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Tough Tommy's Space Force

General Thomas S. Power and the Air Force Space Program

Brent D. Ziarnick
Major, USAFR

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About the Author

Maj Brent D. Ziarnick received his commission from the United States Air Force Academy in 2003. He attended Space and Missile Prerequisite Training and Global Positioning System (GPS) Satellite Vehicle Officer training at Vandenberg Air Force Base, California. Major Ziarnick was then assigned to the 2nd Space Operations Squadron, Schriever Air Force Base, Colorado, where he served as a GPS crew officer, a subsystems engineer, and ultimately a tactics officer of the 50th Space Wing. In 2007, Major Ziarnick joined the Air Force Reserve and became an individual mobilization augmentee (IMA) in the 25th Space Range Squadron where he was certified as a Range Control Officer. Major Ziarnick was then deployed to the 379th Air Operations Center, Al Udeid Air Base, Qatar, as a space control planner in support of Operation Enduring Freedom. Returning from deployment, he became a traditional reservist (TR) in the 701st Combat Operations Squadron, March Air Reserve Base, California, where he served as a Combat Operations Division Space Duty Officer in multiple Ulchi Freedom Guardian and Key Resolve exercises in the 607th Air and Space Operations Center, Osan Air Base, Republic of Korea. Major Ziarnick also participated in many other joint exercises in roles that included Plans Officer and Director of Space Forces.

Major Ziarnick earned a Masters of Engineering in Space Systems Engineering from the University of Colorado at Colorado Springs in 2007, a Master of Operational Art and Science from the Air Command and Staff College in 2015, and a Doctorate in Economic Development from New Mexico State University in 2013. Major Ziarnick is currently an instructor at the Reserve National Security Space Institute, Peterson Air Force Base, Colorado.

Acknowledgments

This study began as a whim in 2014 when I thought it might be interesting to look into Air Force archives for anything I could find regarding Project Orion. It was through George Dyson, who wrote the project's definitive history, and his enthusiastic support of my initial forays that the whim became a research project. My research led me to Dr. Robert Duffner, Air Force Research Laboratory's Command Historian at Kirtland AFB, NM, who graciously allowed a reserve officer to search through his Orion archives. To both men I owe my sincere thanks for setting me on this journey.

As my research shifted from Project Orion to Gen Thomas Power's support of the Air Force's space program, many people provided invaluable help. Dr. Jerry Martin and Dr. Dan Harrington, historians at US Strategic Command, Offutt AFB, NE, provided many insights and documents regarding General Power. I owe deep thanks to Archie Difante, Maranda Gilmore, Tammy Horton, and the staff of the Air Force Historical Research Agency for their help finding and declassifying hundreds of obscure documents. I also greatly appreciate Col M.V. "Coyote" Smith for our many conversations putting General Power and SAC in historical context of both the Air Force and the national space program. Also, I must thank Dr. Tom Hughes for explaining to an engineer and economist how to write history. I am especially indebted to Mr. Frederick F. Gorschboth, an original Project Orion staff officer, for travelling to Maxwell AFB to discuss his role in the effort. To speak to one of the first Air Force space theorists, who should be known as the military father of the Space Navy concept, is a great personal honor.

Lastly, and most importantly, I must thank my wife and children for their patience as daddy worked on too many weekends we should have been swimming in Gulf Shores or visiting the Rocket Center at Huntsville.

Abstract

This study examines the career of Gen Thomas Sarsfield Power, third Commander-in-Chief of Strategic Air Command, and especially his forgotten contributions to the early Air Force space program. The author describes the modern search for an Alfred Thayer Mahan for space, or a space war-fighting icon for the Air Force. The study identifies three major contributions to the Air Force space program Power had, using I.B. Holley's three step organizational model to develop superior weapons from new technology. First, the study describes Power's role in establishing Gen Bernard Schriever's Western Development Division as a true space organization rather than merely a ballistic missile organization. Second, it details Power's efforts to develop concepts and early doctrine for military space activity under the Study Requirements (SR) system. Third, it catalogs Power's efforts to transform Strategic Air Command into a strategic aerospace command by championing advanced nuclear space programs, including a manned strategic space force based on Project Orion, an Air Force program to develop a nuclear pulse rocket. The study reviews today's Air Force space effort and assesses Power's space ideas' modern relevance. Thomas Power should be considered the Air Force's space war-fighting icon, and the Air Force should reclaim Power's ideas to rejuvenate its space program.

Chapter 1

Introduction
Of Insanity and Icons

In 1999 Maj Shawn Rife challenged advocates of an independent space force, fancying "themselves as modern-day [Billy] Mitchells or Giulio Douhets," to become "today's Douhet or Mitchell (or even Alfred Thayer Mahan) for space power." So far, Rife wrote, "no such original thinker has yet clearly emerged. Without one, an independent space force really seems to lack a raison d'être."[1] Fifteen years later, Dr. Dale Hayden raised the same question, writing "Carl von Clausewitz, Alfred Thayer Mahan, and Giulio Douhet serve as foundational figures in the path toward war-fighting doctrine. For decades space professionals have asked, 'Who is our foundational theorist?' or 'Where is the space Mahan?' Who is space's doctrinal icon, and if one does not exist, why not?" Hayden reasoned that Clausewitz, Mahan, and Douhet developed doctrine "that revolutionized warfare" by independently shaping the battlefield by observing "the world around them and chronicled what they saw as the keys to victory. What separated these men from others was their ability to see beyond existing convention or the current state of technological development. They could envision future potential by which armies, navies, and air forces should best deploy forces to defeat their enemies."[2]

Both Rife and Hayden raise fundamental questions facing the space forces from the very beginning of the space age: How are space forces meant to influence strategy? Are space forces supposed to be more than mere auxiliaries to terrestrial power? What do mature space forces look like? Where is the Mahan for space? Even though American space forces have a 'father' in Gen Bernard Schriever, he is at best a father that provided for his young children without adequately preparing them to face the adult world on their own, because space forces still cannot answer these foundational questions of identity. In short, what do the American space forces want to be when they grow up?

There are many reasons why space power cannot yet significantly shape strategy, but that does not excuse space professionals from thinking about its doing so. "The fact that space assets cannot independently

alter the course of combat," Hayden implored, "does not mean that the force should not think about, or even write about, space doctrine."[3] It is no testament to the professionalism of space officers that, although there have been some valiant attempts, we are no closer to answering Major Rife's and Dr. Hayden's question now than fifteen years ago.

This anchorless conception of military space power midwifed the present study. The author intends to use a set of questions first presented by Dr. I. B. Holley, Jr., a Duke history professor and Air Force Reserve major general, in October, 1982. Holley asked what he thought were central questions confronting the military in the Space Age, "What organizational structure is best suited to the exploitation of space as an aspect of national defense? Should SAC [Strategic Air Command], with its splendid track record of aggressiveness and exacting professionalism, have been the chosen instrument? Was a separate 'Space Command' the best solution?"[4]

At its birth, the space mission was given to the engineering-based Systems Command under General Schriever, an organization that drew its lineage from Air Research and Development Command, specifically the Western Development Division that developed the ICBM. What make Holley's questions so interesting, however, are his inferences to the organizational history of American military airpower. Holley argued the airplane was originally given to the Army Signal Corps because the airplane was an engineering marvel, but it made much more sense doctrinally to give the airplane to the cavalry, an Army combat arm. Holley believed classic cavalry operations such as strategic deep strike, screening, reconnaissance, and battlefield attack missions had very close analogues in modern air operations. To Holley, "Aircraft, even in their crude and undeveloped state in the years before World War I, gave promise of becoming a far better horse."[5]

Here Holley's question as to whether space should have been given to SAC showcases its true importance. If the cavalry had been given the mission of developing the airplane, it might have developed a combat theory for airpower far faster than did the Signal Corps. If the cavalry might have seen the airplane as a better horse, might have SAC been able to see the spacecraft as a better bomber, and, consequently, might it have been able to develop a combat theory for space power, a feat that has thus far eluded the Schriever-inspired Systems and Space Commands? This study suggests that one man in SAC tried to do exactly that.

Gen Thomas Sarsfield Power, the third Commander-in-Chief of Strategic Air Command, is Dr. Hayden's war-fighting icon for space and—though Power may not exactly be the Mahan for space—he was nonetheless Rife's critical "original thinker" who would have allowed the Mahan of space to emerge. Indeed, Power championed the work of one junior officer who might have been—and may yet still become—a Mahan for space. This study will argue that Power's vision and attempt to develop and integrate space into the American defense establishment and the United States Air Force make him a greater space father than Schriever. Schriever's lack of a comprehensive space vision, which emerged from his emphasis on the ballistic missile rather than the space domain itself, is the major contributing factor for space's current dilemma. Alternatively, General Power's efforts to provide the doctrinal and material "meat" to make Gen Thomas D. White's "aerospace" concept a reality was a comprehensive space development campaign that would have placed USAF space efforts front-and-center in the work to provide military aerospace power to the nation.

White claimed the air and space were "not two separate media to be divided by a line and to be readily separated into two distinct categories." Rather, they should be considered the aerospace, because space "is the natural and logical extension of air" and "space power is merely the cumulative result of the evolutionary growth of air power."[6] White coined the aerospace concept. Power lived it.

Tommy Power is one of the most misunderstood officers ever to have worn the uniform of the United States Air Force. Popular history, written mostly by anti-nuclear polemicists searching for a villain and civilian defense experts who loathed him, remember Power as a tyrannical sadist—the living embodiment of everything wrong with both nuclear weapons and the military mind.[7] To them, Power was a demonic, despotic, and detested commander—the willing and able hatchet man of Gen Curtis LeMay, a senior leader who himself was one of the cruelest men in uniform. If given the chance, the thinking goes, LeMay and Power would have started a global thermonuclear war against the Soviet Union. Power was also a man intellectually incapable of performing the duties entrusted to him, for he was only a high-school graduate. Demented and dimwitted, the world was spared destruction only because the world was lucky enough that Power was stopped.

Air Force history, if Power is remembered at all, portrays him as a second-hand copy of Curtis Lemay. Power emerged as LeMay's right hand man in the firebombing of Tokyo and remained LeMay's loyal subordinate for almost two decades, faithfully executing LeMay's innovations without critical reflection. Power was a bomber boy addicted to flying, who was fortunately bested by the visionary Bernard Schriever and his ultimate weapon, the intercontinental ballistic missile. Power's lackluster leadership of Strategic Air Command began SAC's slow decline into irrelevance as LeMay's crown jewel tarnished into a plodding, bureaucratic freak show finally discarded and forgotten by the real Air Force. Power was also the last senior Flying Cadet, the last general without a college diploma, and a relic of a bygone era of barnstormers perhaps high on courage but low on intelligence.[8] In history, Power was a "sadist," because LeMay himself admitted as much—a trait only partly redeemed because Power "got the job done."[9]

This narrative is wrong. Power's reputation is the function of both the extreme arrogance of the intellectual class in the 1960's and the emotional vitriol of the anti-nuclear movement in subsequent decades, abetted by Power's relatively early death. But perhaps the most unfortunate fact of Power's life is that he lived for so long under the shadow of Curtis LeMay. Historians have been uninterested, and polemicists have peddled half-truths about Power. As a result, history has accepted a caricature.

No longer. Thomas Power deserves to be seen as his own man, not what the conventional wisdom suggests. Rather than a sadist and tyrant, Power was a stern but compassionate man of deep faith, devotion, and character deeply respected by those who knew him well. Rather than a dim copy of LeMay, Power was an innovative and daring combat commander largely responsible for the development of SAC itself. Rather than a strategic dullard easily beaten by whiz kids, he was a man of remarkable military insight and experience who could—and did—speak intelligently and articulately. And, perhaps most important to today's Air Force, instead of a man intimidated and horrified by the rise of the ICBM in his flying club, Power had the most accurate understanding of the real value of space to the Air Force and the nation. He, more than Schriever, is the true father of the United States Air Force space effort. Ultimately, Thomas Power is the last, unsung, founding father of American airpower and the champion of the United States Aerospace Force—the peak evolution

of the airpower visions of Billy Mitchell, Hap Arnold, and Haywood Hansell.

This study argues that Power should be the war-fighting icon for space by using a set of criteria first presented by Holley in his book *Ideas and Weapons* regarding the growth of American airpower. Holley explained that in World War I "exploitation of the air weapon depended upon two critical factors: doctrine and equipment."[10] Holley wrote "World War I emphasized the necessity for a conscious recognition of the need for both superior weapons and doctrines to ensure maximum exploitation of their full potential," as well as for an adequate organization to manage the two.[11] Further, Holley explained that such "adequate organization" required two different kinds of activity. First, it needed an organization for information and doctrine, which involved "agencies for objective, systematic compilation" of facts about warfare and doctrine, facts regarding developments both tactical and technical, and facts about scientific findings for possible application to weapons. Its second requirement was a "means of making decisions" requiring "organizations at all echelons for making authoritative decisions based upon information systematically, objectively, and continuously accumulated by responsible and effective organizations especially created to gather data."[12]

Power should be space doctrine's war-fighting icon because he was able to see beyond the existing political and technical conventions of space in the 1960's and realize the USAF could not "afford to play catch-up or wait for the day when the battlefield is shaped by the heavens."[13] To ensure the United States was ready for the space age, as commander of Air Research and Development Command (ARDC) and later Commander in Chief, Strategic Air Command, Power almost single-handedly orchestrated the development of the organizations, doctrine, and equipment necessary to achieve a mature military space power for the nation and turn its airpower arm into a true United States Aerospace Force.

This study will describe how Power established the organization, doctrine, and equipment required for effective military development in space. Chapter Two summarizes Power's early years and career to 1954 to introduce the man and the early influences that shaped him. Power's flying career was in many ways very ordinary in the American air service until World War II, when his activities set the stage for his later rise to four-star rank and command of what was arguably the most destructive military force in human history. Nevertheless, early

events hinted at the man he would become, and some of his early experiences show tantalizing glimpses not of an evil and dimwitted personality, but of a highly innovative technical officer capable of becoming a future space visionary and operational commander.

Chapter Three will detail the beginning of Power's time as Air Research and Development Command commander from 1954 to 1956. It will describe Power's first major contribution to the Air Force space effort—assigning the Air Force WS-117L satellite program to the Western Development Division (WDD) to be concurrently developed with the Atlas ICBM, against WDD commander Schriever's wishes. By mating a potential payload to a potential space launch vehicle, Power fundamentally altered the WDD from being merely a ballistic missile development organization into a true space development organization. In doing so, Power satisfied Holley's requirement to establish an information organization to manage the development of American space power.

Chapter Four continues the examination of Power's ARDC command tour from 1956 to 1957.This portion of the argument describes General Power's innovative Air Force-industry partnership to develop military operational concepts reflected in the Study Requirements (SR) system. The SR series of reports ultimately provided thousands of pages of data on space issues, including orbital military space doctrine, performance studies, and military space force requirements. This classified research informed early Air Force space efforts and added great depth to Gen Thomas White's aerospace concept. The chapter will use declassified data to outline the scope of this remarkable—yet mostly unknown—attempt by the Air Force to understand space doctrine through intense research by both military and civilian experts. Through the SR reports, Power met Holley's requirement for an organization to study doctrine as well as equipment to put that doctrine into practice.

In 1957 Power became the third Strategic Air Command Commander-in-Chief. Chapter Five will explore his activities as SAC commander from 1957 to 1964 to further space activities that would help SAC move its mission into space and provide the United States militarily significant space capabilities far in excess of the NASA program, building the equipment Holley required for space power. Power's drive is encapsulated by his support of Project Orion, a program devoted to launching extremely large human payloads into space using nuclear power. Power's efforts culminated in the 1962 Air Force

Space Program, an ambitious agenda supported by Chief of Staff Gen Curtis LeMay, but ultimately rejected by the Department of Defense under Secretary of Defense Robert McNamara. It will also describe other activities by Power to instill an Aerospace Force mentality at SAC, turning the organization into a champion of aerospace power. However, with General Power's retirement in 1964, his efforts to develop the organization, doctrine, and equipment necessary to develop combat space power ended in failure, relegated to little beyond classified archives.

Chapter Six details what happened to Power's space vision after his retirement. It relates the rise of Bernard Schriever as the "father of the Air Force space program" and Schriever's efforts to disassemble Power's constructive vision for space and refocus the organizations meant to build American space power from space development back to ballistic missile technology. Because of its classification, most of the Aerospace Force plans supported by Power are today forgotten by the service and neglected by historians who are not aware of their existence. In addition, Power himself was forgotten except by his enemies, who have defined his memory.

Chapter Seven will offer some thoughts on why Power was forgotten and what his legacy as space doctrine's war-fighting icon means to the United States Air Force space program today. The paper will conclude with observations and recommendations to preserve Power's legacy, rejuvenate Air Force Space Command, and place the United States Air Force on the path to becoming a true Aerospace Force in the full meaning of General White's and General Power's vision.

Thomas Power deserves a hearing and the Air Force space program needs a hero. This thesis aims to provide both.

Notes

1. Shawn Rife, "On Space Power Separatism," *Airpower Journal* (Maxwell AFB, AL: Air University Press, Spring 1999), accessed 23 August 2015, http://www.airpower.maxwell.af.mil/airchronicles/apj/apj99/spr99/rife.html.

2. Dale Hayden, "The Search for Space Doctrine's War-Fighting Icon," *Air and Space Power Journal* (Maxwell AFB, AL: Air University Press, November-December 2014), 55.

3. Hayden, "The Search for Space Doctrine's War-Fighting Icon," 61.

4. Maj Gen I.B. Holley, Jr., *Technology and Military Doctrine* (Maxwell AFB, AL: Air University Press, August 2004), 113.

5. Holley, *Technology and Military Doctrine*, 115–16.

6. Thomas D. White, "The Inevitable Climb to Space," *Air University Quarterly Review*, Vol 10, No. 4 (Winter 1958-59), 3–4.

7. For a representative popular account of Power, see Richard Rhodes, "The General and World War III," *New Yorker* (19 June 1995), 56.

8. Stephen Budianski, *Air Power* (New York, NY: Penguin Books, 2004), 366.

9. Thomas M. Coffey, *Iron Eagle: The Turbulent Life of Curtis LeMay* (New York, NY: Crown Publishers, 1986), 276.

10. I.B. Holley, Jr. *Ideas and Weapons* (New York, NY: Yale University Press, 1953), 50.

11. Holley, *Ideas and Weapons*, 175–6.

12. Holley, *Ideas and Weapons*, 176.

13. Hayden, "Space Doctrine's War-Fighting Icon," 55, 61.

Chapter 2

The Development of an Aerospace Officer
1905–1954

Thomas Sarsfield "Tommy" Power was born in New York City on 18 June 1905 to Irish immigrants Thomas S. and Mary (Rice) Power. The Powers were a relatively wealthy farming family from Tipperary, Ireland. But Thomas and Mary were not destined to receive a large inheritance, so they immigrated to the United States in 1900. Thomas soon became a dried-goods salesman and provided the Power family (they would have two daughters along with son Thomas) with a solid middle-class income, but the family was raised in an aristocratic manner stemming largely from their family's upper-class Irish heritage.

Tommy Power was educated at Mamaroneck School in Mamaroneck from 1918-1919 and transferred to Barnard's School for Boys in the Bronx, where he received a fine classical education. He was set to attend college when the Power family fell apart. Thomas and Mary divorced shortly before Tommy was set to graduate Barnard's, and in 1921 he dropped out of high school to get a job because there was no money for him to attend college.[1]

Although he was raised to think of himself as a member of the upper class, Tommy was no stranger to hard work. Instead of going to college, he joined Godwin Construction Company on 41st Street and Lexington Avenue in New York City as a clerk. Convinced he should go to college, Tommy also enrolled in Cooper Union night classes to study civil engineering. By 1926 he had become a construction superintendent. Years later, Power referred to his time between 1922 and 1927 in a resume as "construction engineer."[2]

Tommy was probably content to have remained a civil engineer in New York City, but two events took his life in a different direction. First was Charles Lindbergh's historic flight from New York to Paris from 20-21 May 1927. Like many people, especially in New York, Tommy was caught up in the euphoria. In a 1960 interview Power recalled that he had "the natural longing to fly that a lot of youngsters get," but that it was "probably Lindbergh's flight [that] really got me to make up my mind that I was going to do something about a career in aviation."[3]

As in the case of many fancies, reality became a difficult roadblock. Flying was expensive, so Power continued to work. It was not long after Lindbergh's flight that Tommy had his second—and personal—encounter with aviation. At a company outing Tommy and his crew sat watching a barnstorming pilot over a nearby cow pasture with a World War I-era Curtiss Jenny trainer.[4] Fascinated by what he saw, Tommy asked the pilot for a ride. Like most barnstormers of the period the pilot complied, for a price—$10 a flight ($140 in 2015 dollars). Tommy borrowed the money from his crew, and the pilot took him for a ten-minute flight that included a few loops.[5] Impressed with Tommy's enthusiasm, the barnstormer took him up for a second flight and performed a few more stunts.[6] After he climbed down from the cockpit, Power could only say years later, "I was hooked."[7]

Perhaps remembering that Lindbergh had graduated from the program a few years before, Tommy decided to apply as an Army Air Corps Flying Cadet. Tommy's rationale for joining the armed forces was straightforward—to get free flying lessons. Only the year before, the requirements to become an Air Corps Flying Cadet had been to be an unmarried male citizen of the United States between the ages of twenty and twenty-seven with a high school diploma or equivalent.[8] However, the 1928 classes had much stricter requirements. The Air Corps flying training program had had an exceptionally high attrition rate, and Air Corps officials sought to maintain a high standard of professionalization for the officer corps. Therefore, officials raised the educational requirements from a high school graduate or equivalent to two years of college or, at a minimum, be able to pass a test that showed mastery of material one would see in the first two years of college. Tommy Power was not a high-school graduate, and could not show two years of college with his night classes at Cooper Union, so he had to take the equivalency test.

The test was difficult. Air Corps records indicate that between July 1928 and June 1939, roughly 1,500 applicants took the test and only 411 passed.[9] To succeed, Tommy could not rely on Cooper Union's part-time night classes. Therefore, after work and on weekends, he entombed himself in the New York Public Library for months studying every subject he would have to master.[10] He maintained this demanding schedule for almost six months, but as soon as he thought he was ready, he reported to the testing center and took the exam. He passed.

Flying Cadet Thomas Power reported to the Air Service Primary Flying School at March Field, California, on 29 February 1928. The

March Field Primary School was relatively new, its first class entering in November 1927.[11] Power's class was only the second at the field. It was destined to begin the careers of two important airpower leaders. In addition to Power, Haywood S. Hansell (who later gained recognition as a writer of Air War Plans Division-1) also began his flying career in the March 1928 class.

The Air Corps flying training program had just completed a major revision when Cadet Power arrived in Riverside, California. The six-month initial school was extended to eight months. Cadets and Flying Officers (newly commissioned officers from West Point or ROTC attending pilot training) were sent through a battery of medical and physical tests. Before they could even touch an airplane, they were subjected to the infamous 609 medical examination as well as the Ruggles Orientator, a metal cage inside a gyroscope designed to test the student's ability to control the stick and rudder simultaneously in various circumstances.[12] Those who passed were then given four months of instruction on the standard Army trainer. For the second half of the course, the students were upgraded into an Army Observation aircraft and taught the skills necessary to perform the observation mission. At the end of these two critical periods, the graduate was deemed "a thoroughly competent airplane pilot."[13]

Three decades later, Power recalled the "most difficult stage [of Primary School] perhaps was the first one, the solo stage. . . . We soloed first and, from there, went right into an aerobatics stage which is rather surprising."[14] After the aerobatics stage, the students went through an accuracy stage, then upgraded their flying platform to a World War I-era DeHavilland. In the DeHavilland, instructors focused on control accuracy rather than basic flying skills, and students began formation flying and other skills necessary for Army aviators.

In October 1928, 48 of the approximately 100 students who began graduated, and moved on to Advanced Flying School on 1 November. In addition to Power and Hansell, the Kelly Field Advanced School November class added Frank Armstrong, a Brooks Field Primary School graduate, who would later become the inspiration for the movie *Twelve O'clock High.*[15]

The four-month Advanced Flying School was the last obstacle before earning the grade of airplane pilot. All students received finishing training as observation pilots and aerial gunners while there, but the Advanced School's primary role was to give every flyer

his specialty as an observation, pursuit, bombardment, or attack pilot.[16] In an odd twist of fate, Power started out as a pursuit pilot.

