *Blue Ribbon Panel of the Air Force on Space in the 21st Century* . recommendation no. 6, develop a new spacelift system, 16; recommendation no. 8, develop antisatellite capabilities, 18; and recommendation no. 9, expand the Air Force role in ballistic missile defense, 19.

89. *TIG Report*, 3, 7, 15, 25. *Blue Ribbon Panel on Space Implementation Plan,* task 1: prepare Air Force Space Policy letter; task 2: revise space doctrinal publications; task 6: update the Air Force Space Plan; and task 11: integrate space-based weapons into Air Force doctrine.

Chapter 5

Summary and Recommendations

This research used the historical analogy of integrating aviation into the US Navy in the 1920s and 1930s to develop a framework against which to measure the progress of integrating space into the Air Force with a view to creating an air and space force. The case study identified 10 policy areas that contributed to the integration of aviation into the fleet and culled from them the five areas most essential to the integration process.

1. Increase the understanding of aviation within the Navy through exposure to aviation capabilities, inclusion in professional military education, and participation in fleet exercises.
2. Promote aviation as an enhancement rather than as a threat to battleship performance.
3. Provide a career path for aviators to achieve senior rank and command.
4. Maintain aviators' familiarity with surface operations.
5. Include aviation in naval war games.

Current space integration policies were compared to the contemporary equivalent of these five areas. Some of the Air Force programs matching the five policy areas are robust; others are weak or require redirection.

Space Integration Policy

The most startling conclusion of this research does not come from what was present but from something that was conspicuously absent: Neither the Air Force nor Air Force Space Command has an articulated and documented space integration plan. In 1989 and 1992, the Air Force built implementation plans to integrate space into air operations. The planners approached integration as a series of loosely related discrete tasks, but the plans were officially sanctioned nonetheless.[1]

A vision statement does not constitute a road map. If the Air Force is going to prevail in integrating space, it should formulate a plan for its people to follow.

Knowledge and Understanding of Space

The most successful segment of the space integration effort is the incorporation of space capabilities and products into air operations. Just as in the early days of naval aviation, association and exposure are awakening the knowledge and understanding of space within the war-fighting community. The Space Warfare Center is making space more accessible to users as downgrading classification levels moves systems and capabilities into the light. Space force participation in field exercises is demonstrating the capabilities space power brings to the fight. The Air Force Wargaming Institute is fostering an environment in which students and senior officers can watch space forces perform in combat operations and understand the role of space in warfare. These initiatives are effective and growing. That war fighters in the field are demanding and pulling space into their operations is a healthy indication of the progress of space integration.

Promoting Space Capabilities

The most contentious fight and the most acrimonious debate between the fliers and the space operators will not be over roles and missions—it will be over funding. Space power does not presently threaten the big three air weapons (fighters, bombers, and airlifters), but it is in direct competition with the airborne intelligence, surveillance, and reconnaissance (ISR) missions; the battle will commence with the migration of those missions to space. There is not enough money to purchase F-22s, airborne lasers, joint strike fighters, unmanned aerial vehicles (UAV), expendable launch vehicles, and space-based warning systems—*and* to fund expensive fleets of AWACS, JSTARS, and RC-135s. The Air Force has to answer the question about the future of these 707-based platforms, UAVs, and space-based ISR. Air Force leaders must then develop a real list of priorities; they must not avoid their responsibility to make tough decisions. Senior leaders bear that responsibility,

and the mission will require hard choices by courageous leaders.

Space Officer Career Progression

The most difficult problem the Air Force faces in integrating space is how to create an air and space officer to employ an air and space force. Twice before, blue ribbon panels recommended developing a comprehensive approach to teach fliers about space and space operators about airpower. Twice before, the panels recommended a cross flow of officers between air operations and space operations assignments. Twice before, the Panels recommended assigning officers with space expertise to the most senior levels of the Air Force.[2] The programs foundered because the Air Force failed to devote sufficient leadership capital into making them work. Career, education, and experience are interrelated because they involve people—and solving the people equation will lead the way to the air and space force.

The Navy once required all officers to serve aboard ship to inculcate into them the meaning of sea power before they entered aviation. Today's Navy no longer maintains that requirement, but all aviators do serve tours aboard ship as seamen "haze gray and underway" early in their careers.[3] The modification of requirements may reflect the success of integrating aviation into the fleet. The competition for flying slots is fierce, and the path to power and influence in the Navy goes from the flight deck to the bridges of aircraft carriers. Naval aviation and sea power have become synonymous.

Every Marine officer spends five months at the Basic School learning to be a Marine infantry rifleman. All officers learn to be platoon leaders, which means learning how to employ marines in combined arms warfare from the platoon leader's perspective. After this mandatory training, the officers select their specialties—but no matter which they choose (aviation, artillery, intelligence, logistics), it exists for the sole purpose of supporting the infantry in combat. Every marine is first and always a rifleman.[4]

Until 1983, the US Army required officers to earn qualification in a branch (infantry, armor, artillery) before entering

aviation. Aviation is now a primary branch itself, but the Army professional military education process uses a building block approach to training that is fundamental to all branches: the command of progressively larger units in battle as part of the combined arms team. The officer courses, basic and advanced, teach lieutenants and captains how to lead and employ platoons and companies. The Army Command and General Staff College trains majors and lieutenant colonels to employ battalions and to function on planning staffs. The Army War College teaches colonels and generals how to develop campaign strategies for brigades, divisions, and corps.[5] Army officers learn how their specialty operates as part of the combined arms package.