Power and the 85 other members of his class constituted the largest class in the history of the Advanced School since the Great War and earned their wings on 28 February 1929, a year after Power entered the Air Corps as a Flying Cadet. Power became a second lieutenant in the Air Corps Reserve on the same day. Shortly after, Power received orders—along with Hansell and Armstrong among others—to the 2nd Bombardment Group at Langley Field, Virginia. Power arrived at Langley in late March. Hansell, Armstrong, and Power were all assigned to the Group's 46th Bombardment Squadron.

Power was not the only pursuit pilot to be flying bombers. Lt Howard E. Hall, writing in the 26 April 1929 *Air Corps Newsletter*, said of the new batch of lieutenants, "Only six of the new officers have had any training in bombardment at the Schools, the rest being Pursuit, Observation, and Attack men. It will be necessary to give these officers training in Bombardment in the Group, so it will be some time before they are ready to take part in Group Operations."[17]

Flying at this exciting but hazardous time, Power was not immune to the dangers of the Keystone bomber, the unit's assigned airplane. He later recalled, "I must have had about half a dozen actual forced landings. But we used to put our airplanes down in one piece, then fly them out again after they were fixed."[18] Throughout his flying career, Power had many close calls; but a point of pride was that he had never "cracked up a military airplane in some 10,000 hours of flying."[19]

Applying for active service, Power received his regular commission as a member of the Air Corps on 4 September 1929. He ranked higher than most college graduates of his flying training class.[20] He became a fully mission-ready rated Pilot on 13 October 1929.[21] Averaging around 30-40 hours of military flying a month as either a pilot or observer, Power, like all of the flying officers, moved around among various squadrons and jobs, but even routine flying was dangerous. He and his Curtiss B2 Condor were forced down in Boykins, Virginia, in December 1929 due to darkness and a severe snow storm.[22] Still, besides the occasional in-flight mishap common to all pre-war aviators, Power's flying time and military positions were the stuff of a competent but unremarkable career.

Some glimpses of Power's connection to advanced technology and his skill at flying, however, do emerge from his early career. In April 1931, he was part of a 49th Bombardment Squadron night navigation

experimental flight where three bombers used radio navigation to fly from Bolling Field to Langley Field, Virginia. The flyers kept in constant contact with the Langley Field radio navigation beacon as well as 2nd Bombardment Group ground stations.[23]

Lieutenant Power received orders to ACTS—the Air Corps Technical School—beginning 1 October 1931, at Chanute Field, Illinois, as one of the 22 students in the Maintenance Engineering class.[24] This was a major turning point in his career for two reasons. First, it signified the point at which Power became intimately familiar with aircraft from a technical standpoint as well as from an operational flying perspective, a familiarity that proved invaluable later. The maintenance program at the Air Corps Technical School was considered the best in the nation well into World War II.[25] Second, and perhaps most significantly, attendance at the Technical School precluded his early attendance at the Air Corps Tactical School (the ACTS most familiar to people today) instead, as his flight training and 2nd Bombardment Group compatriot Haywood Hansell did in 1934, which led to his tour teaching there the next year. Hansell's connection to the Tactical School made him one writer of Air War Plans Division—1 (AWPD-1) in August 1941 and sealed his future as both a one-star commander of the XXI Bomber Command in August 1944 and the reputation as a father of the United States Air Force. Power, alternatively, remained in operational flying units and did not attend the Tactical School until just before World War II, delaying his emergence from Air Force obscurity until 1945 with his B-29 wing command and significantly only in 1954 as Strategic Air Command vice commander under Curtis LeMay.[26]

Power arrived at Chanute Field in late September and began maintenance training. On 25 June, Power graduated from the Technical School, with the graduation ceremony capped by the launching of the Army's T-6C blimp. A few days later, Power accompanied his maintenance engineering class to a tour of the Air Corps Material Division at Wright Field in Dayton, Ohio, a unit he would command almost twenty years later.[27] Then he moved back to Langley Field and the 2nd Bombardment Group.

By December, 1932, Power served as the armament, intelligence, and range officer of the 96th Bombardment Squadron, as well as the assistant engineering officer. On 14 July 1933, Power became the commanding officer of 118th Company, Civilian Conservation Corps—part of Pres. Franklin Roosevelt's efforts to get Americans

work in the Great Depression.[28] Based at Annette State Forest Camp, New Hampshire, the 118th Company had 200 men assigned to it. The company initially lived in tents; but in the few months before winter, six barracks were built as well as a mess hall, a recreation hall, an officer's barracks, and truck shelters. 118th Company focused on reforestation, cleaning up existing forest plots, building fire trails, digging water holes for forest fire protection, building roads, and fighting pine-blister rust in New Hampshire. In his memoires, Curtis LeMay was dismissive of CCC duty for officers and said that Tommy Power "drew the job of being Campfire Guardian to an aggregation of World War I 'heroes' who in many cases had spent the lion's share of their military careers in the stockade." LeMay also complained that Air Corps officers in CCC duty were forced behind other officers because in the Air Corps any time away from flying was devastating.[29] Regardless of the loss of flight time, however, for Power the CCC posting was a much-needed change of pace and provided the young officer solid leadership experience.

Lieutenant Power was recalled to the Air Corps in February 1934 to assist in one of the most important, and tragic, operations of the interwar Air Corps. In early February 1934, President Roosevelt directed Postmaster General James Farley to cancel all air-mail contracts with private airlines due to widespread contract fraud, and the Army Air Corps was ordered to deliver the mail. During this time, the Air Corps operated in some of the worst flying weather North America had seen for many years. At the end of the operation on 1 June 1934, twelve Air Corps pilots had died in sixty-six crashes. The reasons for these losses included poor Air Corps equipment and inexperienced pilots. More than half of the 260 pilots available to the Army Air Corps Mail Operation (AACMO) had less than two years' flying experience, only thirty-one had fifty hours or more of night flying time, and the overwhelming majority had logged fewer than twenty-five hours of weather or instrument time.[30] But Lieutenant Power had accumulated over 1,150 flying hours between February 1929 and September 1933 alone, and had experience with night radio-navigation dating back to 1931.[31] He was among the most proficient and veteran pilots of the AACMO, invariably delivered his mail, and emerged from the experience unscathed.[32]

In May 1934 Lieutenant Power's demonstrated skill led to an assignment as one of the first instructors in Instrument Flying in the Air Corps, stationed at the new school at Langley Field.[33] At the end

of the AACMO, instrument-flying education was improved to encompass multiple stages. The first stage was blind flying with a turn indicator and rate of climb indicator to prevent the aircraft from stalling. The second phase included compass training to fly a magnetic course. The third phase included instruction in radio navigation, and the final phase utilized an entire suite of instruments to include a directional gyrocompass and an artificial horizon to fly for an extended period of time.[34] The navigation school at Langley also received one of the first six Model A Link trainers, the Air Corps' first true aircraft simulator. This machine taught students how to fly far better than the Ruggles Orientator that Flying Cadet Power had endured seven years earlier.[35] After this assignment at Langley, Power was promoted to the temporary grade of captain on 20 April 1935 and served as the commanding officer of the 2nd Wing Headquarters Detachment and operations officer of the 20th Bombardment Squadron.[36] In December 1935, after six years at Langley Field interrupted only by a few detached duties, Captain Power experienced the first permanent change of station of his career.

He received orders to the 28th Bombardment Squadron and Nichols Field, Philippines in August 1935, reverting to his permanent rank of first lieutenant as he departed across the Pacific.[37] He arrived on station in February 1936. While at Nichols Field, Power stayed busy as the adjutant, as well as the squadron's mess, armament, and engineering officer.

On 3 April 1936, shortly after arriving, and following a courtship dating back to Langley, Lieutenant Power married Miss Mae Ayre, an English woman from the northern England town of Newcastle-on-Tyne. From 1936 to Tommy's death in 1970, Mae Power followed her husband closely, except for his overseas deployments in World War II. Most of the Power's time in the Philippines was happy. The 28th Bombardment Squadron's Keystone LB-5's were quite familiar to him. The squadron's mission was training for coastal defense; and the squadron's aircrews spent most days on navigation, bomb sight training, and aerial gunnery.[38] Power took part in tow—target missions to fly targets for Fort Mills live-fire anti-aircraft gunnery practice from 27 January to 23 February 1937, probably more exciting than most of the pilots wanted, given the open-cockpit of the LB-5![39] Training became much more interesting and fun for crews when the open cockpit biplanes were upgraded to Martin B-10's, the first all metal monoplane bombers in the Air Corps, in late 1937.[40]

While in the Philippines, Lieutenant Power demonstrated some inkling of his talent for forecasting future weapons development. On 8 February 1937, writing from the 28th Bombardment Squadron Office of the Chief Engineer, Power wrote to the Chief of the Air Corps regarding the "Design of an Aerial Torpedo for use against Bombardment Airplanes." Perhaps building on his early fighter pilot experience, Power wrote "I have worked out the general plan of a new weapon for employment against bombers which I submit for your consideration as to the originality and feasibility of designing and building."

Power described his air torpedo as "a projectile mounted on the upper or lower surface of each wing of a pursuit airplane outside the arc of the propeller." The projectile would contain a charge of high explosive to be set off by a timed fuse. The torpedo casing would also have short fins so as to give the weapon lift and stability in flight. The torpedo would be propelled by a gas jet rocket, which would give the missile a velocity of approximately 600 miles per hour. Power envisioned that a fighter using this torpedo would "overtake a bomber from the rear and release projectile when directly behind and at such distance so as to enable pilot to dive out of danger radius of explosive." The warhead would be set to detonate by fighter aircrew using a timer that would account for the target's speed and distance from the interceptor.[41]

Power received a letter about two months later with the opinion of Ordnance Lt Col Burton O. Lewis. Similar rockets developed in World War I were grossly inaccurate, Lewis wrote, concluding "It is believed that the status of development of rocket propulsion is not such as to warrant the undertaking of development of torpedoes such as described in this communication." Nevertheless, Air Corps Lt Col V. B. Dixson told Power "Although the development of rocket propulsion does not warrant, at this time, undertaking the development of the type of torpedo you suggest, your interest in this connection is appreciated by this office."[42]

Given that Power was widely assumed by historians to be against the development of the ICBM later, his early application of rocket technology to warfare is significant. Power was thinking about rocketry as early as 1937, though in a role far removed than that of an ICBM. It is also interesting that his idea was rejected primarily due to the rocket's inaccuracy because Power's early misgivings about the

ICBM as a substitute for the manned bomber was motivated in part due to the ICBM's inaccuracy.

Power was certainly not the first to think of air-to-air rockets for aerial combat. The French Le Prieur air-to-air rocket was first used in the Battle of Verdun in 1916, but at the end of WWI the air-to-air rocket was largely forgotten. Moreover, Power's instincts were mostly correct regarding his rocket. Soviet fighters shot down Japanese aircraft using RS-82 rockets very similar to Power's idea on 20 August 1939, and German R4M rockets, also quite similar, downed US bombers in 1944 and 1945 with tactics very similar to those described by Power in 1937.[43] The United States developed its own air-to-air rocket in the early 1950's. Power's letter to the Chief of the Air Corps should be considered important evidence that Power was an innovative officer in both the equipment and tactical realms of air warfare. This would not be his last example of visionary thinking.

The Power's sailed home on the transport *U.S. Grant* on 2 March 1938, traveling to Honolulu and reaching Tacoma, Washington on 24 March.[44] The transport also held the US Army's 15th Infantry Regiment that had been stationed in Tientsin, China for over 30 years. Japanese forces in Chin Wang Tao had combined massive political pressure and the threat of overwhelming military force to compel the regiment to withdraw from China. The Powers were shocked at seeing a once-proud Army unit withdraw in silent but noticeable retreat, and Tommy knew the Japanese were going to be sources of serious trouble soon. "The American troops came down with their tails between their legs and got on the boat which did not exactly make our spines tingle with pride. Thus, it was quite obvious what was going on, and I came home convinced that we would be in a war real soon."[45]

After the Powers returned to the States, Lieutenant Power was sent to Randolph Field, Texas, to begin his many years associated with flight training. On 26 February 1938 Power reported to the Air Corps Training Center to serve initially as an instrument instructor pilot for the Primary School. He focused on instructing the new generation of pilots who would fly with him to war in just a few years. Power was soon elevated to senior pilot, then assistant flight commander, then flight commander, and finally "A" Stage student commander of Primary School.[46] On 4 September 1939 Power became a permanent captain. Shortly thereafter, he received orders to the Air Corps Tactical School. However, due to the increasing likelihood of war, Gen Henry "Hap" Arnold decided to suspend the regular nine-month

ACTS course in favor of a twelve-week course whose student class would number 100 students rather than the traditional course's 60-70. Air Corps officers over 32 years of age were considered eligible for "responsible assignments" should the Air Corps be rapidly expanded, and 425 officers were identified in this group, which included Power among them, who were not ACTS graduates and should be.[47]

The 99 students that began the last class to graduate from ACTS mustered on the morning of 8 April 1940 to attend opening ceremonies that were described as "inauspicious." ACTS Commandant Col Walter R. Weaver briefly addressed the students, and a number of other instructors spoke to them in turn, among them Maj Muir S. Fairchild, instructor of Air Tactics and Strategy. They were then presented with their books and school materials, and education commenced.[48] For three months Power and his classmates took abbreviated classes on subjects including air forces, attack, bombardment, pursuit, reconnaissance, naval operations, combat orders, communications, logistics, military intelligence, staff duties, observation, antiaircraft, cavalry, chemical warfare, ground tactics, field artillery, infantry, and map reading.[49] The students were rushed through due to the lack of time and, perhaps, due to the low morale of the school itself.

Graduation Day on 29 June 1940 was as inauspicious as opening ceremonies, and Brig Gen Frederick L. Martin, Third Wing, GHQ Air Force commanding officer, devoted address to lamenting the school's closing. Unlike other early Air Force leaders, Power did not talk a great deal about ACTS as a senior officer, but he does have a certain distinction for being the most successful member of the last class of that venerable institution. No other student in his class had nearly as much of an impact on the United States Air Force as Thomas Power. Power should be considered one of the most important Air Corps Tactical School graduates, critical for connecting ACTS to the development of a robust system of space doctrine based on the air doctrine of the "bomber absolutist" culture that ACTS was so instrumental in developing in the Air Force. Through Thomas Power, ACTS may yet also be credited with influencing space power thought as well (which will be explored in subsequent chapters.)

With diploma in hand, Power returned to Randolph Field to instruct new flyers. On 15 April 1941 he was promoted to major.[50] After France fell to the Axis powers in May 1940, the Air Corps began its massive expansion, which included the opening of the West Coast Air Corps Training Center (WCACT) at Moffett Field, California.

Power arrived there to serve as Assistant S-3 (Operations) in May 1941.[51] On 7 December 1941 the United States entered World War II, and the gigantic expansion of the Air Corps into the Army Air Forces commenced. Power went to Fort Worth, Texas, to help establish the Army Air Forces Training Command. On 17 November 1942 he became a lieutenant colonel and served as an Air Inspector until December 1942. Power was promoted to colonel on 26 June 1943, and served as Training and Inspection Officer until 1 August 1943. On 1 September he was named Assistant Chief of Staff of the command until a new assignment would take him to Salina, Kansas.[52]

With the move to Kansas, Power finally entered a combat flying unit as Deputy Group Commander of the 40th Bombardment Group (Heavy). He was quickly reassigned to Colorado Springs, Colorado, posted to A-3 (Operations) and later Assistant Chief of Staff of the 2nd Air Force from 1 October 1943 to 13 January 1944.[53] The 2nd Air Force had the mission of defending the Northwestern United States and Great Plains, but the hard truth was that Power was quickly losing his chance to see combat in a war he had been training for since 1928 and had seen coming since 1938. He got his chance when he was assigned to the 304th Bombardment Wing (Heavy) and found himself in North Africa on 2 March 1944.

Upon arrival in the Mediterranean, Power became the Executive Officer of the B-24 Wing flying out of North Africa and Italy, commanded by Brig Gen Fay R. Upthegrove.[54] While in North Africa, Power and his wing "operated a regular pattern" flying "against Ploesti and other targets."[55] Power missed the infamous low-level raid against Ploesti on 1 August, but he had been over Ploesti "several times" by the time he left the 304th. "It was a pretty sporty course down there," Power recalled, "and we used to get shot up quite regularly along about that time." The other missions with the 304th were also difficult, but routine, bombing marshalling yards and flying fields. Power was named Deputy Wing Commander on 22 April and served with the 304th until 14 August 1944, when he transitioned from B-24's in the Mediterranean to B-29's in the Pacific.[56] In the few months with the 304th Bombardment Wing, Colonel Power played his small part in turning the Fifteenth Air Force into a crack bombing unit, specializing in striking oil and transportation, while also accumulating scores against fighter production facilities, with bombing accuracy even better than the Eighth Air Force.[57] Ultimately, his efforts along with the rest of the Airmen of the Fifteenth Air Force helped to

destroy the Luftwaffe in the east, destroyed over half of Germany's oil supplies, and put a stranglehold on logistics to the German army on the Eastern Front.[58]

Power arrived at Peterson Field, Colorado Springs, Colorado on 23 August 1944 and took command of the 314th Bombardment Wing (Very Heavy) on 28 August.[59] The Wing consisted of four B-29 groups (19th, 29th, 39th, and 330th Bombardment Groups) training in Colorado Springs and Salina, Kansas. The Wing departed Peterson Field on 9 December 1944 to an intermediate stop in Hamilton Field, California, on its way to Guam. On 16 January 1945, the 19th and 29th Bombardment Group's forward echelons arrived at Guam, hopping to North Field a day later. Colonel Power and his deputy chief of staff for operations, Col Hewitt Wheless, arrived on North Field on 25 January.

Before Colonel Power could bring the 314th to the fight, he first had to fight the jungle. North Field, which later became Anderson Air Force Base, was not yet ready for air operations. Any disappointment for having to build the 314th's airfield was partially alleviated when Power learned of his promotion to brigadier general on 15 February, as he was preparing his wing to enter the fight against Japan.[60] Power and his men improved the North Field airstrip sufficiently for a B-24 to land on it on 3 February. Five days later, General LeMay landed the first B-29 on the strip. The 19th and 29th Groups landed shortly thereafter. On 25 February, the 314th Bombardment Wing flew to Tokyo for the first time.[61]

The first 314th Bombardment Wing mission to Tokyo did not go well. Gen Henry H. "Hap" Arnold in Washington had directed the 21st Bomber Command "put on a big effort" against Japan, but as of 20 February Power's wing had only 25 airplanes. The mission required dispensing with the normal shakedown flights a new wing would normally conduct before flying in combat. Beyond that, the 314th's crews had the longest routes to fly of all the XXIst Bomber Command, by 250-300 miles, and there was some concern that the length of flight was simply too far and that some or all bombers would run out of fuel during the flight. In addition, the mission was hampered by poor weather from the beginning and worsened as the three wings attempted to get into formation 300 miles south of Japan. Of the hundreds of airplanes that had started out, only Power's 30 bombers bombed Tokyo that day. The raid had used incendiary bombs, which represented the first time fire bombs had been dropped on Tokyo,

and the crews did not see the city at all during the raid. The entire strike was fraught with difficulty and did not run according to plan, but the 314th Wing had been able to deliver the first of its bombs to Japan.[62]

The 25 February mission may be considered a failure because of the weather and the few planes actually able to make a drop. However, it was also the genesis of perhaps one of the most daring bombing missions to emerge from World War II, with Power firmly in the lead both intellectually and physically. A few days after the first raid, weather lifted and reconnaissance aircraft took pictures of post-raid Tokyo. "We had destroyed about a square mile" of the city, remembered Power. "*This is what gave me the idea of mass bombing and of coming in low.*"[63]

The accepted history of World War II credits Curtis LeMay with the idea of low-level firebombing of Japanese cities. There is little doubt that LeMay had decided upon mass incendiary raids of Japanese cities as early as 15 February 1945 when he requested Brig Gen Lauris Norstad visit the XXIst Bomber Command headquarters on Guam to discuss the issue. LeMay deserves much of the credit for the XXIst Bomber Command's innovation in tactics and processes, but the low-level incendiary attacks also posit Thomas Power as an operational tactician and innovator of the highest order.

Concurrent with LeMay's budding idea, Power and Col Hewitt T. Wheless, the 314th Wing Operations Officer, developed a low-altitude flight path to Tokyo using radar landmarks. "*We would not try to use our bomb-sights at all*," Power emphasized.[64] Once over Tokyo, the formation would spread their bombers "like the leaves of a fan" and have each bomber drop their incendiary bombs at a specific time in order to get "an automatic spread." After working at the basics of the plan, they presented it to LeMay who replied, "Looks good to me. Work it up with the Operations people and see what they think of it." After coordinating with XXIst Bomber Command's planning staff, including John Montgomery, Power's and Wheless' plan was approved by LeMay, who ordered five such attacks, "one right after another" to form a weighted effort.[65]

Post-war accounts have generally given credit to LeMay for developing the low-level incendiary mission profile. Power's contributions began to be diminished early on, when Montgomery approached St. Clair McKelway, a *New Yorker* essayist on the island, to report that the new mission was to have three major characteristics: 1) the bombers

would fly in at low level, 5-6,000 feet; 2) they would carry nothing but six tons of incendiaries in each bomber; and 3) the raids would be staged every two nights. McKelway also wrote Power and Montgomery were merely in favor of the plan while most others in the command were not.[66] Richard Frank writes that "the outstanding feature in the plan incubating in LeMay's mind was the attack altitude . . . by far the most radical part of the plan."[67] Warren Kozack, however, credits Power with developing the low-altitude idea, though he suggests Power was brought in to help plan the mission solely because he was chosen to lead it: "His decision [to attack Japan with incendiaries] made, LeMay worked on the problem with Tom Power who would lead such a mission. . . . Together they came up with a plan to go in at lower altitudes in a series of massive lightning raids that would occur on consecutive nights, catching the Japanese off guard."[68]

Kozack's account is most likely precisely backward. Power had only been to Tokyo once before, on a mission that was mostly a failure, and was the least experienced wing commander on Guam at the time. LeMay would not have chosen Power to lead the mission based solely on his record to that point, nor simply because he was alone among LeMay's wing commanders who supported the plan. Moreover, LeMay would have preferred to lead the mission himself, but "they wouldn't let me lead that one. I had to send Tommy Power instead."[69] For LeMay, it made sense to send the man most familiar with the plan, the man who had originally taken it to him, if he could not go himself. So LeMay sent Power. The 9 March firebombing of Japan should be considered the outgrowth of Power's idea as LeMay's. It turned out to be a violent offspring.

With Power's and Wheless' plan developed and suitably modified by LeMay and his staff, XXIst Bomber Command issued the order on 7 March 1945 to commence mission Meetinghouse Two. Meetinghouse Two sought to put three hundred B-29's from the three wings of the 21st Bomber Command over Tokyo at low level armed with nothing but incendiary bombs. The mission was highly dangerous, mostly because low-level bombing posed very significant risks. With flak and fighters, low-flying bombers were easy targets. Despite these issues, on the evening of 9 March, Power took off to lead the mission and remain over Tokyo to record the strike for LeMay's assessment.

The raid itself lasted two-and-a-half hours, and a quarter of the city in the Koto district was destroyed. It took only fourteen minutes for the firestorm to erupt. The destruction was shaped like a rectangle

three miles wide and five miles long. Although the searchlights were active and there was a great deal of flak, there were few fighters, for the low-level attack worked. The Japanese were caught almost completely off guard at first, though Power noted that at the height of the raid over Tokyo at 5,000 feet, over 500 searchlights with heavy antiaircraft fire met his formation.[70] When it was over, Power estimated that about 15 square miles had been burned out. A more detailed study afterward concluded that the actual total was 17.[71] For his role in the raid, arguably among the most consequential of World War II, Power was awarded the Silver Star.

Power continued to lead his wing until relieved of command on 23 July 1945 and assigned to A-3 on Gen Carl Spaatz's staff at United States Strategic Air Forces, Pacific. While he had been in command, Power personally led the 25 February, 9 March, and 13 April bombing missions against Tokyo, circling Tokyo again to survey the mission on 13 April as he had done on 9 March. LeMay credited Power with many achievements during his command of the 314th Bombardment Wing, including developing the radar pathfinders so critical to the 9 March mission, displaying exemplary initiative by improving North Field quickly to bring it to operational adequacy, and flying his command into combat only 10 days after arriving in Guam.[72] LeMay later called Power an autocratic leader, but also "the best wing commander I had on Guam."[73]

General Power's move to USSTAF-P was part of a general shift of leadership in the Pacific air forces. LeMay had been replaced by Gen Nathan Twining as commander of XXI Bomber Command and became Spaatz' Chief of Staff. LeMay and Power both arrived on Spaatz's staff just as the atomic bomb arrived in the Pacific. Power was in charge of Operations at USSTAF-P during the planning and execution of the atomic-bomb missions against Hiroshima and Nagasaki.[74] Although he learned of the atomic bomb's existence as USSTAF-P A-3, Power did not take any direct role in these attacks, though he soon came to know nuclear weapons quite well.

His sixteen days of wartime service as USSTAF-P were short but eventful. On 6 August, Hiroshima was destroyed in the first war-time use of atomic weapons, followed three days later by a second attack on Nagasaki. On 15 August 1945, the Japanese surrendered and the war was over. Little did Power know that the war that later defined him was just about to begin.

Power was not allowed to take leave between his time in Italy or Guam and was excited to get home and see Mae. But he was sent home via a detour through Europe. In Europe, Power's leave was cancelled; and he was instead ordered to Washington, DC, where he would again meet Curtis LeMay, now Chief of Research and Development on the Air Staff. LeMay told Power that he was now Assistant Deputy Task Force Commander for Air of Joint Task Force One under Admiral William H. Blandy, responsible for the vast air flotilla supporting Operation Crossroads, the first of many post-war nuclear tests in the South Pacific.[75]

General Power was released from Crossroads in August 1946 and, after some much-needed and well-deserved leave, assigned on 14 September to the Air Staff of Gen Earle E. Partridge, who was Chief of Staff of Operations, again as assistant for operations (ACAS-3). On 15 June 1948 Power was assigned as the first USAF Air Attaché to the American Embassy, London, England. He expected to remain as attaché for three years, but circumstances intervened to relieve Power of attaché duty in November of the same year, by order of LeMay.[76] The standard story is that LeMay had been named Commander-in-Chief of Strategic Air Command on 19 September 1948 and immediately replaced SAC leadership with men with whom he worked with in the Pacific and could trust. LeMay decided that seeing Tommy Power in a diplomatic post was incompatible with the needs of a strong nation. "I wasn't going to have Billy-the-Kid going into the front office or running a beauty shop when he should have been down on the flight line," and he had Power returned home.[77]

By 28 October 1948 Power was Deputy Commander of SAC. This is where his reputation of being cold, mean, and potentially unbalanced began to develop. It must be noted, however, that General LeMay never actually called Power a sadist himself, as is normally reported, he only flippantly agreed to the characterization. Thomas Coffey perhaps best summarized Power's role in SAC as LeMay's deputy: "As his deputy commander he chose Tom Power, a man so cold, hard, and demanding that several of his colleagues and subordinates have flatly described him as sadistic. LeMay himself, when asked if Power was actually a sadist, has said, 'He was. He was sort of an aristocratic bastard. But he was the best wing commander I had on Guam. He got things done.'" [78] Coffey's description of LeMay's recollection of Power is probably the most imprinted depiction of Power in the extant literature, but it remains only that: Coffey's description

of LeMay's recollection. A quite different version of Power and his autocratic behavior came from Hewitt Wheless, SAC Deputy Director of Operations under Power (and the man who helped Power develop the Japanese B-29 fire raids). Wheless, as a retired lieutenant general, in 1970 described Power as "the guy that saw black and white. There were very few gray areas where he was concerned." More interestingly, however, to Wheless, Power was not hard-headed and would listen to anybody; "If [someone] disagreed 100% with the boss he could speak his peace," though once a decision was made, it was final. Overall, Wheless had nothing but respect and admiration for his commander: "He was [a] tough guy. Power was a great man. . . . I'll tell you. Wonderful." [79] Great and tough men are often mistaken for being unnecessarily cruel by outside observers bereft of context. Consequently, Wheless's insider perspective—and not Coffey's leading question to LeMay—should be given greater due when considering Power's reputation.

In early August 1950 Power, promoted to major general in December 1948, went to Guam on a quick trip to gain "a better insight" into American Air Force problems in the Korean War.[80] Power's visit was noted in Gen George Stratemeyer's diary entry of 6 August 1950.[81] Power had been sent down to oversee the deployment of the 9th Bombardment Wing on a "training mission" to Guam and perhaps Okinawa. The 9th Wing carried enough nuclear cores to complete nine bombs, for use if the North Koreans began to advance too quickly for conventional forces to stop. Power's trip was so sensitive that when the Air Staff noticed that a congressional delegation would be at Guam at the same time, they gave direct orders to Power to "be missing."[82] Power had been named SAC X-Ray commander in Tokyo, in command of SAC atomic forces in the Far East.[83] Even as LeMay's right-hand man, Power was often in the middle of operational command.

Power also had responsibilities for SAC requirements. One of these requirements was to establish parameters for a long-range strategic bomber to replace the B-52. At the time, development of the intercontinental ballistic missile and the hydrogen bomb had led some defense planners to believe the manned bomber had ceased to be a cost-effective or a militarily effective platform. SAC disagreed, but no bomber other than the experimental Aircraft Nuclear Power (ANP) prototype was yet planned or in development.[84] On 30 March 1953, Power wrote to the Air Force's Director of Requirements that

SAC officers felt "strongly that the requirement for long-range, maximum payload forces will continue to be valid and urgent for the foreseeable future, and well beyond the expected normal life of the B-52 force. . . . *Regardless of the missile program, it is the opinion of this headquarters that the continued advance in the art of manned flight to high altitudes and long ranges should be at all times a priority objective of the Air Force's development programs*."[85] This letter helped begin the development of the B-70 "Chemical" supersonic bomber, and some historians have used it as proof of SAC's—and Power's—disdain for missiles and its generally misguided sentimentality for an outdated form of combat.[86] However, as this thesis will explore later, "the continued advance in the art of manned flight" desired by SAC headquarters would not be limited to the B-70 bomber.

Examining Power's early years is helpful for understanding him personally as well as correcting his place in Air Force history. The caricature of Power is not based on lies. Tommy Power was the last general officer without a college degree. Indeed, there is no evidence he even graduated from high school. He also had a very ordinary, perhaps modest, career before becoming LeMay's deputy at SAC. And he was a tough-as-nails commander. However, this is not Power's complete story. What the caricature leaves out is that Tommy, through pure perseverance, taught himself the equivalent of two years of college through independent study, and excelled on the Air Corps entrance exam that most candidates failed. Also, though his early career focused on flying, Tommy also displayed a keen and experienced technical mind. At first, it was as a civilian construction supervisor and civil engineering student. Later, it was as an aviation maintenance school graduate. Finally, it was as an insightful and innovative tactician, both as a lieutenant who developed a concept of operations for an air-to-air missile using chemical rockets, and later as a heavy bomb wing commander who probably developed most of the low-altitude incendiary tactics used to bring Imperial Japan to her knees. Understanding these events in Power's life provides a much different picture of the man than in most historical literature and offers much more evidence that makes Power's heretofore unknown contributions to the Air Force space program more in consonance with his total persona.

Notes

1. John G. Hubbell, "Tough Tommy Power – Our Deterrent-in-Chief," *Reader's Digest,* May 1964, 72. Eric Schlosser in *Command and Control*, 179, writes that Power had dropped out of high school in the early 1920's and returned to graduate in 1928 after working construction. However, there is little evidence that Power ever graduated high school. In an undated Personnel Security Questionnaire (probably from 1949 or 1950), Power documents his time at the two high schools but specifically states that he did not receive any degree from either institution. Document in Thomas S. Power papers located at Air Force Historical Research Agency (AFHRA) Call No. 168.7155 microfilm Reel 34157, frame 1616. Copy of Thomas Power Papers held at Syracuse University, New York.

2. Biography Located in Thomas S. Power papers located at Air Force Historical Research Agency (AFHRA) Call No. 168.7155 microfilm Reel 34157, frame 1578. Copy of Thomas Power Papers held at Syracuse University, New York.

3. Reminiscences of Gen Thomas S. Power, July 1960 interviewed by Kenneth Leish for the American Heritage of Flight oral history series, on page 1 in the Columbia Oral History Archives, Rare Book & Manuscript Library, Columbia University in the City of New York. Copy in the AFHRA Call No. K146.34.

4. "Four star general" draft article, 1. In Thomas Power Papers, Reel 34157, Frame 1456.

5. Hubbell, "Tough Tommy Power," 72.

6. Leish, Power Interview, 2.

7. "Four Star General," 1.

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Chapter 3

Inventing the Space Organization
Air Research and Development Command 1954-1956

Holley's study of American airpower in the First World War identified three organizational requirements for the development of a new weapon of war: an organization dedicated to the collection and investigation of technical and tactical information relevant to the new weapon; the doctrine necessary to employ the new weapon correctly and efficiently; and the new weapons themselves. Similarly, the development of space power required three components: a space power organization, space power doctrine, and space power equipment. Power made his first critical contribution to American space power by securing an organization that was dedicated to space power, fulfilling Holley's requirement of an adequate organization. Power secured this space power organization when he ruled against recommendations made by Gen Bernard Schriever. To understand how Power saved the USAF space effort from the man history generally credits with being the father of the Air Force space program, we must explore the critical events of 1954 to 1956.

When Power pinned on his third star and took command of Air Research and Development Command (ARDC) in Baltimore, Maryland in April 1954, he had been SAC deputy commander for six years and it was time for a command of his own. LeMay had previously served as Deputy Chief of Staff for Development and was keenly aware of R&D's importance to the future of the Air Force. LeMay may have helped place Power in ARDC specifically to ensure that SAC's interests would have first priority in R&D. Power's command of ARDC at this critical time was highly advantageous to SAC because it was then that the ballistic missile question—a technology that both threatened the manned strategic bomber and promised to open the space frontier—was becoming the paramount concern in the USAF. With Power the senior uniformed officer charged with the development of the intercontinental ballistic missile (ICBM), SAC was well positioned to develop the ICBM the way it wanted.

This does not mean, however, that Power had overall authority of the ICBM project. ICBM development was a high priority in Washington, and many civilians made important decisions regarding its

development. One of the most important early decisions was to establish an organization dedicated solely to ICBM development.

On 26 February1954, special assistant for Air Force Research and Development, Trevor Gardner, fresh from the Teapot Committee that had reviewed the US Air Force's strategic missile programs a few months earlier, argued the Air Force could not field the Atlas ICBM by 1960 under current management conditions. To do so, the Atlas program would have to be given top priority and be managed by a streamlined organization dedicated to the ICBM with a head who would be a major general with the dual title of Vice Commander of ARDC and Chief of Missile Development.[1]

Air Force Chief of Staff General Nathan F. Twining agreed with Gardner and the Teapot Committee recommendations. On 21 June 1954, Lt Gen Donald Putt, Deputy Chief of Staff for Development, ordered Power to speed Atlas "to the maximum extent that technological development will permit" and to "establish a field office on the west coast with a general officer in command having authority and control over all aspects of the program, including all engineering matters." On 1 July, Power ordered the establishment of the Western Development Division (WDD) in Inglewood, California, as an ARDC field office charged with developing a fielding the Atlas ICBM.[2]

Gardner originally wanted Maj Gen James McCormack, the current ARDC vice commander, to become Chief of Missile Development, with Brigadier Gen Bernard Schriever his deputy and industrial contractor coordinator.[3] McCormack, however, suffered a heart attack a short time later and retired from the Air Force. Schriever was instead elevated to an ARDC deputy commander and Chief of Missile Development as commander of WDD.

From the beginning, Power was unhappy with this arrangement. Power knew Schriever primarily from earlier meetings at SAC headquarters when Schriever, then a colonel, argued with LeMay over support of the Aircraft Nuclear Propulsion (ANP) program. Schriever was against continuing the development of a supersonic nuclear bomber, LeMay's favorite R&D program at the time. LeMay thought Schriever insubordinate; and in one rather tense meeting, Power—a black belt—asked Schriever if he would like to practice judo with him.[4]

A lingering distrust of Schriever aside, the practical problems were far more troubling to Power. The Teapot Committee had not only encouraged the development of the WDD, but also the creation of a

unique systems engineering management process that overturned the traditional Air Force approach of prime-contractor acquisition. ARDC had begun the Atlas Project in January 1951, and up to that time Convair had been the program's prime contractor. Gardner and Schriever were convinced that Convair lacked the engineering design skills to manage the complex ICBM project and instead chose the Ramo-Wooldridge Corporation (later TRW) to manage the development of the entire system, leaving Convair to focus on manufacturing. This decision was met by furious objections from the aerospace industry, and Convair in particular. Power did not agree that the ICBM provided such a significant challenge that existing processes would not be effective. Worse than the TRW decision, however, was the fact Putt's 21 June order gave Schriever command over all ICBM decisions but left Power overall responsibility for the project's success. Power carried out the order but was not happy about it.

Power and Schriever met to discuss the WDD on 17 July at ARDC headquarters in Baltimore. This meeting was tense. Schriever had assumed Power would back him in his decision to abandon Convair in favor of Ramo-Wooldridge. Power, instead, disagreed with almost every decision that had been made on the Atlas program in the last few months, and Schriever's actions in particular.[5] Worse for Schriever, Power "let Bernie know it in direct and brutal fashion."[6] After the meeting, Schriever wrote that Power thought that "we were attempting to tie [a] can to Convair and R&W [Ramo-Wooldridge] would grab off the prize." Power was further concerned he would not be able to supervise Schriever if the latter were in Los Angeles. Power felt that as a young brigadier general, Schriever would be "a country boy among the wolves" amid California's aircraft industry and that WDD should be in Baltimore, where ARDC was headquartered.[7] Schriever's explanation that the engineering talent to field the ICBM could most easily be found in California was persuasive, but just barely.

Schriever had told Gardner earlier that to deliver the ICBM on time, he had to be free to make decisions "without any interference from those nitpicking sons of bitches in the Pentagon." Power took Schriever's sentiment poorly. Schriever wrote that Power "made a point that he was senior to me and had much more at stake than I. . . . By his several allusions to my making big decisions on my own . . . he must feel that I am motivated by a personal desire for power. . . . He obviously does not trust me nor have confidence in me—very important factors when undertaking a job of this magnitude."[8]

Schriever left the 17 July meeting shaken, but insistent that he would "win over Tommy Power." As commander of WDD, Schriever wrote a report to Power every week on WDD progress, phoned or sent a teletype message to Power whenever a significant event occurred, invited Power to all significant meetings, and personally traveled to Baltimore to brief Power as often as his work permitted. By far the most important olive branch Schriever offered Power was arranging for frequent rounds of golf for the two men, for both were highly skilled aficionados of the game. Undoubtedly, the personal connection developed between the two men on the links was vital to their effective relationship.[9]

Schriever's overtures to Power worked, aided immeasurably by Schriever's bureaucratic successes at WDD. Power listened to civilian experts such as John von Neumann regarding the ICBM and its importance. He also began to accept that the R-W systems management organization was working well and was impressed that Schriever had prevailed over Convair to continue the R-W management scheme. Power eventually realized "how badly he had misjudged [Schriever] in assessing him as a naïve amateur."[10] In his April 1955 fitness report on Schriever, Power wrote Schriever had "excellent staying qualities when the going gets rough. Professionally, he is characterized by his thoroughness. He has a brilliant mind and can be depended upon for outstanding work."[11]

Less than a year after their first horrible initial meeting as senior and subordinate, Power and Schriever were working with a mutual professional respect and personal trust. According to Gen Bryce Poe II, who served as General Schriever's personal aide and chief pilot, Power routinely inquired of Schriever's well-being.[12]

This did not, however, stop Power's sternness. At one briefing, conducted by a colonel working for Schriever, Power grew angry and rejected the entire presentation.[13] Unfortunately, the briefing was very important to Schriever. When Poe told Schriever about the colonel's performance and Power's rejection of the plan, Schriever said, "I'll go in tomorrow and talk to him about it." Poe recalled that Schriever went in the next day in private and got the proposal approved as originally put forth.[14]

It was important for Power and Schriever to develop a good working relationship because changing priorities in the Air Force and new opportunities were creating a need to confront new organizational decisions almost immediately. Moreover, the establishment

of the WDD and a new emphasis on developing an ICBM also meant that there might soon be available a rocket capable of placing a satellite in orbit. Many Air Force officers began to believe space-age weapons would shortly be operational, and the Air Force would have to develop an operational space capability. "To a great many Air Force planners it seemed obvious that only a military space capability could provide an effective counterweight to an intercontinental ballistic missile force."[15]

In May 1954, HQ USAF directed ARDC to study the potential implications of a satellite program based on RAND's Project Feedback, which examined potential reconnaissance capabilities of spacecraft. On 27 November 1954 ADRC released System Requirement 5 which requested industrial support to develop a reconnaissance satellite. RAND Project Feedback contributors presented many briefings to defense officials over the next few months. LeMay was an early enthusiastic supporter of the reconnaissance satellite, although his SAC staff was much more interested in manned bombers and refueling requirements. Characteristically, Power was also a supporter as he knew that pre-and-post-strike intelligence of Soviet nuclear forces were of paramount importance to SAC planning.

In October 1954 Trevor Gardner requested the ICBM Scientific Advisory Group explore the ramifications of the satellite program, soon to be named Weapon System (WS)-117L, and other rocket programs relating to the Atlas ICBM effort. The group concluded the review should be conducted by the Air Force, and a WDD staff recommendation on 15 October 1954 suggested WDD take responsibility for the management of the satellite, ICBM and IRBM programs.[16] However, the von Neumann Committee—a group that shared many members with Gardner's ICBM Scientific Advisory Group—argued in January 1955 that placing the WS-117L under WDD would put the rapid introduction of the Atlas missile into the Air Force inventory at unacceptable risk. Power evidently agreed with the von Neumann recommendations.[17] Schriever and Gardner both wanted WDD to stay away from WS-117L. In March 1955, Power placed WS-117L under the management of the Wright Air Development Center (WADC) in Dayton, Ohio, the center in charge of managing Air Force air vehicle development.

However, pressure from ARDC, and perhaps Power himself, began to build to place both the WS-117L satellite and the Thor Intermediate Range Ballistic Missile (IRBM) in WDD. In June 1955

Gardner again called a meeting of the ICBM Scientific Advisory Committee to discuss the issue. The committee unanimously agreed that "any Satellite program, Scientific or Reconnaissance, which is dependent on components being developed under the ICBM program, would interfere with the earliest attainment of an ICBM operational capability" and requested the committee chair write a letter to the Secretary of the Air Force advising that such interference could inflict grave damage to the ICBM program.[18]

Official historian Robert Perry criticized the findings of Gardner's group, writing there "was no question of lack of foresight in such a decision. The group was overwhelmingly concerned with keeping the infant ballistic missile program alive and satisfying the critical need for an operational ballistic missile."[19] Perry admitted, however, "there seemed slight prospect that the materiel and personnel resources then available to the Western Development Division could accommodate a major satellite program without diluting the effectiveness of its missile effort," nor were any additional resources likely to be forthcoming.[20]

On 10 October 1955 Power resolved the question of who was to manage WS-117L by placing the satellite program squarely in WDD's jurisdiction.[21] Schriever was officially notified of this change on 17 October through the issuance of System Requirement No. 5, from ARDC.[22] To understand why Power made this decision in the face of Schriever and Gardner's contrary recommendations, it is perhaps best to explore exactly why Schriever did not want to manage the WS-117 or the Thor IRBM project, which Power gave to WDD with Operations Order 4-55, issued on 9 December 1955, though by then WDD had been unofficially working on the TBM for months.[23]

After the October meeting of the ICBM Scientific Advisory Committee, Power requested Schriever and WDD study the potential relationships among the ICBM, TBM (Theater Ballistic Missile), and WS-117L satellite programs. In an undated draft memorandum written by "R-W" and prepared as a staff study by Col Charles Terhune in November, Schriever reported WDD's findings.[24] Schriever opined that many of the technical problems shared between the ICBM and TBM "are virtually identical from 1,000 to 5,000 miles range. The sole and rather important exception is the aerodynamic heating problem." Schriever continued that the engineering "data required cover a broader range for the ICBMS, but this range includes every condition which the TBMS payload meets on its re-entry into

the atmosphere. Accordingly, work done for the ICBMS automatically provides the engineering basis for a sound design for the nose cone of the TBMS, while the opposite is not necessarily true."[25] Schriever explained that the major difference between the ICBM and TBM programs was "the ICBM requires that all aspects of technology be pushed closer to the limit of the available art," while a "realistic program for the shorter-range missile would be based on a more conservative choice of all dimensions and performance requirements."[26]

Schriever made a forceful argument that the TBM program could be satisfied through the use of alternative approaches to the ICBM that WDD was then contemplating for Atlas. A single-stage TBMS could "look like a demagnified version of the one and a half stage ICBMS," or the TBMS "could be looked at as a modification of the second stage of the ICMBS."[27] Schriever felt the Single Engine Test Vehicle and the Re-Entry Test Vehicle—equipment from his "ideally planned ICBMS development program"—would "constitute minimum departures from the planned first or second stage of a two-stage final ICBMS" but "as part of the ICMBS program", they would "increase the chance of the TBMS vehicle's being automatically derived from the ICBMS program."[28] Instead of arguing against the TBM, Schriever attempted to use the TBM requirements to gain additional testing he needed to fund his ICBM program more robustly.

Schriever explained to Power a simple, but significant, fact concerning both the ICBM and TBM programs: "An ICBM missile can be attained by taking a short range missile and fitting it with a heavier booster that constitutes a first-stage to the shorter range missile's second stage."[29] Ultimately, Schriever argued that the ICBM should be explored in two configurations: a single tank one-stage system with detachable rocket engines (a 1.5 stage vehicle, which the Atlas would eventually have), and a two-stage configuration. Schriever recommended Convair proceed with the 1.5-stage approach, but that the "alternate [two-stage] approach should be carried out by some other airframe manufacturer… upon a full two-stage design. This approach is also ideal for incorporating the TBMS as a modification of a second stage."[30] The upshot of all this was that instead of seeing the TBM as a legitimate program in and of itself, Schriever saw it as a potential pathway to secure a much-desired second approach to fielding the ICBM.

When he examined the WS-117L satellite program, Schriever was just as protective of the ICBM. Although Schriever made an early

distinction between the ICBM and what he called the "Satellite missile"—what we know today as a space launch vehicle—he nevertheless argued there were "enough elements in common between any project that contemplates bringing a noticeable mass up to sufficient velocity to orbit the earth and the ICBM to make it obvious that the closest of technical coordination will be necessary." [31] The problem, however, was larger than one of merely technical coordination. Schriever continued, "While it would be a grievous error if the two projects [the ICBM and satellite] were not properly associated with one another for mutual benefit, it would also be erroneous to conclude that the success of the Satellite missile is easily and directly assured by the success of the ICBM, for there are formidable technical problems associated with the Satellite vehicle that have no counterpart in the ICBM." Among these many problems were satellite power; terrain scanning; data storage; processing and transmission; and launch vehicle trajectory control.[32]

Schriever noted that developing a space launch vehicle was a more difficult project than an ICBM, implying that his mission was to provide an ICBM and not a space capability given the time constrains he faced. Schriever was certainly aware there was considerable overlap between the two, but argued that even a space program would benefit from the success of his ICBM program first, saying that the "major problems of propulsion, launching, structure, and guidance along the powered trajectory, by being solved in the ICBM program will save much time for the Satellite vehicle because of the great similarity of these problems."[33] In this and in most of his rationale, however, Schriever's concerns about the space mission seem to extend only as far as it might interfere with the ICBM program. "By the time such satellite flights are practical," Schriever pointed out, "the ICBM program will either have attained or be close to attaining flights involving velocities near Satellite velocity with payloads probably comparable with the total weight to be carried by the satellite . . . [but] it is not easy to see how the ICBM could mount its flight schedule during a period when the Satellite flights are being prepared for, without some substantial dislocation to the ICBM schedule."[34]

The earliest fielding of the ICBM was foremost on Schriever's mind, and both the Satellite and TBM programs were, to him, potentially dangerous distractions. Only close coordination among all of these activities under one office could mitigate such danger. So Schriever and his team sought to exploit the TBM to secure their

sought-after second ICBM development approach, but found no such reason to incorporate the Satellite vehicle in their operation at all, except to ensure it did not interfere with their ICBM operation. Ultimately, it seems that Schriever preferred to focus exclusively on the ICBM but, if necessary, was prepared to oversee both the TBM and Satellite programs to ensure that he had control.