The maturation process for Air Force officers is different from those of the Navy, the Marine Corps, and the Army, but distilling several ingredients from the other service programs might improve the Air Force's process. The Air Force does not require any air operations experience of its officers before they become space operators; yet the Air Force is telling them that fliers are their primary customers. The Air Force attempts to teach most of its officers about air warfare through academics in PME and not through firsthand experience. To understand and embrace airpower, space officers need intimate experience with air operations—but those opportunities are only available to an elite few. An entire generation of space officers is ignorant of airpower; yet the air and space force calls for a new breed of renaissance officers. The pilot supply is too tight to fill more than a handful of space officer billets, but the Air Force could certainly select space operators from officers completing tours in air operations fields such as AWACS, JSTARS, command and control, airborne intelligence, aircraft maintenance, command posts, or even navigators, as their career field shrinks. Drawing space operators from this common foundation of experience would accomplish what the Air and Space Basic Course is attempting to do academically.

But education is artificial experience. The intent of the Air and Space Basic Course is to mold air and space officers, but the Air Force is trying to do with books and computers what the Marines are doing with muscle and sweat. Marines become marines by training and living like marines. The Air Force has

made a conscious effort to produce air and space officers, so it should dedicate the necessary resources to do the job right. Get the lieutenants on the flight line and into aircraft. Get them into air and space operations centers. Let them smell jet exhaust, plan a strike mission, deliver bombs on target, and maneuver a satellite. The physical experience would be worth much more than seven weeks of lectures and exercises.

PME should provide context for officer experiences at the appropriate points during career development. Squadron Officers School should concentrate on the tactical capabilities and employment of air and space weapon systems. The Air Command and Staff College should teach planning and integrating air and space operations into the theater campaign. The Air War College should weave air and space into campaigns and strategies. Only the Air War College space curriculum fulfills these objectives—but it may be too much too late.

Space officers with broader career experiences and greater understanding of air and space power should fare better in the competition for leadership positions. Assignment opportunities in air operations, excellence in space operations, and timely doses of education should cultivate air and space power leaders. The passage of time may permit more space operations officers to achieve senior rank, but as long as the Air Force remains primarily an *air* force, senior space officers with minimal knowledge and experience in air operations will never hold the most influential leadership positions and combat commands. Implementing these suggestions will require a massive overhaul of the Air Force personnel and education process. Blue Ribbon Panels and Air Force leaders demanded this no less than five times in the past. The Air Force should heed its own advice.

The effort to integrate aviation into the Navy from 1921 to 1941 provides a suitable framework that the Air Force can emulate to integrate space power into Air Force operations. The policy challenges of integrating space power into the Air Force are similar—but not identical—to those faced by the Navy in integrating aviation in the 1920s and 1930s. The similarities are compelling, but that does not mean the historical analogy presents a perfect template for emulation. Science builds on the work, the ideas, the innovations, and the discov-

eries of the past. That is called progress. The future of military science can be built on military history. History does not provide prescriptions for success, but it does offer a rich harvest of ideas and guidance. The naval aviation precedent even offers specific recommendations for space integration. More importantly, the naval aviation analogy strongly suggests that the integration process involves more than the acquisition of weapons and combat power. Integration is a social process among people who have institutional identities and loyalties. An Air Force enamored by technological prowess neglected the human component in two earlier attempts to integrate space into air operations. Without a current plan, the Air Force has done well to integrate space capabilities and products but has not done as well with people. Integration also must be a human enterprise. Integration is an attitude.

Notes

1. Both the 1989 and 1992 Blue Ribbon Panels were commissioned by the Chief of Staff of the Air Force.

2. *Blue Ribbon Panel on Space Implementation Plan*, tasks, 3, 15, 17, 18, 22. *Blue Ribbon Panel of the Air Force on Space in the 21st Century*, recommendations 15a, 15b, 16, 24, 25.

3. Naval officers generally attend flight school right after commissioning, but some officers go to sea to await an opening. After flight school, the aviators go to sea on carriers for three to four years, return to shore duty for two to three years, and then perform their tour "on the boat." Cdr Richard Bohner, US Navy, Naval Aviator, interviewed by author, Maxwell AFB, Ala., 30 March 1998.

4. Lt Col David H. "Cow" Gurney, US Marine Corps, Marine Aviator, interviewed by author, Maxwell AFB, Ala., 30 March 1998.

5. Maj Clifton L. Dickey, US Army, Army Aviator, 82d Airborne Division, interviewed by author, Maxwell AFB, Ala., 30 March 1998.

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