On 20 December 1954 Schriever sent a personal telex to General Power describing why he felt the current Air Force TBM program would interfere with the timely, efficient, and successful completion of the Atlas ICBM. First, Schriever explained "important elements of the industry [did] not make themselves available for the ICBM program" due to the TBM program. Schriever noted that Douglas Aircraft and Bell Labs had not participated in the Atlas study program because they were waiting for the Air Force to make a decision on the TBM. Schriever also claimed if the TBM program went forward, his planned alternative approach to the ICBM (a two-stage tandem or in parallel rocket) would probably not be approved due to significant overlap with the TBM. Second, Schriever worried that the shallow pool of ballistic missile engineering talent would be stretched too thin between two competing programs. Third, he was concerned the two programs might compete with each other and cause friction in the Air Force, delaying decision making for both programs significantly as well as add "unnecessary duplication of technical programs and facilities." These problems could disrupt both programs so greatly that a resulting confusion could give detractors sufficient evidence with which to take all missile programs away from the Air Force and give them directly to the Department of Defense.[35]

Ultimately, Schriever concluded "it is the opinion of R-W and the WDD technical staff that a ballistic missile having a range of 1,000-2,000 miles is one of a family of missiles which can evolve from the ICBM program," and that the Air Force TBM program could be best fulfilled by acting on the R-W recommendation to fund the "alternative configuration and staging approach" of a two-stage ICBM by a second airframe contractor.[36] Schriever would eventually be given permission to develop this alternative configuration ICBM. It became Titan, and the program developed an ICBM as well as a fleet of space launch vehicles.

Schriever's hesitations for adding the TBM program to the WDD are completely justifiable. Schriever's mission was to develop an operational ICBM as rapidly as feasible. The Thor IRBM, however,

would be fielded before the Atlas ICBM (though by only a few months); and the Thor system became a mainstay of the American space effort, with its final descendent, the Delta II medium lift vehicle, still in service as one of the world's most successful launch vehicles. Although Schriever could not know it at the time, his primary focus on the ICBM could have negatively influenced the American space program.

As WDD commander, Schriever also argued against an expansion of satellite programs. Schreiver transmitted his original November 1955 "Interactions Amongst Ballistic and Satellite Programs" memorandum to General Putt at HQ, USAF to provide "in some detail both the technical and management reasons for the positions I have taken" (his opposition to the WS-117 L satellite program) but warning Putt that "dissemination of this paper should be very limited." Schriever also made a point to tell Power he had sent the document to Putt.[37] On 30 March 1955, Schriever sent a memorandum to Power regarding intelligence on the Army's Redstone program and Army support of a "Scientific Satellite" and the Army's "willingness to act in a contractor capacity to the Air Force." Schriever concluded "I think that a joint effort of any nature would be a serious mistake. . . . First, it would be impossible for the Air Force to effectively manage a program carried out by another service. Secondly, it would be naïve to think that the Army would develop a weapon and then turn it over to the Air Force to operate. Therefore, I strongly recommend that our relationship with Redstone remain on an exchange of information basis."[38]

Regarding the scientific satellite program itself, Schriever was even less enthusiastic, writing that his technical experts felt Air Force participation in the program "*can contribute little if anything to the ICBM program.*" He felt even "if successful, this program would contribute almost nothing in furthering a militarily useful satellite" and he recommended against any participation at all. "If other reasons are overriding concerning Air Force participation in a short term satellite program," Schriever offered, "the Air Force should offer a separate program having greater payoffs."[39] Schriever then made clear he wanted no such separate program, either.

In mid-1955 it seemed clear Schriever would lose and both the TBM and WS-117L would soon be given to WDD. In a memorandum to Terhune on 15 April 1955, Schriever wrote, the "Satellite Development Plan, if implemented beyond the study stage . . . is certain to interfere with the ICBM program. I feel quite certain that

management of the satellite vehicle program, when it reaches the hardware development phase, must be under WDD in order to control the coordination which will be required among the several large rocket vehicle programs."[40] Schriever had seen the writing on the wall, and while he was still opposed to the satellite program for its danger of interference with the ICBM program, began to believe his management of the program would be the best choice available in a bad situation. Even though WDD would not be officially tasked with the TBM program until October, on 9 May 1955 Power issued Schriever an order to manage some TBM business for ARDC.[41]

Being Schriever was against these transfers, why did Power overrule him and place the satellite and TBM in WDD? There are several possible explanations. From a purely bureaucratic standpoint, Power may have thought the merging of the three programs, however detrimental to the timely deployment of the ICBM, may have simply been inevitable. All three programs were dependent upon advanced rocket propulsion and guidance technology. Indeed, the RAND (then Douglas Aircraft Corporation) report *Preliminary Design of an Experimental World-Circling Spaceship*, which later became famous, envisioned a satellite vehicle as the rocket itself, not necessarily the payload of a launch vehicle as we know it today. The report explained, "There is little difference is design and performance between an intercontinental rocket missile and a satellite. Thus a rocket missile with a free space-trajectory of 6,000 miles requires a minimum energy of launching which corresponds to an initial velocity of 4.4 miles per second, while a satellite requires 5.1. Consequently, the development of a satellite will be directly applicable to the development of an intercontinental rocket missile."[42]

In this worldview the spaceship *was* the launch vehicle, and the majority of the RAND report was on rocket engineering. As a result, the intellectual history of the ICBM, TBM, and satellites all sprang from the same source without distinction between a satellite and a missile. Perhaps intellectual inertia was simply too great to attempt to isolate artificially the ICBM from the desire to develop space capability. It must also be stressed that Schriever himself was of two minds regarding the merger. He did not want the TBM and satellite to interfere with the ICBM, but he also felt that under WDD both "inferior" projects would pose the least risk should the Air Force pursue them. Thus, Schriever's resistance against taking those two projects may have been rhetorically intense, but practically very low. Schriever

probably understood while he did not *want* the TBM or satellite, he *should* have responsibility for them.

Another reason that Power may have overruled Schriever was Schriever's successes at WDD. Power originally was skeptical of Schriever's managerial skill but concluded in 1955 that Schriever was a highly capable officer. Even though Power knew Schriever wanted to focus on the ICBM to the exclusion of the satellite and TBM and that these projects had a high risk of undermining the success of the ICBM, Power may have nevertheless believed that Schriever was capable of overcoming those risks. Even with the danger, Schriever may have been the best man in the Air Force to take on these projects, and Power had confidence that Schriever could complete the mission successfully.

A final possibility should also be considered. Schriever was particularly enamored with the ballistic missile as a technology, and his association with Trevor Gardner and John von Neumann in the beginning of the Air Force's ICBM effort attests to this deep—perhaps myopic—interest. Power, by contrast, was primarily an aviator and one of the leaders of the "bomber mafia," but also had a keen interest in technology in general. As Deputy SAC commander, Power defended the manned bomber from claims of obsolescence by the ballistic missile, and he was not convinced that the ICBM was the "ultimate weapon." Therefore, while Schriever may have seen the potential for space, he was primarily interested in the ICBM and regarded space as being little more than an interesting but nonessential side benefit.

Power, on the other hand, may have thought that the ICBM was an important project but thought the real payoff of the technology was the possibility that it would open up space to the Air Force, a natural extension of the 'higher, farther, faster' mantra of the Airmen that later formed the basis of White's aerospace concept.[43] Power may have believed the Air Force's need for a space organization was greater than the delays imposed on deploying the ICBM by transferring the satellite and TBM projects to WDD. As an indication of Power's inclinations toward space, in 1954 he had approached industry to study problems regarding space, including manned craft and lunar probes, without Pentagon direction. Power's efforts to study the space question will be explored in detail in the next chapter, but there is little doubt that Power saw space as having the potential for being the next great Air Force frontier. There is also little doubt that he saw the ICBM as the initial gateway to that future rather than an end in itself.

This may well have been a primary motivator of aligning the three major space development programs under WDD.

Most likely, Power's motivation was a combination of all three rationales. Thinking the Air Force needed a dedicated space organization, that such an organization was necessary due to existing bureaucratic inertia, and that Schriever could accomplish all of these tasks in a reasonable time were not contradictory beliefs. A combination of all three reasons was possibly why Power made the decision to turn WDD into a space organization. By doing so on 10 October 1955, Power put the United States and the Air Force on the path to space power.

Just as Power accepted Putt's order to establish the WDD with Schriever in command despite his own misgivings, so did Schriever accept Power's order to incorporate both the WS-117L satellite and Thor IRBM with the Atlas program under WDD against his better judgment. And just as Power quickly realized his worries were unjustified, so did Schriever soon realize the wisdom of Power's decision to make WDD into a space organization rather than simply a ballistic missile organization.

Schriever quickly embraced the satellite as well as the rocket into a unified air force space effort through his "concurrency approach," by which he developed both the satellite and the missile in parallel, including launch site construction, installation and checkout, flight testing, and crew training following overlapping and accelerated schedules.[44] This approach dramatically increased risk and cost, but was "revolutionary for the R&D community" and saved an enormous amount of time, ultimately propelling the Air Force to obtain a great many operational space capabilities in the 1960's.[45] Schriever did have some space vision. Perhaps with Power's tutelage, as early as January 1955 Schriever was boasting that the ultimate goal of the ICBM was not war but conquering outer space.[46]

Unfortunately, Schriever was not totally converted to Power's vision of aerospace—that the air and space were operationally indivisible. Schriever accepted the WS-117L and IRBM into WDD, but rejected adding the WADC's BOMI (Bomber-Missile) spaceflight project to the WDD's portfolio in November 1955.[47] BOMI was an early design of a "boost glide" spacecraft designed by the renowned German aerospace engineer Walter Dornberger. Meant to travel into space on a rocket (boost) and use aerodynamics (glide) to maneuver to a landing site, BOMI was a precursor to the Space Shuttle and the direct

antecedent to the Dyna-Soar (later X-20) Air Force manned spaceplane program. Schriever's flat rejection of BOMI in 1955 presaged his later lukewarm attitude toward human spaceflight when he was commander of the Ballistic Missile Division and Air Force Systems Command. With the BOMI decision, Schriever hinted that under his leadership, the Air Force space program would focus on "space and missiles," not the heavy manned space program that Power would eventually strongly support.[48]

Power did not push BOMI on Schriever, so Schriever did not take it. Although Power made WDD into a space organization, he did not force Schriever to make it a truly aerospace one, perhaps to the ultimate detriment of Power's space vision. However, as always, history is not quite as clear cut as simple narratives suggest. While Power advocated that WDD should manage both missiles and space vehicles (including the satellite and BOMI), he did not always push for all space activities to be transferred to WDD. In July 1956, with responsibility for WS-117L, the ICBM and TBM firmly under his control, Schriever requested that primary responsibility for managing nuclear rocket studies be transferred to WDD. Power replied that WDD should stay focused on developing and operationalizing the vehicles at hand and that advanced studies should remain at ARDC under the Deputy Commander for Weapon Systems.[49] The next chapter will examine Power's role in developing the ARDC advanced space studies in detail, but even he did not believe in making WDD the *sole* agency responsible for the Air Force space effort.

The debate over adding WS-117L and the IRBM to WDD has long been neglected in Air Force history. David Spires, in his otherwise excellent history *Beyond Horizons: A Half Century of Air Force Space Leadership*, succumbed to the notion that Schriever was the father of the Air Force space program and claimed Schriever gained WS-117L for WDD over Power's implied objections (based on Power's initial support of keeping WDD focused on the ICBM following the von Neumann Committee recommendations as stated above), which is an inversion of reality.[50] With his decision to turn WDD into an inclusive space organization rather than simply an ICBM one, Power established the Air Force's first organization dedicated to collect, investigate, and manage the development of American space power. WDD became the Air Force's center of space expertise, fulfilling Holley's requirement to have an organization dedicated to acquiring the information necessary for which to confront the space realm smartly

and efficiently. As Spires himself wrote, "The late fall of 1955 arguably [marked] the beginning of what would evolve into a space subculture within the Air Force."[51] But, contrary to popular belief, this milestone was not due to the "father of the Air Force space program" Bernard Schriever, but rather to Thomas Power. Even with such a profound contribution, Power's mark on space was by no means ending. It was just beginning.

Notes

1. Jacob Neufeld, *Ballistic Missiles in the United States Air Force 1945-1960* (Washington, DC: Office of Air Force History, 1989), 104.
2. Neufeld, *Ballistic Missiles*, 107.
3. Neufeld, *Ballistic Missiles*, 104.
4. Neil Sheehan, *A Fiery Peace in a Cold War: Bernard Schriever and the Ultimate Weapon* (New York, NY: Random House, 2010), 157–8.
5. Sheehan, *A Fiery Peace in a Cold War*, 251.
6. Sheehan, *A Fiery Peace in a Cold War*, 250.
7. Sheehan, *A Fiery Peace in a Cold War*, 252.
8. Sheehan, *A Fiery Peace in a Cold War*, 252.
9. Sheehan, *A Fiery Peace in a Cold War*, 253.
10. Sheehan, *A Fiery Peace in a Cold War*, 260.
11. Sheehan, *A Fiery Peace in a Cold War*, 260.
12. Gen Bryce Poe II, US Air Force Oral History Interview (Washington, DC: Officer of Air Force History, 7 November 1987), 143. AFHRA Call No. K239.0512-1729 Volume 1. General Poe recalled that after a T-33 [the trainer version of the F-80 fighter] flying a brigadier general to ARDC headquarters crashed, killing both aboard, General Power told Poe (then an aide to Schriever meeting with Power), "Schriever is flying coast to coast all the time in that T-33, and he has all that [Atlas] program in his head. Tell me who he is flying with!" Thinking that Power didn't trust Schriever's pilot, Poe responded, "His aide is flying with him." 'How much time has he got?' 'About 300 hours of jet time, but we have a guy out there with several thousand hours of jet time (Poe) that doesn't know how to do anything else.' . . . At that point Poe found himself as the aide to [General Schriever] and his pilot."
13. Poe Interview, 157.
14. Poe Interview, 157.
15. Robert L. Perry, *Origins of the USAF Space Program 1945-1956* (Los Angeles AFB, CA: Air Force Space Systems Division, 1961), AFSC Historical Publications Series 62-24-10, 41.
16. Perry, *Origins of the USAF Space Program*, 42.
17. Perry, *Origins of the USAF Space Program*, 43.
18. Perry, *Origins of the USAF Space Program*, 44.
19. Perry, *Origins of the USAF Space Program*, 44.
20. Perry, *Origins of the USAF Space Program*, 44.
21. Perry, *Origins of the USAF Space Program*, 44.
22. ARDC System Requirement SR No 5, 17 October 1955 located in *Document History of WS-117L 1946 to Redefinition* (Los Angeles AFB, CA: Air Force Systems Command, no date), no. 68. AFHRA Call No. K243.012-34v1.
23. Operations Order 4-55, HQ Air Research and Development Command, 9 December 1955. Reprinted in David N. Spires, ed., *Orbital Futures: Selected Documents in Air Force Space History*, Volume 1 (Peterson AFB, CO: Air Fore Space Command, 2004), 518–9
24. Memorandum, Col Terhune to Col Sheppard, Subj: Visit of Majors Green and Rieppe WADC, to WDD, 3 November 1954, located in *Document History of WS-117L 1946 to Redefinition* (Los Angeles AFB, CA: Air Force Systems Command, no date), no. 35. AFHRA Call No. K243.012-34v1.
25. Memorandum (Draft), Schriever (WDD) to Power (ARDC), "Interactions Amongst Ballistic Missile and Satellite Programs," undated, 1–2. AFHRA Call No. 168.7171-82.

26. Memorandum, "Interactions," Schriever to Power, 3–4.

27. Memorandum, "Interactions," Schriever to Power, 5.

28. Memorandum, "Interactions," Schriever to Power, 6–7.

29. Memorandum, "Interactions," Schriever to Power, 13–14.

30. Memorandum, "Interactions," Schriever to Power, 15.

31. Memorandum, "Interactions," Schriever to Power, 16.

32. Memorandum, "Interactions," Schriever to Power, 16.

33. Memorandum, "Interactions," Schriever to Power, 18.

34. Memorandum, "Interactions," Schriever to Power, 19.

35. Schriever, Memorandum for Record, Subj: Interaction of TBMS with ICBM," 30 December 1954. AFHRA Call No. 168.7171-75.

36. Schriever, Memorandum for Record, Subj: Interaction of TBMS with ICBM"

37. Letter, Schriever (WDD) to Putt (DCS, Development HQ USAF), 4 February 1955, located in *Document History of WS-117L 1946 to Redefinition* (Los Angeles AFB, CA: Air Force Systems Command, no date), no. 41. AFHRA Call No. K243.012-34v1.

38. Memorandum, Schriever (WDD) to Power (ARDC), Subj: Redstone – Scientific Satellite, 30 March 1955. AFHRA Call No. 7171-82.

39. Schriever, "Redstone – Scientific Satellite," emphasis added.

40. Memorandum, Schriever to Terhune, 15 April 1955, located in *Document History of WS-117L 1946 to Redefinition* (Los Angeles AFB, CA: Air Force Systems Command, no date), no. 47. AFHRA Call No. K243.012-34v1.

41. Memorandum, Power (HQ ARDC) to Schriever (WDD), Subj: Tactical Ballistic Missile 7 May 1955. AFHRA Call No. 168.7171-82.

42. Douglas Aircraft Company, *Preliminary Design of an Experimental World-Circling Spaceship*, Report No. SM-11827, 2 May 1946, 10.

43. Thomas D. White, "The Inevitable Climb to Space," *Air University Quarterly Review*, Vol 10, No. 4 (Winter 1958-59), 3–4.

44. Neufeld, *Ballistic Missiles*, 201.

45. David M. Rothstein, *Dead on Arrival? The Development of the Aerospace Concept 1944-58* (Maxwell AFB, AL: Air University Press, November 2000), 54.

46. Sheehan, *A Fiery Peace*, 266.

47. Rothstein, *Dead on Arrival*?, 54.

48. See Roy F. Houchin II, *US Hypersonic Research and Development: The Rise and Fall of 'Dyna-Soar,' 1944-1963* (New York, NY: Routledge, 2006) for more information on the Dyna-Soar project.

49. Alfred Rockefeller, *History of Evolution of the AFBMD Advanced Ballistic Missile and Space Program 1955-1958* (Baltimore, MD: Air Research and Development Command, 11 February 1960), 3.

50. David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Peterson AFB, CO: Air Fore Space Command, 1996), 37–8.

51. David Spires, *Beyond Horizons*, 37–8.

Chapter 4

The Study Requirements for Space Dominance
Air Research and Development Command 1956–1957

When Power directed the Western Development Division to take responsibility over the WS-117L satellite system, an organization for the collection and investigation of relevant military space information (both tactical and technical) was in place. The next step for space power in Holley's model was to identify and generate appropriate military doctrine to guide the Air Force's actions in this new military endeavor.

Holley's definition of doctrine is simple: "doctrine is what is officially approved to be taught."[1] Military doctrine is normally derived either from past experience such as actual combat operations, or from tests, exercises, and maneuvers. Holley stressed, "Only when necessary will doctrine consist of extrapolations beyond actual experience of some sort," but in those circumstances, often when dealing with new technology, doctrine can be developed from reasoned extrapolation.[2] Military space activity in the mid-1950's qualified as such a situation. There was virtually no experience with spaceflight at the time, yet doctrine to guide employment of this new technology effectively was necessary to remain competitive in the Cold War.

Effective doctrine has two purposes: to provide guidance to decision makers, planners, and policy makers; and to provide a common basis of thought for contemplated action.[3] Holley concluded in *Ideas and Weapons* that in the end doctrine, or the accepted concept of the mission to be performed by a new weapon, inevitably determines the direction of development for that instrument of war.[4] Holley later posited the "Doctrine Continuum," in which an *action* motivates an *observer* to create a *concept* that would be developed and accepted into *doctrine* that, if durable, could mature into a *principle*.[5] To Holley, a concept is a speculative and tentative mental construct or theory—an unproven idea that springs from a creative imagination.[6] Doctrines, on the other hand, are "precepts, suggested methods for solving problems or attaining desired results" based upon reflection on accumulated experience and promulgated by competent authority.[7] Thus, concepts are not fully formed doctrines, but they can be considered doctrines in larval form. In the search for an appropriate doctrine for Air Force

space power, collection and study of concepts with which to build that doctrine was essential. Power was quick to place Air Research and Development Command to work developing the concepts necessary to germinate doctrine that would guide the Air Force efforts to dominate space.

Power, throughout his tour as ARDC commander, stressed that ARDC's main responsibility was to retain and expand America's qualitative superiority in weapons relative to her adversaries, especially the Soviet Union. Speaking about ARDC's role in the Cold War, Power believed that in "their determined quest for world domination, the Soviets have unscrupulously resorted to a seemingly inexhaustible variety of hot and cold war techniques. Since the end of World War II, they have placed increasing emphasis on a third type of warfare—the slide-rule war. As a result, the United States has been forced into an all-out struggle with the Soviet Union for technological supremacy."[8] To win this slide-rule war, ARDC stood ready to play its part.

Power argued, "As I have explained in several recent addresses, we *can* remain ahead of the Soviets in the development and production of new weapons. I am confident that continually advancing the state-of-the-art; by an aggressive development program, utilizing the latest findings of basic research; and by applying principles of management which are possible only in a free economy such as ours and which are far superior to any advantages the Soviets might derive from their system of dictatorship, we can maintain our qualitative supremacy for as long as is needed and can do so within the limits of our economic capability."[9] Nowhere did Power apply this method with more enthusiasm than in determining the role of space in the Air Force of the future.

In May 1955 ARDC proposed a feasibility study of a "Manned Ballistic Rocket Research System." Major aircraft companies and other interested organizations were briefed on the study. Because ARDC had no money to support a study on its own, they were also urged to conduct independent investigations of the problem. AVCO studied a manned satellite and RAND, a strong proponent of reconnaissance satellite systems since 1947, reported on space vehicles for other than reconnaissance purposes. In May 1956 RAND also proposed a "Lunar Instrument Carrier" that circulated through ARDC and the Air Force.[10]

The May 1955 Moscow Air Show deeply shocked the nation, the Air Force, and Thomas Power. The clever Soviet deception of flying

ten Bison bombers twice to convince the viewing public that the Soviet Union had twenty-eight at the show alarmed the Western Alliance and jarred the United States into closing the new "bomber gap" at lightning speed. Power appreciated Holley's contention that qualitative superiority of weapons was particularly imperative in the Cold War against the Soviet Union and sprang into action. "There is no person in this country who is not, directly or indirectly, concerned with the race for qualitative supremacy in the air—the keystone to our survival as a free and prosperous people," Power wrote in 1956. "To achieve and maintain such supremacy, the United States Air Force has created a management tool unique in the history of military warfare—the Air Research and Development Command." Power lauded the ARDC as "the greatest team [of Air Force personnel, other government agencies, and American science and industry] ever assembled for one single purpose—qualitative superiority for the Air Force-in-being as well as the Air Force to-be."[11]

Developing this team required many long-standing barriers be broken down between the military and industry, a task Power quickly began. To achieve and maintain qualitative superiority required shortening the development cycle of new weapons, necessitating the rapid development of new weapon systems, and the similarly rapid transmission of military requirements to industry. ARDC expedited this process in a number of ways. First, the organization offered more definitive guidance to contractors to guide their internal preliminary studies. Second, ARDC guided contractor research and development along promising lines and prevented misdirected effort. Third, ARDC encouraged "independent proprietary" work by contractors. Finally, ARDC decreased the time of the development cycle by gaining contractor interest and effort at the earliest possible date while conserving "valuable engineering and technical manpower."[12]

On 7 October 1955, Power requested that his newly established Board of Officers on Guided Missile Development "be bold and imaginative in its concept of the scope and importance of future space vehicle development programs."[13] The Air Force needed many studies to assist in planning during the technological revolutions that took place in the 1950's, including exploratory, feasibility, analytical, and design investigations. But money for such inquiries were lacking. An ARDC review for FY 1956 indicated that the 55 studies ARDC contemplated required $13,678,000, but only $4,357,000 existed in the current budget. To bridge the gap, Power established a weapon

system requirements release program in late 1955 to communicate "future weapon system requirements to industry sooner than heretofore" and encourage contractors "to conduct voluntary, unfunded studies which will be used for planning purposes."[14] Rather than keeping industry at arm's length until a contract was awarded, ARDC would instead "let industry in on what used to be ARDC secrets."[15]

An opportunity to test the philosophy of the requirements release program occurred in summer 1955, when an urgent need arose for design information to "satisfy Air Rescue, Resupply, and Assault requirements."[16] ARDC held informal conversations with "appropriate members of industry in an effort to discover those members who would have both a capability and a desire to undertake studies in these particular areas."[17] ARDC avoided smaller contractors that did not have the resources to support free studies which "they would have no hope of accomplishing." [18] Instead, ARDC stuck with well-known contractors Convair, Douglas, Grumman, Fairchild, Lockheed, Martin, and Stroukoff. Determining from the industry that contractors would prefer to meet individually with the Air Force rather than in a group, ARDC complied while preparing the study.

New ground rules for such a novel Air Force-industry relationship were required quickly. Air Force Regulations prohibited the release of General Operational Requirements (GOR) documents outside of the government, so ARDC quickly generated new documents called "Performance and Characteristics Design Data Sheets" that were releasable but also provided needed information to the contractor. ARDC also stipulated that contractors must safeguard the classified information released to them as well as fully understand that participation in these studies "does not constitute a request for work, nor will any such request necessarily follow-on, and that USAF assumes no obligations of any sort by virtue of passing on this data."[19]

Industry and ARDC leaders met between 18–22 November 1955, and the discussions were considered to be successful. Both contractors and the Air Force reacted positively to this experiment. Lockheed believed that the approach utilized by ARDC in seeking to fill those GOR's would "provide superior results." A general statement of requirements left the contractor "full scope to suggest novel approaches."[20] George Bunker, president of the Glenn Martin Company told Power, "All of us are familiar with the term 'technological breakthrough' . . . It seems to me of equal import that you and your command have accomplished a comparable 'policy breakthrough' by

conceiving and putting into effect your System Requirement Plan." Bunker acknowledged the "old set-up" kept industry in the dark regarding the Air Force's requirements and believed that the new system whould perform very well. "This plan should bring about a much closer relationship between the Air Force and the industry and reduce to a minimum the misconceptions and loss of time that have resulted in the past from lack of complete understanding between two groups of people intent on a single purpose," he concluded.[21]

Due to the apparent success of this initial attempt, ARDC was quick to codify the lessons learned into an established system. Thus emerged the Study System Requirement (SR) program, defined as "a statement of an anticipated requirement for a weapon or supporting system, including a definition of the problem area or need, and all considerations having a bearing on the problem and its solution, such as background, intelligence information, present state-of-the-art, related development, etc."[22]

The ARDC Directorate of System Plans, led by Maj Gen Albert Boyd, was critical to the SR system. The directorate was responsible for the long-range planning and programming of ARDC weapon systems and assisted Air Force Headquarters in preparing General Operational Requirements documents. It was thus the office responsible for initiating new SR studies and also served as the primary point of contact between the Air Force and industry during the early stages of system studies. Through conducting SR studies and other explorations, the Directorate focused ARDC's desired areas of concentration for years to come and was intended to determine the "shape of things to come" for the Air Force and nation. Through the SR program, the directorate provided a great deal of information that benefitted Air Force planning in the early 1960's.[23]

Directorate Systems Plans Office Instruction No. 2 contained the SR release procedure. An SR could be initiated at the discretion of any ARDC division chief and, after coordination with HQ ARDC, a collection of SRs were shared in conference with industry representatives.[24] "At this point some company representatives" faced "temptations like those of a boy at the candy counter," wrote Claude Witze, but they were "forced to limit themselves to the two or three areas where they have the greatest capability."[25] After the conference, the SRs selected were published and distributed to the selected contractors.

The resulting document, the ARDC System Requirement (Study), contained a number of sections:

1. Directed Action: Alerted all ARDC elements of the existence of the study and directing their full support of each contractor selected to perform the study.
2. General Information: A statement of the ground rules binding both ARDC and the contractors, stressing the safeguard of classified information and proprietary rights of the industry group.
3. Reference: A list of previous work, to include feasibility or exploratory studies, draft or firm GOR requirements, and other pertinent information.
4. Requirement-Problem: A statement of the problem, background, desired performance requirements, other characteristics, possible approaches or solutions, and a Performance and Characteristics Data Sheet (if available).
5. Guidance: An estimate of the operational time period, possible applications of the results of the studies, and any additional information ARDC might require.
6. Other Information: A section including Project and Task numbers for the study, the names of other participating industry groups, and other information deemed necessary.
7. Statement of Desired Work: A statement outlining work desired, potential Air Force action dates, suggested reporting procedures, and any other relevant data, but with a clear statement that the study was being conducted voluntarily and would be completely unfunded by the Air Force.
8. Technical Brief: A resume of known work being accomplished that might have implications relevant to the study, a brief of the present state-of-the-art, and a list of agencies engaged in work that might be able to assist in solving the problem.[26]

Because the SR was unfunded, the industry group retained proprietary rights to the information they provided, with the single caveat that the proprietary aspects of the study not prevent or retard the reporting of the overall study to the Air Force or ARDC. The SR system proved popular with both ARDC and industry.

Within six months of beginning the formal SR program, 95 industry groups representing over 30 contractors were working on 54 separate studies. Even though most SR studies were unfunded (some SRs began to be modestly funded a few months in the SR program), because the studies helped "orient ARDC toward a firm GOR or a new weapon system, the contractor who contributes cannot escape attention when early history of the project is considered," a fact that ARDC and the System Plans directorate did not hesitate to stress.[27]

Claude Wintze believed the SR program offered both the government and industry a distinct advantage. "At no time in history," he claimed, "has there been closer co-operation between industry and the government. . . . The secret is that the System Requirements study program should improve industry's capability before the final weapon system requirement becomes urgent. Technical knowledge, placed on the shelf as it sometimes will be, will shorten the engineering learning curve when the project gets hot. The same holds true for the USAF: with better material upon which to base decisions, the decisions should come more quickly and have more merit."[28]

Power, assessing the early results of the SR program, concluded, "Industry in general has indicated a willingness to expend effort toward defining possible solutions to Air Force problems." As a result, Power was inclined to give them more opportunities to do so through the SR program. He declared, "It is the intent of the [SR] program to identify areas for study which will significantly improve our operational capability, thus permitting contractors to channel engineering efforts into the most profitable fields.[29]

For Power, closer cooperation between the Air Force and industry to shorten the development cycle for new weapon systems was merely a mean to an end. The goal was qualitative superiority of weapons over the Soviet Union, and that required what he called "big jumps" in the advance of weapons technology.[30] In the late 1950's, especially after the USSR launched the Sputnik satellite in 1957, the "big jumps" were into the new sea of space. The SR program was ready for the transition.

In December 1956, Power established the Guided Missile and Space Vehicle Working Group. In December 1957 the group issued a "Special Report Concerning Space Technology" that laid out an "ARDC Five Year Projected Astronautics Program." These included a "Manned Lunar-Based Intelligence System," with a projected first flight in 1967. By January 1958, the Air Force initiated Program 499,

a "Lunar Base System," and by March the Air Force was formalizing plans for a "Manned Lunar Base Study."[31]

The Air Force Space Study Program was initiated in 1959 to build upon the SR program specifically to study space issues. The SR studies under the Space Study Program in 1959 were SR 126 Boost Glide, SR 178 Global Surveillance System, SR 181 Strategic Orbital System, SR 182 Strategic Interplanetary System, SR 183 Lunar Observatory, SR 184 24-Hour Reconnaissance Satellite, SR 187 Satellite Interceptor System, SR 192 Strategic Lunar System, SR 199 Advanced Ballistic Missile Weapon System, SR 79500 Intercontinental Glide Missile (ICGM, which superseded SR 126 Addendum 1, 20 March 1959), and SR 89774 Recoverable Booster Support System.[32] In FY 1959 the Space Study Program was funded at $2.9 million, but the $3.3 million requested for FY 1960 was placed on the deferred list by the Director of Defense Research and Engineering, Harold Brown, and was not released to the Air Force.[33]

The *Air Research and Development Command Long Range Research and Development Plan 1961–1975* noted the role of man was still undefined in the upcoming age of ballistic missiles. "Manned aircraft have very definite and vital capabilities which should assure them a complementary position in the SAC inventory during the entire 1961–1976 time span."[34] The manned aircraft would need the "ability to recognize targets otherwise inaccurately located or fleeting targets of opportunity" and to complement "the vastly intricate machine computers with man's inherent judgment and ability to make decisions on the spot."[35] The document mentioned five projected platforms for consideration: a Subsonic Airborne Military Platform, a Subsonic Nuclear Powered Aircraft, the Dyna Soar spaceplane, and an Advanced Recoverable Booster System "Space Plane" (SR 89774, SR 19786).[36] Of the five platforms considered for future SAC manned requirements, two were space platforms.

Together with the strategic air offensive mission, the ARDC SAC plan also included a Space Programs section that stressed deterrence, which implied "a mixed force with capabilities appropriate to the several missions, exploiting fully the spectrum of survival techniques." This mixed force would have to exploit space eventually to maximize survivability "in an era of ever increasing enemy offense capabilities." The plan identified SAMOS, MIDAS, DISCOVERER, and other Air Force space efforts with NASA and ARPA [Advanced Research Projects Agency], and the document noted there was at present "little

documented space weapon system development effort in the offense area."[37] Nevertheless, taken together, the ARDC studies described the force structure possible for the space strategic effort in the 1961–1976 time period.

The ARDC SAC plan that year also discussed several potential space capabilities. The first was the Bombardment Satellite. Results of the SR 181 (Strategic Orbital System), initiated in 1958, indicated that there were three "specific space systems warranting future study": a Low Altitude Offensive Space System (SR 79821), a Stationary Orbit Offensive Space System (SR 79822), and a High Altitude Offensive Space System (SR 79822).[38] These and other studies outlined a rationale for an "Earth Military Orbital Space Force" and "Manned Space Vehicles and Platforms."[39] Throughout this period, the ARDC SAC assumed "that the Soviets will put man on space platforms in cislunar space and on the moon as expeditiously as possible. For both reasons, this Nation must have man in space, and man probably will be utilized eventually in space offensive weapons."[40]

Acknowledging the potential of manned astronautics suggested by the X-15, Dyna Soar, and Mercury programs, the ARDC plan identified other significant SR studies ongoing at the time "to give an indication of the scope and magnitude of the R&D effort and to indicate cursorily the management, the evaluation, the analysis, and the decision making tasks that lie ahead before man can be sustained in space equipped, trained, and capable of combat operations." They were:

a. Strategic Lunar System (SR 192)

b. Strategic Interplanetary System (SR 182)

c. Nuclear Rocket Propulsion System (SR 79812)

d. Recoverable Orbital/Launch System (SR 19786)

e. Military Test Space Station (SR 17527)

f. Space Logistics, Maintenance, and Rescue Systems (SR 79814)

g. Lunar Base Complex Study (SR 17514)

h. Lunar Base Logistics System (SR 17513)

i. Strategic Orbital System (SR 181)[41]

The plan also mentioned "miscellaneous vehicles and weapons," including a "Space Plane," which was a manned aerodynamic vehicle capable of operating in space while taking off and landing like a conventional airplane, and "Putt-Putt," a concept using "nuclear detonations to boost tremendous payloads" into space, which became Power's particular favorite and will be explored in the next chapter.[42]

The Strategic Air Command System Studies documented in the *ARDC Long Range Plan for 1960–1975* showcase the broad and rich concept development effort ARDC undertook when it applied the Study Requirement system to study potential future development.[43] The overwhelming majority of SR space studies are still classified (the author has attempted to get many declassified for a number of years) but the declassified descriptions from the *Long Range Plan* suggest fascinating reading over a grand swath of the space domain's potential.

The SR studies did not focus entirely on fantastic manned, winged spacecraft evolved from the "higher, faster, farther" mentality. SR 89774 – Recoverable Booster (Project/Task No. 7990/89774; ECD: Oct 59) looked to perform a comprehensive design study and operational analysis study of recoverable boosters. The SR intended to compare air-breathing and rocket-propelled carrier aircraft to launch payloads into orbit, similar to modern concepts such as Virgin Galactic's "Launcher One" vehicle.[44] Other studies included near-term requirements for improved ballistic missiles for ground-based strategic deterrence. SR 199 – Advanced Ballistic Missile Weapon System (Project/Task No. 7990/79992; ECD Feb 60) studied the feasibility of a quick reaction ICBM with a range in excess of 8,500 nm, with payloads from 20,000—100,000 lbs and hardened sites to complement the Minuteman.[45]

Some studies contemplated nuclear propulsion. SR 150 – ANP [Airborne Nuclear Power] Rocket System Studies (Project/Task No. 7990/89784; ECD Undetermined) attempted to "support, from the complete weapon system standpoint, Air Force, AEC [Atomic Energy Commission] and NASA studies and development in the reactor-power plant area." This SR examined the potential of nuclear rockets for space lift, but appeared primarily interested in exploring the potential worth of a nuclear-rocket ICBM.[46] SR studies were not limited to launch vehicles; SR 196 – Advanced Strategic Communications System (Project/Task No. 7990/49754; ECD Undetermined) attempted to determine the best physical configuration of an airborne

communications package to provide the airborne links of the 1960 communications satellite system.[47]

In addition to immediate launch vehicle and communication needs, the SR studies also performed extremely visionary work and often took a long view of space exploitation. Two remarkable studies, SR 192 and SR 181, shed light on one Air Force long-range vision for space activity. SR 192 – Strategic Lunar System (Project/Task No. 7990/79990; ECD 1 Apr 60) was "implemented to explore the strategy of potential military application in the lunar area." The very comprehensive study considered the "potential offensive, defensive, reconnaissance, and support (communications, weather, logistics, etc.) aspects of the lunar area, all integrated into one system concept."[48] SR 183 – Lunar Observatory (Project/Task No. 7987/19769; ATP: 1968, ECD 15 Nov 1959) was an allied study to determine an optimal approach for establishing a manned intelligence station on the moon. SR 183 was considered especially critical to national security because it was believed a moon base would provide unparalleled surveillance of hostile space vehicles and the Earth's surface. It was also felt that a military base on the moon might provide the ultimate high ground in space supremacy and provide a highly-effective deterrent if armed with ballistic missiles. The SR argued the "military and political effect of earth circling satellites might be nullified by the control of the moon with the accompanying control of cislunar space."[49]

SR 181 – Strategic Orbital System (Project/Task No. 7990/79503; ECD Oct 59) explored an integrated, mature earth orbital military space force that might have existed in the 1965–1980 time frame. The study considered relationships of potential offensive, defensive, reconnaissance, deterrence, and support systems for the orbital military force. The study specifically addressed both manned and unmanned systems, as well as conventional and exotic systems and their potential impact to military operations, including "potential methods of offense and defense using other than nuclear bombs." This study was meant to be holistic, considering political, military, and economic dimensions of military space activity. It also aimed to identify new areas that deserved further in-depth study in the SR system.[50] This study spawned numerous others in its wake, including:

- SR 89774 Recoverable Booster Study
- SR 17527 Military Test Space Station

- SR 79814 Space Logistics, Maintenance and Rescue System Studies
- SR 79821 Earth Satellite Weapon System Studies
- SR 79822 Advanced Satellite Weapon System Studies
- SR 79817 Advanced Satellite Interceptor System
- SPAD [Space Patrol Active Defense*][51]

SR 17527 – Military Test Space Station (Project/Task No. 7969/17527; Date 1 Sept 59; ECD Late 1961; Responsible Division: WADD) may be the most interesting of the SR 181-derived studies. Its objective was to "obtain feasibility studies of preliminary designs of a space station in which military tests can be conducted in a space environment." Most historians of early Air Force space activity claim the Air Force was interested in manned space stations for orbital surveillance and reconnaissance. The Military Test Space Station SR study (perhaps the first study to consider a manned military space station), however, envisioned the station not as an alternative to unmanned spy satellites, but as a critical technology development laboratory in which man would be a vital element. SR 17527's objective clearly documents a need for a manned space station that an unmanned satellite system could not address. "Some testing of space components, equipment, techniques, and subsystems for military use can be accomplished in Air Research and Development Center laboratories and other facilities available to those laboratories," the SR justification argued.[52] "For those components, equipment, techniques, and subsystems that are to be used in space systems," it continued, "it is necessary to conduct some tests in the harsh space environment which cannot be simulated in a ground laboratory."[53] The existing method of placing test articles in the nose cones of ballistic missiles was very limiting and inadequate for real space testing. The justification concluded, a "military test space station could provide the capability of conducting many tests simultaneously over an extended period of time. . . . The need for a test space station appears quite clear. In order to make progress in space technology, appropriate testing and training in the environment is a necessary ingredient."[54]

These words explode the contemporary assumption that the Air Force identified no compelling need for man in space. It is unclear if SR 17527's Military Test Space Station is in any way connected to the

later Manned Orbiting Laboratory (MOL) project, but it is clear is that the Air Force vision for a space station extended far beyond the utility of a manned intelligence platform. What ARDC really wanted was a space materials and test laboratory that would be critical to the development of space systems to a highly advanced state—a capability that an unmanned satellite could not provide.

SR 79821 – Earth Satellite Weapon System (Project/Task No. 7990/79821; Date 19 Feb 60; ECD Feb 61; Responsible Division: WADD) and SR 79822 – Advanced Earth Satellite Weapon System (Project/Task No. 7990/79822; Date 24 Feb 60; ECD Feb 61; Responsible Division: AFBMD) both also emerged as the weapons development studies derived from SR 181. The Earth Satellite Weapon System intended to study space-based weapons for "global strike" of targets on earth, while the Advanced Earth Satellite Weapon System studied space-to-space weapons. These studies appeared to develop preliminary plans for many General Operating Requirements (GOR) documents, including, GOR 174, Earth Satellite Offensive Weapon System, dated 25 November 1958, and GOR 173, Advanced Strategic Space Weapon System dated 14 November 1958. Both studies may offer new understanding of the Air Force vision for space as well.[55,56]

The internal dynamics of the Air Force/contractor relationship under the SR system were displayed by a letter from Convair Astronautics to the Air Force Special Weapons Center. In this letter, Convair asked the Air Force for a number of papers written by General Atomics under contract AF 18(600)1812 that ranged from "Hemholtz Instability over a Shallow Layer of Fluid" to "Trips to Satellites of the Outer Planets" by noted scientist Freeman Dyson, so that it might use them in preparation for its own study for SR 181 under contract AF 33(600)38558.[57] Although prepared under contract from a competitor organization, there is little doubt that Convair received these papers. This conclusion is evident in the fact that two years later Convair delivered an SR 181 report of breathtaking scope and breadth later (under an additional contract AF 33(600) 41867), with the General Atomics program an important centerpiece.

SR 181 was, surprisingly, not the farthest-looking study of the SR series. SR 182 – Strategic Interplanetary System (Project/Task No. 7969/79504; Date 1 Oct 58; ECD May-Jun 60) intended to "determine probable military applications in interplanetary space; recognize and outline state-of-the-art advances which are prerequisites to these applications; and to indicate the type and phasing of research vehicle

and test programs required to attain and support an interplanetary weapon system concept."[58] Like most of the SR studies, SR 182 is still classified; but in its pages may exist the most advanced and forward-looking space thinking accomplished under the United States Air Force's banner. It is fitting, then, that the man most responsible for these studies, Thomas Power, should be considered one of the Air Force's greatest space visionaries.

But doctrine requires more than just vision; and regardless of their visionary contents, the SR studies would be worth little if they only collected dust on ARDC or WDD shelves. Very little is known about most of the SR studies. However, some information regarding SR 183 and SR 192 has been declassified, and a few documents exist that shed some light on how they were received by the Air Force and the broader space community.

SR 183 – Lunar Observatory, and SR 192 Strategic Lunar System, were ultimately combined by the contractors by assent of AFBMD, the responsible division for both studies. Under SR 192/183, six contractor studies were ultimately delivered, three from paid contractors (Boeing, North American Aviation, and United Aircraft) and three from voluntary participants (Douglas, Minneapolis – Honeywell, Republic Aviation).[59] In keeping with Power's desires to rely upon contractor funds as much as possible (SR space studies began to receive funding with the American space expansion after the Sputnik launch), the Air Force paid $800,000 for the studies with a voluntary contractor contribution of $1.2 million of corporate funds.[60]

The studies were divided into two volumes. Volume I analyzed how to establish and support a lunar base. Volume II was a detailed technical plan for detailed research and development required to attain the capability to build the base. The report's findings included the following:

1. A lunar base was the initial and essential step in attaining any military capability in the lunar environment

2. A military lunar system was potentially highly valuable, primarily because it could help "assure positive retaliation."

3. It was desirable for the United States to establish a lunar base as soon as possible.

4. It was technically feasible to establish a lunar base "by extension of present techniques."

The total cost of the Lunar Base program was estimated to be $8.1 billion.[61]

NASA was kept appraised of the SR program. Edwin P. Hartman, of NASA's Western Coordination Office in Los Angeles, California, was present at the SR-183 Midpoint Briefing at the Air Force Ballistic Missile Division in Los Angeles, which took place over 24–26 March 1959. He was relatively unimpressed with what he saw. In his memorandum on the trip to NASA's Director of Space Flight Development, Hartman explained that the three-day series of briefings were attended by 50-100 people from around the Air Force, Space Technology Laboratories (a division of Ramo-Wooldridge), and one other NASA member from the Jet Propulsion Laboratory. Hartman said of the presentations that there was "not much of a general nature to be said about the presentations except that they all seemed a little fantastic." He continued, "All of the presentations suffered greatly from a lack of basic knowledge about the subject discussed. In them the meager knowledge that exists was over-extrapolated. Fanciful concepts were described which, aside from the intellectual stimulation they produced, are probably of little value."[62]

Hartman also questioned the "free" nature of the SR program. He wrote the "companies that undertake SR studies for the Air Force do so largely at their own expense. However, as the income of most aircraft companies comes mainly from the government, it is obvious that the studies are paid for by the government with the costs appearing as overhead charges on military contracts."[63] Overall, Hartman preferred the more modest presentations, especially "the briefest, most pessimistic and most down to earth—if a lunar venture may be so described."[64]

Hartman did, however, find some utility in the SR series:

The companies carrying out the SR studies benefit by the build up of their technical competence in the space field and the improvement of their chances of getting a hardware contract. One wonders, however, whether the hopes for a hardware contract may not tempt companies to present overly optimistic viewpoints on space projects. . . . However, the intellectual stimulation of the SR-183 studies is of definite value and if the practical limitation of the material produced is recognized, the studies may be regarded as being a worthwhile effort.[65]

Some of the intellectual stimulation of the two lunar studies on Air Force thinking may be gleaned from a 1959 *Air University Quarterly Review* essay by Lt Col S.E. Singer of the Air Force's Command and

Staff College titled "The Military Potential of the Moon." Lt Col Singer, a physicist, partially developed his ideas from the studies.[66] Singer assessed the moon as a potential base for observation as well as deterrence. Signer also advocated advanced concepts with which space thinkers continue to grapple. Among them was Singer's concept of "Lunar autarky." Autarky is an economic term that means self-sufficiency. Singer believed "the moon is not nearly so barren as it seems. All the energy man could conceivably use is certainly available on the moon, and most if not all of the chemical elements he requires are probably there as well."[67] Singer argued, "the concept of an eventual lunar autarky cannot be excluded from consideration, and no analysis of the dollar cost of long-range lunar programs is meaningful unless this concept is included."[68] Indeed, the April 1960 study summary of SR 183 indicated that the total cost of a permanent lunar base would total $8.15 billion over ten years, with annual operating costs of $631 million, which the study compares to just one aerospace company's annual revenue from Air Force activities, or one-tenth of the annual US Farm Subsidy Program. Developing lunar resources, however, could decrease the total cost of strategic lunar operations by 25 percent.[69]

Singer concluded that a moon base could fundamentally influence military doctrine. "Military doctrine is a product of both vision and experience. But its very essence is experience. Mitchell's visionary views were vindicated by experience and not by the rhetoric that surrounded them." Singer, in parallel with Holley, declared, "Only experience will permit the evolution of a meaningful space doctrine."[70] Perhaps, but the existence of the SR studies promised to jump-start the process.

Many of the advanced space-related SR studies were made the responsibility of the Wright Air Development Division (WADD) rather than the Air Force Ballistic Missile Division (AFBMD). The dissemination of the SR studies does not, however, appear to follow any type of clear responsibility because some forward-leaning space studies, such as the SR 182 Strategic Interplanetary System was an AFBMD study while SR 181 Strategic Orbital System, a similarly advanced and expansive study to which SR 182 seems a sequel, was sent to WADD. Even with an unclear demarcation of responsibility, it makes sense that AFBMD's, the successor of Schriever's Western Development Division, programs would be mostly developed while WADD's forward-leaning aerospace systems were discarded when

Schriever took over ARDC. Schriever knew the ballistic missile systems of AFBMD best and did not care as much for WADD man-in-space studies. It is clear that while Schriever as ARDC commander neglected WADD space studies, Power at SAC certainly did not.

The SR studies can be considered an early Air Force attempt to achieve Burton Klein's "Type II flexibility" with regards to research and development. Type II flexibility "attempts to reduce the uncertainties confronting the decision maker by buying information on competing development alternatives."[71] The SR space studies certainly attempted to garner information on competing developmental possibilities for the uncertain future regarding the Air Force in space. Stephen Rosen argues that "Concretely, Type II flexibility manages uncertainty by buying information and then deferring large-scale production decisions."[72] Classic Type II behavior culminates in the flying of a prototype, but the SR studies did not quite get that far. However, the SR space study system should not be seen as classic "charity work with taxpayer money" as historian Dwayne Day described the studies, but rather as a rational, reasonable, innovative way to confront a future of great uncertainty, "when political and technological conditions are in great flux" and pursuit of hardware to accommodate every contingency would otherwise be prohibitively expensive.[73]

While the SR studies themselves may not have risen to the highest quality level of doctrine as defined by Holley, they certainly moved the Air Force's institutional thinking on space along Holley's doctrinal continuum to at least the concept stage. Collectively, the SR studies also provided a remarkable opportunity to construct a holistic proto-doctrine for the Air Force in space. This was exemplified by the nested SR characteristic in the program, in which many study requirements were expansions of previous studies, capable of influencing the direction of Air Force space development for years to come. Unfortunately, they were not given the opportunity to do so.

In a 10 November 1964 letter to AFRDC on "The Air Force Space Program," Lt Gen Hewitt T. Wheless, then Deputy Chief of Staff for Programs and Requirements, stated his concern that the future of manned spaceflight in the Air Force would soon be completely subsumed by NASA. Wheless vented his frustration at the Office of the Secretary of Defense (OSD) requiring specific operational requirements for space systems while it cancelled exploratory and advanced development programs of the kind explored in the SR studies. Included

in his thoughts on how the Air Force could get its space programs back on track with Congress and OSD, he lauded the achievements of the SR studies, saying the "Air Force Space Study Program, which proved so successful in providing fresh thought and new ideas during the 1958–1961 time period, has ceased to exist. Sterility of ideas in most areas of planning has resulted. Imaginative thought can again be applied by re-instituting a well-planned study program." [74]

But when Wheless wrote, the ARDC SR program had already been terminated. The ARDC space program was under threat as soon as it began, with the introduction of the Department of Defense's Advanced Research Projects Agency (ARPA). The history of ARDC lamented, "While the Weapon System space plan was being developed, ARPA moved into the field, and although the new agency's relationship with the armed services was not clear at first, it became increasingly plain as the months wore on that neither the Air Force nor the Air Research and Development Command would be permitted to manage so large and integrated a program as that being worked in [ARDC]." Consequently, "The Weapon System ARDC space plan was doomed, for ARPA, which assumed primary cognizance over such matters, was not organized to develop all the elements of a weapon system as defined by the Air Force. The Air Force did not have the opportunity during the first year of ARPA's existence to develop the appropriate relationship that would have enabled all the parties concerned to exploit this storehouse of experience in military research and development that the Air Force had accumulated."[75]

The SR-based Air Force Space Study program had begun when ARPA had already assumed most national space development authority for themselves, aided by President Eisenhower's "space for peaceful purposes" platform. It is not surprising, then, that the program was strangled as OSD withheld funds in 1960, and the resulting reports of the study were classified, stored, and forgotten by the Air Force. The SR space studies were tantalizing glimpses of what might have been in space had ARDC been allowed to pursue space activities the way it envisioned them, but ARDC was never given this opportunity. As the command historian wrote of the first fateful year of the space age, the decision to strip ARDC of its space mission was not due to ARDC's failure or lack of skill. Rather, the "events removed from the Command most of its natural mission of research and development in the space area in much the same manner and for the same reason that decisions by a commanding officer may remove suddenly the duties

of a subordinate: policies made on a higher level, from which there was no appeal, changed the course of action."[76]

One wonders if a strong commander may have been able to change ARDC's fate. Power had left ARDC on 1 July 1957, only a handful of months before the Sputnik launch. Would he have been able to resist the sidelining of ARDC in the space age? ARDC had developed and studied advanced space concepts years before Sputnik; these studies included such evolutionary subjects as advanced ballistic missiles and revolutionary combat concepts such as entire war-fighting formations in Earth orbit. The Air Force was diving deep into space stations as orbiting component development laboratories and lunar bases. These studies, if allowed to inform the later American effort in the space race, might have provided the concepts from which powerful space doctrine could have emerged.

The space work begun by ARDC under Power's leadership would not, however, die completely with the activation of ARPA. The Air Force space vision, carried on by the Air Force Space Study program using Power's SR system, would find a new champion. The focus of advanced Air Force space thinking would move from a de-fanged ARDC to the most powerful military organization ever created—the only Specified Command in American history—the Strategic Air Command and its commander–in–chief, Gen Thomas S. Power.

Notes

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18. *History of ARDC*, 1 July – 31 December 1955, V-180.
19. *History of ARDC*, 1 July – 31 December 1955, V-181 to V-182.
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51. ARDC LRP 61-76, C2-5.

52. ARDC LRP 61-76, C2-4.

53. ARDC LRP 61-76, C2-4.

54. ARDC LRP 61-76, C2-4.

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62. Edwin P. Hartman, NASA Western Coordination Office to Director, Space Flight Development, memorandum, 2 April 1959, 3.

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66. Editorial, "Space: An American Necessity," *Life Magazine*, 30 November 1959, 36. This editorial identifies Lt Col Singer as a physicist. It is possible that, previous to the Staff College assignment, Lt Col Singer worked at the Air Force Ballistic Missile Division Directorate of Space Planning and Analysis, which oversaw the SR 183 study. However, the author is aware of no direct proof that Lt Col Singer was connected to SR 183 in any way.

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68. S.E. Singer, "Military Potential of the Moon," 45.

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72. Stephen Rosen, *Winning the Next War*, 244.

73. Dwayne A. Day, "Take Off and Nuke the Site From Orbit"; Stephen Rosen, *Winning the Next War*, 244.

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Chapter 5

The Aerospace Evolution Ascendant
Strategic Air Command 1957–1964

After organization and doctrine, the final requirement Holley identified for effective weapon systems was to produce the weapon itself. But ideas were still critical to producing weapons. Holley explained that during World War I, "advocates of the air weapon within the Signal Corps could expect to see the fullest exploitation of the potentialities of aircraft only insofar as they succeeded in setting the pace, that is, in defining objectives for the aircraft industry."[1] In like fashion, with the knowledge from the Study Requirement program as background, the Air Force had to translate that knowledge into operational requirements for space systems to be developed by a nascent space industry. Holley argued there were two prior assumptions necessary to produce superior equipment: a knowledge of the mission of the new weapon; and a knowledge of the type of craft necessary to accomplish that mission.[2] Leaving the research and development world to take perhaps the most important and powerful operational command in the United States armed forces, Power was now in a position to state the operational requirements necessary to influence both the mission and performance parameters to fully develop war-winning space power for the nation.

On 1 July 1957 when LeMay handed him the reins, Power became commander-in-chief of Strategic Air Command. At that moment, the 29,946 officers, 174,030 airmen, 2,711 tactical aircraft, 40 bombardment and strategic wings, five strategic reconnaissance wings, 40 refueling squadrons, 68 bases spanning the globe, and the mission of deterring Soviet aggression through the threat of overwhelming nuclear retaliation became Power's responsibility.[3] The technological future of the Air Force would no longer be his primary concern. Now he had the immediate responsibility of defending United States interests while ensuring the Cold War stayed cold. But, in seeming tribute to his work in bringing the Air Force into the space age, the same day Power took command of SAC, the first American intercontinental ballistic missile wing, the Atlas-equipped 704th Strategic Missile Wing (Training), became active at Cooke (later Vandenberg) Air Force Base in California as the newest member of the SAC family.[4]

With his ARDC experience, neither space nor ballistic missiles were unfamiliar to Power. But when Power took command, integrating ballistic missiles into SAC became a much higher priority than space issues. Power has been criticized by historians for his lukewarm attitude toward ICBMs, but this charge is overstated. Power was not an uncritical enthusiast of ICBMs. In 1956 he stated what remained his position on the ICBM: "There is no doubt that our operational missiles are effective weapons and that the missiles now under development hold much promise. . . . But no matter how ingenious, how complex, and how advanced their guidance mechanisms, guided missiles cannot cope with contingencies which have not been previously keyed into them. Only the human brain can make important decisions quickly in unexpected situations."[5]

Given the importance of the ICBM, however, Power worked to explain exactly what he saw as the role of the ICBM in SAC. Power described the SAC mission in many speeches and articles as "'to be prepared to conduct strategic air operations on a global basis so that, in the event of sudden aggression, SAC could immediately mount simultaneous nuclear attacks designed to destroy the vital elements of the aggressor's war-making capacity to the extent that he would no longer have the will or ability to wage war'."[6] Where the ICBM could help in this mission, the ICBM belonged. Power's rationale for exploring the role of the ICBM also sheds much light on his thinking about potential space weapons as explored in the SR studies, but the first space weapon Power had to confront seriously was the ICBM.

In 1958, Power argued, in order "to maintain its deterrent strength indefinitely and at a convincing level, SAC must always have, first, an adequate quantity of weapon systems that reflect the latest advances in technology, and second, a global and centrally controlled organization flexible enough to be readily adaptable to any new weapon system or technique, no matter how revolutionary. "[7] All of SAC's weapons were intended to "serve but one purpose: the *strategic employment* of the most advanced weapon systems in the most effective manner."[8] Therefore, Power concluded that missiles would "supplement and complement rather than replace the manned bomber" because the "coordinated employment of both will give us an invaluable flexibility in the choice of weapon systems best suited for each strategic mission."[9]

In his contribution to *The United States Air Force Report on the Ballistic Missile*, published in 1958, Power said as "with every other

new weapon system, SAC must make optimum use of current missile capabilities by exploiting their favorable characteristics and minimizing their deficiencies."[10] Ballistic missiles had great range, very high speed, and a quick-reaction capability that made the ICBM invaluable to SAC. Power noted, however, they were not perfect. "Operational limitations and problems affecting the employment of ballistic missiles in their present state of development pertain primarily to accuracy, reliability, limited payload, maintainability, and lack of operational experience."

ICBMs had a fixed flight trajectory which made them potentially vulnerable to anti-ballistic missile (ABM) weapons. ICBMs could also not be recalled once fired. Furthermore, they could neither be re-targeted in flight, nor alter their flight path if their initial target-position information proved to be inaccurate. Power also argued, no "matter how ingenious, the missile's 'brain' has no reasoning power to deal with unexpected situations but can only follow the instructions given it prior to launch. Furthermore there is at present no positive and direct method of ascertaining whether and to what extent it followed these instructions." ICBMs were, in short, inflexible. "To cope with these problems, Power concluded, it is important to assign missiles only to those missions which are within their capability at the prevailing stage of development."[11] To him, it all condensed to an operational flexibility that required both manned bombers and ICBMs. "Just as the transition from propeller-driven to all-jet aircraft was a gradual one, so the transition from an all-bomber to a mixed bomber-missile force must be orderly and carefully programed. To achieve the maximum benefit for this combination, every effort must be made to reflect the latest technological advances in all operational weapon systems, both manned and unmanned."[12]

Power was concerned by the "space-conscious public's" tendency to regard the ballistic missile as "the ultimate weapon." He offered five reasons why there would probably never be an "ultimate strategic weapon." First, he argued complex weapon systems took long times to develop—enough time for an adversary to develop a defensive counter. Second, he believed monopolizing highly advanced weapons was no longer possible for "any appreciable length of time," and used America's loss of the nuclear monopoly as a case in point. Third, revolutionary weapons or techniques would "have little bearing on relative technological strengths" among belligerents, and would not bring arms races to an end since all sides would keep searching

for a "still more potent weapon."[13] Fourth, Power asserted that strategic operations "entail a number of highly specialized missions that can best, or perhaps exclusively, be accomplished by a variety of specialized weapons or combination of weapons." Finally, he believed any "tool fashioned by the mind and hand of man has weaknesses and limitations."[14]

In sum, Power did not think of the ICBM as an ultimate weapon because he did not believe in ultimate weapons. The ICBM's role in SAC would be commensurate with its advantages and disadvantages as a weapon system. Power applied this rule to every weapon system, be it an ICBM, a space weapon, or a bomber. Power was not biased against missiles or spacecraft as he attempted to integrate both into SAC. However, integrating missiles was his first priority.

Power did not escape space concerns for long. On 4 October 1957 the Soviets launched Sputnik, and the nation heard the first few beeps from the communist technological marvel that floated over their heads in the cold fall night, the race for space became real in the American imagination. Power's reaction to Sputnik was much less serious than his dismay at the public's dire assessment of the event. In his book *Design for Survival*, he wrote, "many of our citizens not only acted as if Sputnik had made this country virtually defenseless overnight but also created the impression that our own missile and rocket program was a complete failure." Power knew that Sputnik had not invalidated America's military strength or SAC's deterrent in the least.[15] Still, Power lamented the defeatist public reaction.

On 9 November 1957 in a memorandum to the members of the newly created SAC Alert Force, Power laid out his vision for SAC in the post-Sputnik era. He wrote that the Alert Force was "contributing to an operation which is of the utmost importance to the security and welfare of this nation and its allies in the free world."[16] The men of the Alert Force were kept away from their family for days and weeks at a time, often working 70 or more hours a week. Power appreciated their commitment and explained why the pace was necessary. "We no longer have a monopoly on nuclear weapons and long-range bombers. Many of the rapid advances in military technology which are reflected in our weapon systems are also utilized by the Soviets, permitting them to attack us with greater speed, firepower, and accuracy. Our own strike forces are no longer immune to destruction before they can be launched, and continuous improvements in the Soviet's aerial defenses make successful counterattacks more difficult."[17]

Power was confident SAC would prevail against these new problems "because SAC is not based on any particular weapon system but on an organization of experienced men like [those in the Alert Force] flexible enough to be readily adaptable to any new weapon system or technique, no matter how revolutionary." The Alert Force was on duty because the new missile age enhanced the importance of what Power called Tactical Warning, that there was "so little advance warning of an impending attack that the commander must fight from his present position and configuration." SAC would win a war even if forced to "fight tonight," because the present position and configuration of the SAC Alert Force would be enough to overwhelm the Soviet Union.[18]

Power's memorandum brought into relief that his first priority at SAC was not to advance his space vision, but to stare down the Soviet Union in the Cold War contest of nuclear deterrence. Power was first and foremost an operational commander in arguably the most important position in the American military establishment. This fact does not diminish Power's role as a space visionary, but rather enhances it. Even with one of the most demanding positions in the world, Power still became the Air Force's most vociferous advocate of Air Force manned spaceflight.

Power was among the first senior Air Force officers to develop a specific policy response to the space challenge. In a 13 August 1958 letter to Air Force Chief of Staff General Thomas D. White, Power outlined his "Strategic Air Command Space Policy." In it, he wrote: "During the past year, public recognition that we are standing on the threshold of the space age has been amply demonstrated. Broad national policy on space exploration, and the organizational structure to carry out this policy, have been established by both executive direction and recently enacted congressional legislation. As an operational command that will translate basic national and Air Force space policies and programs into concrete military capabilities it is deemed appropriate to state Strategic Air Command policies for the development and integration of future spacial [sic] weapon systems."[19]

Power then outlined three basic objectives of the American space program as viewed by SAC. The first objective was "Prestige through Leadership." In the Cold War, Power saw space as a race for technical and scientific leadership. "The prestige that accrues from leadership in space exploration will immeasurably strengthen the position of the

Free World," Power proclaimed, and "the conquest of this vast new [space] frontier provides us the channel for unlimited U.S. initiative."

Power's second SAC objective stressed space as a new medium for the "Instruments of National Power," and he argued it was America's military policy to apply the instruments of national power "through application or potential application to the enemy heartland—the source of hostile power." Through this effort, Power believed SAC was justified in seeking space-based deterrence weapons, or, as he put it, "the development of operational weapons systems to expand the air power of today into the space power of tomorrow." Power suggested SAC's first role for military space would be reconnaissance, but its critical role must be to evolve true space weapons systems for nuclear deterrence. "The fulfillment of this future potential will be determined by our degree of positive military thinking," he pleaded. "We must not, in the fashion of decadent nations, permit our gross potential to be bled off into purely defensive weapons, weapons that will neither further our advance into space nor achieve any significant capability until just too late to be of any real military worth. As we enter the space era the primacy of the offensive has never been more clearly defined."[20]

The last objective Power identified was the "Economic – Commercial" potential of space. He declared somewhere "beyond the next decade the contribution of our national space program will be the improved well being of all peoples." Noting the high cost of space operations, Power was sure those costs would rapidly decline in the future. He was confident in America's space future, and boldly pronounced "technological progress will provide the basis for astronautics to contribute to civilization in the next century as significantly as aeronautics has in the twentieth century." To reach these objectives, Power believed scientific and military space efforts had to remain integrated in a directed long-range national program to conquer space. Accordingly, SAC argued space should be funded at a national level, not simply from the Air Force budget. From start to finish, two firm conclusions underwrote Power's entire policy statement: that man's presence in space was essential and that the future of deterrence would be in space.[21]

To support this SAC space policy, the command planned to argue for its space program aggressively as essential for the nation's future security. It would also endorse "funding of research and development of these systems on a national basis," so as to de-conflict the high cost

of fielding offensive space weapons from SAC's current "force-in-being" requirements. The command would also "emphasize constantly the positive contributions of offensive weapons systems" to scientific and national leaders with "control of direction and the power of decision." Finally, SAC would "identify the mandatory presence of man in the space environment before significant fulfillment of either military or economic potentials can be enjoyed."[22]

However revolutionary his goals, Power advocated an evolutionary plan to achieve manned strategic spacecraft. In a public address shortly after penning his classified space policy entitled "Strategic Aspects of Space Operations," Power explained the actions the command would take. Observing that military astronautics was in roughly the same level as military aeronautics in the day of the 1800's hot air balloon, Power nevertheless believed the ballistic missile would be able to compress the time to move conventional firepower to a military target from the hours it would take jet bombers to mere minutes. [23] Speculating on the future, Power offered that a "manned missile" may compress firepower time even further. Power opined the "forerunner of such a missile could well be the B-70 'chemical' bomber [noted in Chapter 2]" which was "presently under development as a successor to the most advanced bomber in SAC's present inventory, the B-52." Or it could be, Power offered, the Dyna-Soar space plane (studied under SR 126 and others in the SR series) which was projected to exceed the performance of even ICBMs. "Indeed", General Power maintained, "such a vehicle would represent the first true manned strategic spacecraft."[24] Power's search for a manned strategic spacecraft would be an important part of his space vision.

The importance of the 1958 SAC Space Policy cannot be overstated as it relates to understanding Power's future actions as SAC commander regarding space. Nor had any previous statement been more pregnant with insight into the pitfalls and promises of the space age. Power quickly grasped America's immediate concern in space was to earn prestige over Communist powers. His conception of space prompted Gen Thomas White's aerospace concept, which the Chief of Staff coined mere months later. And, perhaps most fundamentally, Power's conviction that military space programs must further the general American advance into space to exploit fully the space medium infused much of what would follow in the space age. Compared to General White's aerospace speeches, General Power's SAC space policy is clearly more ambitious and visionary. This document

strongly suggests that Power, not White, was the true aerospace visionary.

However visionary, no Air Force space research program identified in the Study Requirement efforts offered anything remotely like the manned, maneuverable, offensive space weapons system that could serve as the ultimate mobile and dispersed deterrent system that could also be the vehicle for America to conquer space both militarily and economically. This deficiency in Power's thinking disappeared immediately after he received a briefing from ARDC's Air Force Special Weapons Center in September 1959 regarding a research program unassumingly named "Putt-Putt."[25]

Project "Putt-Putt" was the Air Force designation for the Advanced Research Projects Agency (ARPA) program to study a nuclear pulse rocket, originally named Project Orion. Conceived by Manhattan Project alumni Stanislaw Ulam and Fred Reines in 1947, the nuclear pulse rocket was based on using many small nuclear explosions to propel gigantic spacecraft fitted with a pusher plate into orbit—a technological marvel that would provide greater than an order-of-magnitude more power and efficiency than the largest chemical rockets, thus opening up vast new applications for space operations.[26] Ulam's original idea was taken up in 1957 shortly after the Sputnik surprise by legendary nuclear weapons designer Theodore "Ted" Taylor, who designed the 500-kiloton Ivy King shot super oralloy bomb, the largest fission device ever tested. Under contract to ARPA via General Atomics, Taylor built an impressive team of scientists and engineers, including the famous physicist Freeman Dyson, to study the feasibility of the nuclear pulse rocket.

The largest chemical rocket, the Apollo Program's Saturn V, could lift 155 tons of payload to low Earth orbit (LEO) and 54 tons to trans-lunar injection and had a specific impulse that ranged from 263-421 seconds. In contrast, by 1959 Project Orion engineers estimated that an 880-ton prototype Orion test vehicle would be able to achieve a specific impulse of 3,000 to 6,000 seconds and land 170 tons on the moon, or land 80 tons on the moon and then fly it back to Earth. Larger, interplanetary Orion craft ranging from 4,000 to 10,000 tons could achieve specific impulses of 12,000 seconds and land 1,300 tons of payload on a moon of Saturn and return to Earth.[27] The cost of these performance numbers would be about 800 atmospheric explosions of nuclear fission explosives per launch, ranging in yield from 3

tons to 0.35 kilotons (kT) at sea level tapering to 0.5 kT to 15 kT in space, with a cumulative total yield of 20-250kt to 125,000 ft and 9 megatons (MT) to completely deploy to a 300 nm circular orbit.[28] Further refinement of the Orion concept would yield higher payloads and efficiencies, as well as lower necessary yields and cleaner modes of operation. Orion represented a quantum leap in space launch technology, and to this day is the most powerful space propulsion system yet designed. Aerospace historian Scott Lowther said the 10,000-ton Advanced Interplanetary Ship design "could have truly been the Starship Enterprise of the late 20th century."[29]

The Air Force became involved in Orion research almost immediately. While civilians engineered the craft itself, the officers of the Air Force Special Weapons Center were directed to determine the military potential of Orion and develop a concept of operations (CONOPS) for Orion spacecraft. The task of forming an initial Orion CONOPS fell to a young Air Force atomic weapons officer, Capt Donald M. Mixson.

In July 1959 in *Military Implications of the Orion Vehicle*, Mixson argued that the Air Force needed the virtually unlimited payload and propulsion capabilities that Orion provided, which no Schriever-inspired system could match, to field a game-changing weapon system—a manned, spaceborne strategic deterrent platform.[30] Mixson reasoned that a "strategic space force" comprised of twelve to fifty Orion spacecraft could remove America's deterrence force from the homeland itself, making a Soviet strike on American population centers militarily unnecessary.[31] Because of Orion, Mixson wrote, for "the first time in this decade, it is at least conceivable that the majority of our people will not die if our policies fail."[32]

Beyond that, Mixson argued, Orion could move the base of SAC strategic operations from the continental United States, eliminating any incentive for an enemy to strike the homeland for military reasons; provide a strategic retaliatory force that was invulnerable to attack; and provide a continental defense against any irrational "mad dog" attacks. A military force comprised of nuclear pulse propulsion (NPP) Orion spacecraft thus promised many dividends.[33]

On 17 September 1959 Mixson traveled from New Mexico to Offutt Air Force Base in Omaha, Nebraska, to brief Project Orion to SAC leaders, including Power.[34] No records of the meeting have been found, but on 21 January 1961 General Power issued a SAC Qualitative Operational Requirement (QOR) for a "Strategic Earth Orbital

Base." In the only SAC space-requirement letter he signed personally, Power explained, the "objective of the QOR is to define a Strategic Air Command requirement for a strategic earth orbital platform capable of sustaining extremely heavy, composite payloads from low orbite [sic] to lunar distances and beyond." Only an Orion-like spacecraft could meet the payload requirements for such a base.[35]

With such a capability, Power sought to develop a strategic space force. He envisioned a "number of vehicles in various orbital planes at progressively distant orbital altitudes" to "provide integrated facilities for unlimited surveillance, depth of force, secure command and control, and a high probability of delivering weapons to any terrestrial target. Any system, Power stressed, must be "capable of accurate weapon delivery, with a variety of weapons. Growth potential should include the capability to attack other aerospace vehicles or bodies in the solar system occupied by an enemy."[36]

Mixson's mark on the Strategic Earth Orbital Base QOR is unmistakable. In this QOR, Power stated SAC needed the capability that NPP provided to perform the mission that Mixson described in his strategic space force concept. It is interesting that this QOR described a base rather than a ship, but with its emphasis on maneuverability, it is likely the vehicle was described as a base to match the contemporary public desire of the Air Force to develop a manned space station. In 1960, Power was arguably the third most powerful general in the Air Force, behind only the Chief of Staff and the Vice Chief of Staff, and he wanted Orion so much that he put his name to a requirements document asking for nuclear pulse propulsion vehicles that only Project Orion could provide.

Between Mixson's briefing to SAC leaders and SAC's issue of the Strategic Earth Orbital Base QOR, Power wrote in *Air Force Magazine* an update simply titles "Strategic Air Command." Here, he argued that the "past year has witnessed continued and significant improvements all along the line which have added greatly to SAC's fighting capability and, hence, its deterrent strength."[37] As he stated in the 1958 SAC Space Policy, Power insisted that "to achieve and maintain such supremacy for the sake of a lasting and honorable peace will demand an all-out cooperative effort which will have to draw upon all the economic, technological, and military assets at our command." Finally, echoing Mixson, Power declared, "In the event of need, SAC can be expected to contribute its share to this effort by putting into space strategic weapon systems designed to provide as convincing a

deterrent to aggression as we have had in the past. To attain this goal, we may think in terms of strategic satellites, or, even, perhaps, of manned spacecraft which would orbit the earth in a continuous space alert."[38]

Power's conversion to an Orion believer coincided with one of the Air Force's most enthusiastic attempts to express its vision for the national space program and the Air Force's role in it. In reaction to many Soviet firsts in space, especially Yuri Gagarin's space flight in 12 April 1961, the Air Force believed that perceived public weakness in the American national space program created a growth opportunity for space development. Consequently, the Air Force updated its Space Plan of 1961. The plan identified the Air Force's two primary space missions as to "enhance the general military posture of the United States through military use of space" and to "provide a military patrol capability within the space region." Ultimately, the Air Force planned to develop the capabilities that could deny to any hostile power "the uninhibited military exploitation of space, and to provide a system of protection for U.S. scientific activities in space."[39] The details and funding requirements of how the Space Plan would accomplish that mission was to be developed in the five-year 1962 Air Force Space Program for Fiscal Year 1963–1967, which became the high-water mark for Project Orion.

The 1962 Air Force Space Program began as a Space Technical Objectives Group study by Air Force Systems Command's Space Studies Division (SSD) on 14 April 1962 to "formulate long-range space program requirements centered around technical objectives."[40] After spending two months analyzing a dozen space research areas, including propulsion, launch, weapons, and others, the SSD delivered its analysis to the DOD, which suggested the Air Force develop a five-year space program for DOD consideration. This led to the creation of a "Space Executive Committee" under Lt Gen James Ferguson, the Deputy Chief of Staff for Research and Development.[41] Rather than focus on technical requirements, the committee focused on operational matters. Fundamental to the committee was a "requirements panel" staffed by colonels and general officers who explored space's potential impact on strategic, reconnaissance, defense, command and control, and support capabilities.[42] Ferguson's task force was specifically influenced by the Air Force's operational commands, including SAC.[43]

SSD's first proposal to Air Force Systems Command (AFSC) arrived in early September 1962. In it, SSD's members requested funding for sixteen different programs: Dyna-Soar; Blue Gemini, a military version of the NASA Gemini capsule; an Aerospace Plane meant to fly into space and back as easily as an airplane; the Military Orbital Development System, an early manned space station; and various other satellites and propulsion technologies. Power made his requirements known. Two of these programs were specific to Orion NPP: funding for "Orion" as a propulsion system and funding for the "Strategic Earth Orbital Base" (SEOB). The first proposal was for almost $10 billion in Air Force space funding over five years. The first SSD draft dedicated 6.7 percent of the proposed budget to total Orion funding. Of the $9,768 million total budget of the first proposal, $21 million was slated to develop the SEOB and $635 million for Orion propulsion development.[44] After its receipt, the Executive Committee considered the draft and sent a slightly modified proposal to the Air Staff. Theirs would be the first of many revisions to the 1962 program.

The proposal was vetted among various staffs and committees from 10 to 18 September as military hawks and budget hawks took turns gutting and refunding their favorite programs. Total space budgets ranged from $6.9 billion to $10 billion, with Orion funding wildly swinging between $25 million to $1.2 billion.[45] Chief Scientist of the Air Force Launor Carter, a member of the committee, reported most of the civilians on the committees felt many programs the Air Force was advocating were beyond the state of the art and "it was their unanimous opinion that the program was much too ambitious, was in many ways technically unfeasible, and could not be sold to DDR&E (Director of Defense Research and Engineering)."[46] The argument over "state-of-the-art" is important. Project Orion was by far the most technically aggressive program and provided a space capability far in excess of any other proposed technology, so it's reasonable to assume that others balked at Orion. However ambitious, though, the Project Orion team never found any reason to believe nuclear pulse propulsion was technically infeasible, and many also believed it to be highly economical. It is probable that civilian scientists were conditioned to believe that pounds—not tons—to orbit was the best the "state-of-the-art" could offer and considered Orion infeasible due to its potential and not its technical merit.

LeMay, now Air Force Chief of Staff, tried to break the impasse by siding with Power and SAC. The Chief sent his approved plan to

Secretary of the Air Force Eugene Zuckert on 1 November 1962. The total budget was $7,936 million, with SEOB receiving $722 million and Orion receiving $638 million, meaning Orion received 18 percent of the proposed funding.[47] LeMay was, of course, very close to Power; and both were dedicated to the mission and future of SAC. But LeMay's support for developing Orion seems to be a change from his earlier stance on the project, in which he considered it a "premature" technology.[48]

Zuckert took LeMay's budget proposal and sent his own to the Department of Defense on 22 September 1962. Zuckert's total budget was $2,852 million, with nothing budgeted for either Orion-derived projects.[49] In denying funding, Zuckert was undoubtedly influenced by Defense Secretary Robert S. McNamara's and the DOD's general mistrust of the Air Force's space ambitions. McNamara did not believe space operations could provide the revolutionary military advantages Power perceived. McNamara testified to the Senate Armed Services Committee on 11 September 1963 that the "prospect that remarkable new weapons can provide a sudden change in the margin of superiority is not, in my judgment, likely."[50] McNamara, for all practical purposes, ignored LeMay's plan.[51] It is interesting to note that, of the sixteen original programs and the six that the Air Force ultimately requested funding for only one—Midas—was ever fielded. Midas was the precursor to the successful Defense Support Program missile warning satellites that provided world-wide missile-launch warning, but it was far removed from the types of space power General Power envisioned.

Power did not accept Orion's loss lying down. He undoubtedly knew quickly about Secretary Zuckert's refusal to ask for Orion funding from OSD, but he also knew that Zuckert was not the major obstacle.[52] The Director of Defense Research and Engineering (DDR&E), Harold Brown, was the face of the McNamara DOD research and development effort and held the real power to get Orion funded. In a 3 November 1962 letter to Brown, Power argued the "capability to launch and maneuver truly large payloads [in space] could provide the operational flexibility which has always been the key to effective military posture. Unilateral ORION capability gained by either ourselves or the Soviets could be a decisive factor in achieving scientific and commercial, as well as military supremacy. . . . I understand you have recommended disapproval. I believe these [ORION] experiments should proceed without delay."[53]

This letter encapsulates why Power and the Air Force wanted Orion. Project Orion offered operational flexibility, i.e. high payload and maneuverability potential, in space akin to the flexibility that Power's bombers had in the air. Orion allowed for military flexibility in space, while more conventional programs did not. A few days later, Brown responded to Power's letter, retorting that the "development program would be a very high risk one. . . . If we accept the possibility that military operations will require large maneuverable payloads in space, it is still far from clear that substantial investment in ORION is warranted now. . . . Very large chemical boosters are under development. . . . They could launch other large military payloads, if required."[54]

Brown's letter reveals a significantly different attitude from Power's. Rather than seeking capability, as Power did, Brown was focused on risk. Brown, and the rest of McNamara's budget-conscious DOD, saw Orion and other ambitious programs as high-risk, high-cost gambles. They were less moved by the potential of Orion's "high-payoff" military capability should the program succeed. It is worthy of note that Brown mentioned large chemical boosters as potential substitutes for Orion, which he almost certainly knew had far less capability than NPP. This was an argument that Wheless had anticipated and rejected months earlier.[55] Power thought the sheer capability Orion offered in space was worth the risk. Brown did not.

Perhaps Orion nuclear pulse propulsion was impossible to operationalize with 1960's technology, and Brown and the McNamara DOD were correct in rejecting the 1962 Air Force Space Program. Perhaps LeMay and Power pushed too hard for pie-in-the-sky technology. Nevertheless, the decision to reject Orion seems to have been based on the assumption that the capability Orion represented was unnecessary even if it worked. Therefore, two different potential flaws can be identified in the reasoned foundations of both positions: Power may have over-emphasized capability and downplayed risk, or Brown may have over-emphasized risk and downplayed capability. In either case, the most ambitious attempt by the Air Force to realize Power's space vision was blocked by Brown and McNamara. LeMay's rejected space program was Orion's high-water mark. But, Tommy Power would not stop fighting, nor would he soon forget OSD's refusal to abet what he saw as the Air Force's destiny in space.

Orion may not have been made a flagship program, but it did nonetheless continue. Shortly after Brown's decision not to fund it, Power wrote to LeMay and Schriever on 20 February 1962 to outline

his reasons for supporting Orion. "Space is now just opening up an entirely new arena where nations will eventually develop new weapons as they have done for the land, sea, and air. We must plan today for the Space Power of tomorrow. *Unfortunately, there is not today any single space program designed to provide this nation with the foundation of a predominant military space superiority.*"[56] Power wanted Orion because its performance "cannot be met by any other known program or propulsion concept." Additionally, he claimed that "during the post 1970 time period it may be necessary for the United States to fight its way into space against a previously deployed enemy to prevent space being permanently denied to us. Under these conditions it would be imperative to enter space with a vehicle immediately capable of conduction offensive/defensive operations in a sustained conflict. The Orion project offers such a capability." For these reasons, Power maintained, Orion was "essential to the future welfare of the nation and urge that it be pursued with the utmost vigor consistent with the technical state-of-the-art. Such a breakthrough in the art of propulsion will produce revolutionary improvements in the science of warfare."[57]

Power mentioned Orion publicly in a speech to the Union League of New York on 10 April 1962, explaining why such a capability was essential for SAC. "*There is as yet no manned space system under development that would meet SAC's future needs*" to maintain "mastery in space."[58] Power believed achieving this mastery required "intensive and coordinated efforts in many areas*, including the development of radically new power plants—possibly of the nuclear pulse type—and perhaps of revolutionary new weapons.* The most critical element, however, will be time. Whoever will assert his place in space first, will be its master, and we simply cannot afford to lose the race for mastery of space."[59] Power was convinced Orion could achieve space mastery for America, but since OSD withdrew from the race, time was no longer on America's side.

Unfortunately, Power's enthusiastic support may have inadvertently hurt Orion as he struggled to keep it alive after the 1962 Air Force Space Program effort. Ted Taylor, the General Atomic chief of Project Orion, believed that those "big briefings by SAC with a hundred slides of variations, themes, and more variations on the theme 'whoever develops Orion will rule the world' had a very negative effect on a lot of people, and I think that had a lot to do with it being easy to kill."[60] Fred Gorschboth, a friend and fellow captain with Mixson at

the Special Weapons Center, who later wrote a book developing the Orion concept as a military vehicle, believed that scientist Freeman Dyson turned against Orion immediately after the team approached SAC.[61] There is some evidence to indicate Dyson might have been against SAC's involvement. Dyson had served in Royal Air Force Bomber Command during World War II and reportedly did not like the organization or its leader Arthur Harris.[62] It seems plausible that Dyson saw much of "Butcher" Harris in "Tough Tommy" Power, and that might have dampened Dyson's enthusiasm for the project. Even Mixson, who wrote the critical *Military Implications* document and developed the Strategic Space Force concept, came to regret the consequences of taking Orion to SAC. After Freeman Dyson's book *Disturbing the Universe* brought Mixson's paper to light in 1979, Mixson responded to Dyson that "[*Military Implications*] was written not to make Orion a military machine, but to con a military machine into yet another installment of funds to keep your big beautiful dream alive. You see, I shared the same dream and it was the only reason I was in the Air Force. NASA did not exist."[63] Whether these are after-the-fact laments or accurate reflections of contemporary sentiment, Orion was scuttled, and Power's over-aggressiveness in selling the idea may have been partially to blame.

One legendary event in the history of Project Orion involved a meeting at Vandenberg Air Force Base on 23 March 1962 when Power and some Project Orion staff presented a large model of an Orion vessel "bristling with bombs" to President Kennedy and his entourage, which included Brown. This model was "Corvette sized" and cost $75,000 to produce according to Dan Weiss, the designated test pilot of Project Orion at General Atomic. [64] By most accounts the sheer scale of Orion appeared to leave President Kennedy questioning the sanity of the project, and it certainly did not win his support. Weiss recalled, "We were looking at the scale model—and this was when Kennedy was there—just simply discussing how powerful it could be. . . . And I said, 'Well, it would take out every Russian city over the population of 200,000 if we wanted to build the next larger model. We'd have enough weapons to do that.'" [65] According to Taylor, Kennedy "was absolutely appalled that that was going on, had no use for it."[66] Brown recalled that Kennedy "was obviously appalled, and amused, too."[67] The model disappeared shortly thereafter. Aerospace historian Scott Lowther quipped of this meeting, "When the President of the United States thinks what you are working on is an evil mon-

strosity, your chance of further funding may tend to decrease."[68] Power's enthusiasm for the vehicle as a machine of war rather than a machine of exploration may have poisoned the social construction of Orion as a technology in Kennedy's view, helping doom the project despite the best of Power's intentions.

Power argued for Orion as much as he could, but his retirement in 1964 brought large-scale support to Project Orion in the Air Force to a close. Dyna Soar and Orion both had prominent sections in official SAC annual histories between 1961 and 1964. But this, too, ended in 1965, at the end of Power's tenure. Like the B-70 before them, neither program would fly. Dyna Soar, however, would be remembered. Orion was promptly forgotten. It appears the Air Force attempted to bury or ignore Project Orion in its official histories. For all intents and purposes, Orion disappeared from the highest levels of the Air Force and DOD discussion. Orion's high-water mark had been reached, and slowly subsided until Orion entirely disappeared from the Air Force's collective memory.

In retrospect, Power's greatest contribution to Air Force space power was to clearly communicate an operational definition of what superior space power looked like. For him, it was a weapon that could propel thousands of tons into orbit in a single launch, maneuver in space as easily as an airplane in the air, carry truly substantial payloads and conduct a wide array of military missions, and could send a payload anywhere in the solar system. Power did not need the weapon to have a nuclear pulse propulsion system like Orion, but he did need the performance that only an Orion NPP system might have provided. Schriever, alternatively, did not care to push beyond the boundaries of chemical rocket propulsion, a limitation that still hampers space efforts today. The Air Force of today would be infinitely more capable in space had it decided to follow Power's, rather than Schriever's, vision.

Power retired from the Air Force on 30 November 1964, after 36 years of service. As SAC commander for over seven years, his tenure was exceeded only by that of LeMay. During his time, Power "polished the command" that LeMay had built.[69] Power had perfected the Alert Force, deployed the airborne command post, enhanced SAC's reconnaissance capabilities, and managed SAC's transition from a bomber force to a mixed aerospace force of bombers and missiles. He fielded three new bombers and three new ICBM's, as well as a whole new command and control system. He created and matured the Joint

Strategic Targeting and Planning Staff.[70] He oversaw SAC during the Cuban Missile Crisis, arguably SAC's finest hour next to the end of the Cold War. "General Power had honed SAC into a multi-faceted combat organization capable of going to war at a moment's notice."[71] Fortunately, SAC never had to fight using nuclear weapons. However, General Power's vision of SAC as a true aerospace force capable of defending the free world while also conquering space remained unfulfilled.

Power would not stop defending the country simply because he had hung up his uniform. Mr. Power was now a private citizen, and the defense establishment could no longer muzzle him as it did while he was SAC commander. Now, Power could take his message directly to the American people. As he mustered for battle, the wheels of the Defense Department and the Air Force machines kept on going with a momentum that might not be easily stopped. The Cold War was not yet over, so the coldest warrior sallied forth in his new position as civilian.

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48. Gen Curtis E. LeMay, Vice Chief of Staff, to Gen Thomas S. Power, commander, Strategic Air Command, 16 July 1962. Document is now declassified.

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50. Statement of Secretary of Defense Robert S. McNamara to Senate Armed Services Committee 19 February 1963. From Current Views of the Secretary of Defense. Draft staff summary, 11 September 1963. Air Force Historical Research Agency TS-AFSHRC-80-75. (Top Secret). Information extracted declassified 6 August 2014.

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52. Zuckert's personal belief was that civilian defense officials should support the operational requirements of military officers and resented the McNamara DOD's harsh treatment of the Air Force in acquisition descriptions. Zuckert appealed to the DOD on Orion's behalf many times between 1962 and 1965 for additional funding was considered by Project Orion staff as a staunch supporter.

For more details on Zuckert's time as Air Force Secretary, see George M. Watson, Jr. *The Office of the Secretary of the Air Force 1964–1965* (Washington, DC: Center for Air Force History, 1993), 205–44.

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Chapter 6

The Gelded Age
United States Air Force 1965–2015

On 1 December 1964 Power woke up as a civilian. But his war was not over. The Soviet threat still existed, and Power knew where and how he would continue the fight. First, however, he built his civilian life. Originally intending to retire to the Florida Gulf Coast, Tommy and Mae instead chose to build a home in the Thunderbird Country Club at Palm Springs, California. During his years in Omaha, friends kept telling Power about how beautiful the deserts of California were. In 1959, Power drove through the high desert en route to La Jolla, California, to see what they were talking about. "I liked it the minute I saw it," he recalled. "I've been all over the world, and there's just no place like this."[1] He and Mae began visiting Palm Springs in their few free periods of leave and sold their lot in Florida to purchase one in Palm Springs. The new Power home was a cozy, modest "off-white house of simple lines and a charcoal roof, with a swimming pool and a magnificent view" with access to plenty of golf.[2]

Power's first phase of his new efforts as a civilian was to release his book *Design for Survival*. Reviewer James D. Atkinson wrote in *Military Affairs* that with *Design for Survival* Power had penned "one of the most significant books in the field of national security affairs of this decade. Writing with all the authority of his distinguished career" Power discussed "in concise and cogent fashion the principal problems relating to our defense posture."[3] Alternatively, Ronald Steel in the *New York Review of Books* called the book "part Air Force brochure, part lecture on why you can never trust a Communist, part critique of current defense policy." To him, Power had offered "carping laymen just a hint of what Secretary McNamara and his civilian helpers must be up against . . . [Power] has chosen to treat us to his quaint views on foreign policy and explain how SAC can do everything—except wrong." Steel believed Power had "made us once again agree with Clemenceau that war is, after all, too serious a matter to be left to generals."[4] Perhaps the most knowledgeable of the era's defense correspondents, Hanson Baldwin, of the *New York Times,* wrote that "those who seek the sensational here will not find it in these pages; *Design for Survival* is the pragmatic philosophy of the realist."[5]

Despite the diversity of its reviews, *Design for Survival* became a national bestseller. It debuted on the *New York Times* Bestseller List (Nonfiction) on 18 April 1965 at number 10. For five weeks it was in the top 10, reaching its highest point at number six the week of 9 May.[6] Power engaged in a long stretch of speaking and television engagements in which he discussed his views on deterrence and the Cold War. In 1968, *Design for Survival* was released in comic book form in an early example of a graphic novel.[7] Power was working hard and succeeding in becoming a leading personality in the public discourse on defense issues.

Power's civilian efforts aimed at the Sino-Soviet bloc came to an abrupt and tragic end when on 6 December 1970 he suffered a fatal heart attack while playing golf in Palm Springs near his home. His end was sudden and unexpected. Mae Power buried her husband at Arlington National Cemetery with full military honors a few days later.

Air Force Magazine's obituary stated Power was "known as a spit-and-polish commander in the traditional ramrod straight manner" and noted his roles in World War II, the development of missiles, and his efforts to strengthen SAC. "Before retirement in 1964, he was to see SAC become the most powerful military force in history."[8] And that was it. Gen Thomas Power, who had risen from high school dropout to four-star general, who had helped shape some of the most iconic missions of American airpower, who had flown everything from the earliest biplanes to the fastest supersonic bombers, and who ended his career as commander-in-chief of the vaunted Strategic Air Command, was gone. It did not take long for the Air Force and the American people to forget him. Power's death, however, is far more significant than the neglect afforded him by historians. With the end of Power's career had come the Air Force's gelded age.

The United States Air Force culturally faced a crossroads when Power relinquished command of SAC in November 1964: it could conquer space by pursuing Power's strategic deterrence vision, or it could turn to the tactical mud of Vietnam. Power vehemently blocked SAC's combat involvement in Vietnam.[9] When the Air Staff approached him to use SAC B-52s there, Power retorted "Don't talk to me about that; that's not our life. That's not our business. We don't want to get in the business of dropping any conventional bombs. We are in the nuclear business, and we want to stay there."[10] But General Power's

successor at SAC, Gen John Dale Ryan, soon committed SAC bombers to the slugfest in Southeast Asia.[11]

Col Mike Worden, a fighter pilot, refers to Vietnam, which lasted from 1965 to 1972, as the "Vindication of Airpower and the Rise of the Fighter Community."[12] In Worden's telling, the crucible of Vietnam ended the reign of the bomber "absolutists" in the Air Force, with Power the most absolute of the absolutists. He referred to those men who had focused myopically on Douhet's strategic bombing and nuclear retaliation, and ushered instead the era of the fighter "pragmatists" who were better educated and understood the more nuanced policies of their civilian masters in the McNamara Defense Department. In Worden's narrative, Tactical Air Command was in, Strategic Air Command was out; and the fighter generals led the service to airpower's great Desert Storm victory in 1991.

An alternative explanation of the Air Force's experience in the half century between 1965 and 2015 is that it may be considered the service's gelded age. To geld is to "take strength, vitality, or power from; weaken or subdue" an object.[13] The term gelded age evokes memory of the Gilded Age, Mark Twain's description of the period from the early 1870's to 1900 that satirized an era beset by serious social problems masked by rapid economic growth and other superficial signs of progress, much as a thin gold gilding might add a glimmering shine of value to a cheap tin serving bowl.[14]

In the gelded age construct, the airpower vision of Douhet, Mitchell, and the Air Corps Tactical School came to full fruition in LeMay's Strategic Air Command. There, airpower kept the nuclear peace by ensuring the United States could not be attacked without the aggressor suffering assured destruction of its vital centers through overwhelming nuclear attack. The successor of that absolutist airpower vision, Gen Thomas Power, championed that classic vision by applying it to the ultimate high ground, space. By moving the strategic attack mission into space to create an unopposable strategic deterrent and move the locus of enemy attack away from the United States, the vision begun by Mitchell to protect the country while providing the added benefit of giving the American people uncontested access to the solar system. Unfortunately, after General Power's retirement in 1964, his successors were unable or unwilling to champion these visions. Instead, the leadership of American airpower went to the McNamara whiz kids, aided and abetted by the fighter mafia "pragmatists" who began to garner power in 1965.

The gelded age took visual form when SAC bombers began to retreat from their silvered aluminum color scheme to the dark camouflage brown/black with which they were adorned at the end of Vietnam. No clearer visual example of the Air Force's philosophical turn from the boundless sky to the cruel, merciless dirt can be imagined. But the worst impact of the gelded age was the Air Force surrender in its quest for security through an assured war-winning capability. Thus, while the Air Force of 2015 is a technological marvel of precision global conventional strike and persistence, its gilded veneer covers a service that cannot deter even a small adversary such as North Korea from developing nuclear weapons and ballistic missiles, cannot defend American civilians from an ICBM strike if launched, has been satisfied until recently to let its nuclear deterrent decay at alarming rates, and has allowed the United States' space capability to deteriorate so badly that American astronauts must ride to space on Russian rockets.

The gelded age's loss is most decidedly felt in space. The Air Force vision in space is a pale, weak reflection of only the easiest and most modest of programs from the Air Force's airpower-inspired vision for the space medium articulated by Power. Power's aerospace vision yielded to the chemical propulsion technology-driven, ballistic-missile-derived space vision of Shriever's WDD. Instead of Power's vision of sending tons and humans to space, after 50 years the Air Force still operates with the same poundage and unmanned satellites to orbit it did a half-century ago. The Air Force's air dominance is a golden gild cover to a rusted tin bowl, compared to a true aerospace force capable of defending the United States from missile attack from space as easily as sending hundreds of colonists to Mars that the airpower absolutist Thomas Power championed.

The origins of gelded age thinking in the Air Force space program was evident from the beginning of the space age. But, the eventual dominance of Schriever's vision of chemical-rocket limited American space power was probably assured when Power left ARDC in Lt Gen Samuel E. Anderson's hands. Anderson's previous assignment was with the Weapon System Evaluation Group under the Office of the Assistance Secretary of Defense for Research and Development. Neither Anderson, nor Schriever, who commanded ARDC after Anderson, appeared hostile to ambitious Air Force space projects. They simply had different approaches than Power's, which carried serious consequences. Power can be said to have favored an operations-centric

R&D approach that would fully support *revolutionary disruptive* technologies, such as Orion, if it encouraged *traditional* Air Force missions, such as strategic bombardment from space. Power supported high risks if they offered high reward. Anderson and Schriever, on the other hand, favored a technology-centric R&D approach that supported *evolutionary sustaining* space technologies, such as incremental improvements in chemical rocketry that improved *general capability* in space. While this technology-centric approach may not be wrong *per se*, it is inherently conservative due to its focus on improving the limits of known technology over the high-risk/high-return potential of whole new classes of technology.[15] In this case, Schriever's incremental strategy has allowed American space capability to plateau because sustaining technologies no longer provide significant benefit. This inherent limitation of the sustaining-innovation R&D strategy can be seen in the 1958 ARDC document Anderson commissioned, the *USAF Manned Military Space System Development Plan*.

The *Manned Military Space System Development Plan* aligned early space missions of 1959 to early air missions. It stated, "Today, reconnaissance, communications, and early warning are three obvious Air Force military missions of space vehicles," however, "history teaches us that, as presently visualized, these applications are merely the rudimentary ancestors of the sophisticated Air Force space weapons systems of the 1970-1980 era and beyond."[16]

The study correctly identified man in space as the critical factor for effective Air Force systems."[17] But the plan was flawed. Its objective was to "conduct expeditiously a program of exploratory space flights which *leads in an orderly fashion* to manned military space vehicles at the earliest practicable date and *determine the role that the USAF will play* in the control and use of space." [18] The plan's focus on orderly development, rather than extending classic airpower missions into space quickly metastasized into gelded age thinking.

The plan offered a gilded conclusion: the landing of Air Force personnel on the moon and returning them to Earth. The moon is a "ready-made space station provided by nature," it argued; and "the time and cost required for the development of the capability for a manned landing on it is relatively modest when compared with the time and cost required to develop the artificial space station and the capability for landing on it." [19] This mission could also be the first step to a moon base. Unfortunately, the plan's final stated advantage was

that "adoption of this goal forces the development of a new large booster, the *next major, logical step* in booster and airframe design."[20] Again the evolutionary mindset of the gelded age is evident.

The plan acknowledged the SR studies, but chose not to incorporate them. The plan's writers believed "the ARDC space technical development effort that will be pursued during the period of the 'Manned Military Space Systems' program will advance the state of the art so greatly that it would not be realistic at this time to attempt to define vehicles, propulsion, and guidance to do these advanced missions."[21] The plan's superficially ambitious goal was the product of evolutionary, not revolutionary, thinking. By not considering that advanced space technologies could offer far greater capability than chemical rockets, shooting for the moon was not shooting high enough to account for the capability of Orion to revolutionize space flight. The adage "aim for the stars and you'll at least hit the moon" seems apt. But in this case, it became translated into "aim for the moon, and you won't hit the stars." In the 1958 USAF manned space plan, aiming for the moon did not even allow Airmen to break the atmosphere in Air Force vehicles.

Power was able to fight against gelded age thinking from his position at SAC, but he could not defeat it. Schriever quickly became the top Air Force space officer after Power left ARDC and, without Power's oversight, Schriever began to instill his technocratic vision without resistance, even upon projects Power favored. The bitter fruit of Shriever's limited, technology-focused, evolutionary vision began to emerge in 1963 when Secretary Zuckert approached Schriever, then the commander of ARDC, to explore the frontiers of technology through *Project Forecast*, a future-capabilities study in the spirit of *New Horizons*. *Project Forecast* dismissed Orion as a concept worthy of continued Air Force attention, stating "ORION nuclear impulse concept does not appear to offer a capability which will be useful to the Air Force because of the very large payload required for economical operation. . . . It is recommended that a final summary progress report on ORION be prepared and the program terminated."[22] Even considering the Limited Test Ban Treaty of 1963 restrictions on nuclear activities, this is still a shocking conclusion. In an official study, the Air Force dismissed Orion for requiring very large payloads for economical operation, completely overlooking that Orion—unlike any space technology before or since—offered economical operation of very large payloads. An equivalent decision would be dismissing jet engines because they offered bombers too high a speed

and too large a bomb payload capacity to be useful. Although Schriever was not necessarily opposed to Orion, neither was he an advocate. Without Power to push for it, the Air Force in 1964 demonstrated that it did not know what to do with unlimited access to space even if offered.

The Headquarters, USAF *New Horizons II* study, completed in June 1975, should be considered a representative document that illustrates space concepts in the Air Force developed during the gelded age. *New Horizons II* reflects Air Force space thinking ten years after the cancellation of Project Orion, which was coincident with Power's retirement, and the onset of gelded age thinking. In many ways it was a forward looking document with regards to missions, but it was also highly limited in the propulsion techniques it considered. *New Horizons II* explored potential Air Force missions for space in the 1985–2000 time period. The study examined future capabilities from three viewpoints: technological feasibility, identifying tasks as low, medium or high risk; military suitability and potential value; and policy acceptability, whether they violate laws, treaties, or agreements. Using these three criteria, various capabilities were categorized as being Preferred, Promising, or Least Promising.[23]

The operational tasks *New Horizons II* considered ranged from space surveillance to strategic attack from space.[24] The study concluded counteraerospace against satellites, surveillance and reconnaissance, spacelift, and space support were "preferred military capabilities." The study strongly recommended "the US acquire an anti-satellite (ASAT) system to provide counteraerospace capability against enemy satellites," and acknowledged "the attendant requirement for a space surveillance capability to detect, track, and identify objects in space out to at least geosynchronous altitude." In addition to developing surveillance, communication, and navigation satellites, a follow-on chemical rocket launch vehicle to the Space Shuttle, and a survivable satellite control facility "independent of overseas bases," *New Horizons II* advocated development of a high-energy laser for ASAT purposes. Interestingly, the last preferred capability was "the proposed use of the manned Space Shuttle to perform on-orbit research and development testing of space system components, e.g., qualification tests which currently must be performed in simulated environments on earth."[25] The Military Test Space Station requirement from SR 17527 still lived.

The promising military capabilities were identified as strategic attack and counteraerospace against missiles and aircraft. The ghost of Project Orion may have appeared when the study discussed strategic attack. It argued "Weapons of mass destruction in space are now prohibited by treaty; however, in the extraordinary event that this treaty were changed, such space-based systems would provide a high degree of survivability and the recall capabilities of the bomber. Such a space-based force would suddenly become much more desirable should any potential enemy develop the technology to make our ballistic missile and bomber forces vulnerable to a preemptive attack." [26] These reflected the arguments Power made for an Orion combat system a decade earlier. The study concluded that "Destroying enemy aircraft and missiles with space-based weapons would have excellent relative military value; however, the high technical risk, high cost, and possible conflict with national policy lessen their attractiveness."[27] The least promising military capabilities included interdiction of surface ships and ground forces from space, as well as close support from space, as the team could find "no significant advantage over the more conventional methods now in use."[28]

New Horizons II's discussion of strategic attack makes for fascinating reading. It assessed nuclear-weapon kill mechanisms for counteraerospace, close support, interdiction and strategic attack missions as 'low' technical risks.[29] Delivery of nuclear weapons from space for strategic attack was also considered a low technical risk.[30] The report argued that the technical risk of strategic attack from space was low, that it would be a revolutionary capability, had a relative military value from poor to excellent, depending on whether the existing nuclear triad became compromised. The study noted advantages of placing strategic platforms in deep space, claiming "such a deployment could provide the recall capabilities of the bomber, hiding properties beyond even those enjoyed by the submarine, and a potential fourth means for delivering strategic weapons. In short, the TRIAD could become the QUAD."[31] But the study also anticipated the mission would remain prohibited as a matter of policy.[32] Through its discussion of strategic attack, *New Horizons II* demonstrated that the instinct for Airmen to use space to improve their traditional mission of strategic attack still existed in the Air Force.

The knowledge of how to make such a space deterrent force possible, however, appeared to be lost. In its discussion of spacelift, *New Horizons II* made no mention of nuclear pulse propulsion—or indeed

any propulsion method besides chemical propulsion. *New Horizon II* focused almost exclusively on the space shuttle. The study lauded the shuttle, claiming the "use of such a vehicle for transporting satellites to orbit, repairing them on-station, and returning vehicles to a space platform or earth for repair, refurbishment, and modification would represent a range of capabilities we do not now possess." Echoing the gelded age fascination with reusability over performance, the study also maintained, "With its major components largely reusable, the Shuttle will usher in routine, ready access to and from space, thereby enhancing the potential for manned operations. In addition to re-supply, repair, and recovery operations, the Shuttle could bring new opportunities to conduct counteraerospace and reconnaissance/surveillance operations in either a manned or unmanned configuration."[33]

The *New Horizons II* study clearly demonstrated the Air Force's devolution of space thinking and acted as a very important bridge from the visionary space program championed by Power to today's singular fixation on satellites and space support, which is the end result of the gelded age brought about by the Air Force's embrace of Schriever's emphasis on the ballistic missile as well as by chemical rocketry's relative impotence as a space propulsion system. The *New Horizons* study remembered enough of the Air Force's doctrinal past to include ideas derived from the SR study system and sections on many space missions originally intended for Project Orion, including a space-based strategic weapon system, a manned space station, a ballistic missile launch platform, and a spaceborne anti-ballistic missile system. But the study failed to mention Project Orion or nuclear pulse propulsion as a means of achieving them. The two major improvements *New Horizon II* desired were space-based lasers and an improved space shuttle with horizontal takeoff capability. Forty years later, the Air Force has neither, but the gelded age "forward" vision of space still requires them. The Strategic Defense Initiative of the 1980s championed the space-based laser, but SDI failed to materialize. The space shuttle failed to deliver on its promises of low-cost spacelift, yet the horizontal space plane is still desperately sought after, as DARPA's XS-1 spaceplane project attests. Gone are Power's visions of low-technology physical space mines to serve as ABM shields, and nuclear pulse propulsion's quantum leap of performance over sterile chemical rocketry. The gelded age of Schriever's rocket acolytes has kept space advancement permanently over the next directed energy and reusable rocket horizon.

Whether *New Horizons II* ignored Orion because of its emphasis on "policy acceptability" or whether the Air Force had already begun to forget about Project Orion and the Study Requirement System studies is difficult to determine. What does seem clear is that the Air Force focused on the identified space support mission and only made slight progress on the counteraerospace mission. In the Air Force of 2016, there is no room for advanced propulsion, spaceborne ABM, or strategic strike from space. Not only has the Air Force been gelded in space, it does not even remember the vision it once had. Power's fear, expressed in his 1958 SAC space policy, that an American focus on cautious, defensive space systems would hamper America's quest to conquer the space medium, remains operative today. Both the Air Force and the American space programs still suffer as a result.

There are indications the Air Force may soon reap the whirlwind sown by the gelded age. On 25 November 2015, President Obama signed the United States Space Launch Competitiveness Act of 2015 (short title: The Space Act of 2015). According to Section 5302, the United States government will "facilitate commercial exploration for and commercial recovery of space resources by United States citizens; and promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources free from harmful interference." [34] Further, the Act directs the government to determine "the authorities necessary to meet the international obligations of the United States," including "the allocation of responsibilities among Federal agencies for the activities described in" the Act. [35]

Most explosively to the space legal world was the clear statement in Section 51303 of United States citizens' property rights in space. The Act declared a "United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, own, transport, use, and sell the asteroid resource or space resource obtained in accordance with applicable law, including the international obligations of the United States."[36]

The space enthusiast community widely regards this Act as a great victory for space industrialization. Specifically, the Act is seen as reducing the legal uncertainty behind private economic space activity because it specifically states American companies are entitled to ownership of the resources they extract. This legal recognition is seen by many as eliminating a huge confidence barrier to private investment.

Two American companies, Planetary Resources and Deep Space Industries were supporters of the Act and are already building space equipment and developing plans to harvest the space resources the Act authorizes. Deep Space Industries' Chairman Rick Tumlinson said of the bill in "the future humanity will look back at this bill being passed as one of the hallmarks of the opening of space to the people."[37] Planetary Resources was somewhat more grandiose. Co-Chairman Eric Anderson wrote, this "is the single greatest recognition of property rights in history," and Co-Chairman Peter Diamandis, added, a "hundred years from now, humanity will look at this period in time as the point in which we were able to establish a permanent foothold in space. In history, there has never been a more rapid rate progress than right now."[38] One wonders if Power's prediction in the 1958 SAC Space Policy—that the astronautics industry would one day contribute to civilization as greatly as the aeronautics industry had—is at hand.

While not readily apparent, the Space Act of 2015 contains some serious ramifications for the USAF. The Act requires the United States government allow its citizens to harvest space resources *free from harmful interference* and directs the president to assign necessary responsibilities to appropriate departments.[39] As the Department of Defense's Executive Agent for Space, the USAF may find itself with the responsibility of defending American citizen's rights from physical hostile interference from nations that may not recognize American claims.[40]

Therefore, the USAF may need to act in defense of American rights and property beyond the planet, yet there exists today little interest or thinking in doing so. In the September 2015 *Air Force Future Operating Concept: A View of the Air Force in 2035*, space forces were directed to achieve Adaptive Domain Control, which "includes the ability to operate in and across air, space, and cyberspace to achieve varying levels of domain superiority over adversaries seeking to exploit all means to disrupt friendly operations."[41] This concept does not appear to anticipate operations in deep space. The document continued, "2035's AF forces have robust space mission assurance capabilities, including the resilience to operate effectively in this important and increasingly contested, degraded, and operationally limited domain" conducting space situational awareness missions, "routine and operationally-responsive launch operations from both ground sites and airborne delivery vehicles," and maintaining "effective satellite constellations."[42]

The most recent vision statement for future Air Force space forces is the 2014 Air Force Space Command White Paper *Resiliency and Disaggregated Space Architectures*. The paper explains that the Cold War "led to satellite designs that *maximized the size, weight, and capability of every payload within the constraints of a given launch vehicle,*" an interesting statement given the reason for *Project Forecast*'s rejection of Orion.[43] The paper argues that to confront today's congested, competitive, and contested space domain, the Air Force needs "to provide resilient and affordable capabilities to *preserve* operational advantage in space."[44] Air Force Space Command's solution to this problem is to "disaggregate" space capabilities onto many different, smaller satellites that currently exist on large, expensive, and vulnerable satellites."[45] Disaggregation is meant to increase the resilience of the Air Force's constellation of satellites from damage by an adversary attack by distributing mission functions from large, single satellite targets to many smaller satellites, leaving an attacker with a more complex targeting calculus. Ultimately, Air Force Space Command concludes the resilience and disaggregation path suffice to take the Air Force space program to its desired future state, but *Resiliency and Disaggregated Space Architectures* reflects a very weak and vulnerable posture. Air Force Space Command fears for the safety of its "large" satellites from both adversary attack and orbital debris. Power would be shocked at how pitiful the Air Force's space position is, for his Strategic Space Force was meant to be orders of magnitude larger and capable not only of defending itself from a massive nuclear attack in orbit, but also of actually lifting off from the launch pad in the face of enemy space superiority to fight *through* a blockade to wrest space superiority from an enemy deeply entrenched in the ultimate high ground. We are in a gelded age, indeed!

The first step in rising above the gelded age is to remember the golden age of Air Force space, the time when Airmen dreamed of empires in space and the ballistic missile was not the ultimate weapon of American space power. "The Faded Vision of 'Military Man in Space'" appeared in the November 2015 issue of *Air Force Magazine*. In an otherwise fine and succinct overview of what the Air Force remembers about its attempt to place Airmen into space, historian John T. Correll makes no mention of Project Orion or Gen Thomas Power. Correll does, however, quote Air Force Gen Donald J. Kutyna, commander of US Space Command, in 1990: "We've had military man in space from the dawn of manned spaceflight, looking for

missions, and we have found very few, if any. Just look at the nature of things we do in space—communications, surveillance, warning systems, navigation. We don't use man for most of those things down on Earth, so why would we put man in space to do them?"[46] The obvious answer is that you would not. But that is the wrong lesson. The Air Force should not have passively looked for a mission as it has in the gelded age, it should have taken Power's advice and declared that classic Air Force missions could better serve American defense in space and demanded technology that would make those missions a reality. By reclaiming General Power as a critical player and singular visionary in Air Force space history, the Air Force may yet awake from the gelded age.

Notes

1. "The 4 Star General" draft (unknown author) with edits by Thomas S. Power. Gen Thomas Power Papers, Reel 34157, Frame 1458.

2. "The 4 Star General," General Power Papers Reel 34157, Frames 1458-9.

3. James D. Atkinson, "Design for Survival," Book Review, *Military Affairs* Vol 29, No 2 (Summer 1965), 95. Emphasis original.

4. Ronald Steel, "Hitting the SAC," *New York Review of Books*, 20 May 1965.

5. Hanson W. Baldwin, "The Creed of Strength," *New York Times*, 21 March 1965

6. Adult New York Times Adult Hardcover Best Seller Listings, Hawes Publications, accessed 16 January 2016, http://www.hawes.com/pastlist.htm.

7. Dr. Thomas Hughes first offered this insight.

8. "Gen Thomas S. Power, 1905-1970," *Air Force Magazine*, January 1971, 17.

9. Alwyn T. Lloyd, *A Cold War Legacy: A Tribute to Strategic Air Command, 1946–1992* (Missoula, MT: Pictorial Histories Publishing Company, 2000), 343.

10. Mike Worden, *Rise of the Fighter Generals* (Maxwell AFB, Alabama: Air University Press, March 1998), 173.

11. Alwyn T. Lloyd, *A Cold War Legacy*, 380.

12. Mike Worden, *Rise of the Fighter Generals*, 185.

13. Dictionary Reference.com, accessed 16 January 2016, http://dictionary.reference.com/browse/geld?s=t.

14. The term gelded age was coined by Lt Col Peter Garretson, USAF and introduced in an article "Starfleet Was Closer Than You Think!" by Lt Col Garretson and the author, accessed 16 January 2016, http://www.thespacereview.com/article/2714/1.

15. For a particularly good description of the pitfalls of sustaining innovation-focused R&D, see Clayton M. Christensen, *The Innovators Dilemma: When New Technologies Cause Great Firms to Fail* (Cambridge, MA: Harvard Business School Press, 2016).

16. HQ Air Research and Development Command, *USAF Manned Military Space System Development Plan Pacing and Long Lead Items*, Volume II, 2 May 1958, II-2. Document is now declassified.

17. HQ ARDC, *USAF Manned Military Space System Development Plan,* II-2.

18. HQ ARDC, *USAF Manned Military Space System Development Plan*, II-3. Emphasis Added.

19. HQ ARDC, *USAF Manned Military Space System Development Plan*, II-3.

20. HQ ARDC, *USAF Manned Military Space System Development Plan*, II-3. Emphasis Added.

21. HQ ARDC, *USAF Manned Military Space System Development Plan*, II-4.

22. Air Force Systems Command, *Project Forecast Propulsion Report*, March 1964, IV-9. Excerpt is declassified.

23. Headquarters, USAF. *New Horizons II Volume V: The Role of the Air Force in Space Final Report*, June 1975, iii. Document is now declassified.

24. *New Horizons II, Vol V*, xiii-xiv.

25. *New Horizons II, Vol V*, xv.

26. *New Horizons II, Vol V*, xv-xvi

27. *New Horizons II, Vol V*, xv-xvi

28. *New Horizons II, Vol V*, xvi.
29. *New Horizons II, Vol V*, 3–4 to 3–7.
30. *New Horizons II, Vol V*, 3-11.
31. *New Horizons II, Vol V*, 3–20 to 3–21.
32. *New Horizons II, Vol V*, 3–32.
33. *New Horizons II, Vol V*, 3–21 to 3–22.
34. *United States Space Launch Competitiveness Act of 2015 [Space Act of 2015]*, H.R. 2262, 114th Cong., 1st Session (25 November 2015), 18–19.
35. *Space Act of 2015,* Section 51302*,* 18–19.
36. *Space Act of 2015*, Section 51303, 18–19.
37. Deep Space Industries Press Release, "US Makes Space History: President Obama Signs Law Enabling Commercial Use of Space Resources," 25 November 2015, accessed 6 January 2016, http://deepspaceindustries.com/u-s-makes-space-history/.
38. Planetary Resources Press Release, "President Obama Signs Bill Recognizing Asteroid Resource Property Rights Into Law," 25 November 2015, accessed 6 January 2016, http://www.planetaryresources.com/2015/11/president-obama-signs-bill-recognizing-asteroid-resource-property-rights-into-law/.
39. *Space Act of 2015*, 18-19. Emphasis Added.
40. Some international legal commenters claim that the Space Act of 2015's asteroid resource section violates international law. For a representative opinion, see Gbenga Oduntan "Who Owns Space? US Asteroid-Mining Act is Dangerous and Potentially Illegal" 27 November 2015, accessed 6 January 2015, http://www.sciencealert.com/who-owns-space-us-asteroid-mining-act-is-dangerous-and-potentially-illegal.
41. Headquarters, United States Air Force, *Air Force Future Operating Concept: A View of the Air Force in 2035*, September 2015, 18.
42. *Air Force Future Operating Concept*, 18–19.
43. Air Force Space Command, *Resiliency and Disaggregated Space Architectures*, 2014, 2. Emphasis Added.
44. Air Force Space Command, *Resiliency*, 2.
45. Air Force Space Command, *Resiliency*, 2–3.
46. John T. Correll, "The Faded Vision of 'Military Man in Space," *Air Force Magazine*, November 2015, 81.

Chapter 7

Space Power Reconsidered
Conclusions and Recommendations

Thomas Power and his contributions to the Air Force space effort deserve to be reconsidered. From this limited study of a complex man, three main conclusions emerge regarding Power's space efforts.

1. Thomas Power can and should be considered the Air Force's Space War Fighting Icon.

Power was single-handedly responsible for forming the Air Force's first true space organization, the Western Development Division, specifically overruling the "father of the Air Force space program" Bernard Schriever's attempt to keep WDD as a ballistic-missile organization. Power also developed Air Research and Development Command's ability to study rapidly emerging issues and applied that new construct to study the emerging opportunities in the space frontier through the Study Requirements (SR) system. The SR system, from 1956 to 1961, provided the Air Force with concepts that embraced a wide spectrum of topics, ranging from mundane communications satellites to revolutionary manned space bombers, space stations, lunar bases, and interplanetary travel. The SR studies, in total, represented a "proto-doctrine" for the Air Force in space. Finally, Power identified the technology that would allow Air Force doctrine to be applied in the space environment and enthusiastically supported the nuclear pulse Orion concept. Through Orion, Power provided an alternative to the ballistic-missile-driven, technology-limited military space effort that Schriever advanced and dared to dream of an Air Force space program not limited by thrust or payload to form a true space force.

Power provided the organization, doctrine, and equipment necessary for the Air Force to build truly superior space weapons, encompassing all three critical factors identified by I. B. Holley for the development of military capability. Power was able to see beyond the existing space conventions promoted by defense intellectuals who championed the ballistic missile and envision a plausible future by which American security could be firmly assured by space forces. For these reasons, Power should be seen as Hayden's "Air Force space warfighting icon"

and be held up as at least an equal, if not superior, space hero to Schriever.

Of course, General Power failed and neither the Orion spacecraft nor the Strategic Space Force ever flew. Like Giulio Douhet, Power would not live to see his vision realized, but he should nevertheless be considered a war-fighting icon for space, just as Douhet is for the air.

2. The Air Force's early space history must be reexamined, specifically the reality of the Aerospace vision.

Simply because Power's vision of space power was defeated in the mid-1960s by gelded age thinking, it does not follow that his vision was illegitimate. The SR studies, Project Orion, and his speeches and writings on space power are every bit as much Air Force space history as anything written by Schriever. In fact, these three forgotten legacies of the early Air Force space program are critical to understanding White's aerospace vision.

White's aerospace vision, properly operationalized by Power's ideas, made the early Air Force space effort a viable vision for the Air Force in space. It demonstrates that the Air Force did not blindly attempt to find a reason to put an Airman in orbit for its own sake. Rather than mishandling space, as argued in most histories, the Air Force had a robust and rational space plan far superior to the gelded age space program that ensued. Was Eisenhower's "space for peaceful purposes" drive really sophisticated? Was Kennedy's belief that there was nothing militarily useful to do in space justified? Was General Kutyna correct that for all of the Air Force's searching, it could simply find no reason to have an Airman in space? Or was the Air Force simply ordered to forget about the future?

The only way to answer this question is for historians and theorists to reconsider Power's work on space as plausible military theories and concepts. In order to do so, the SR space documents and the military conceptual work done on Orion as a weapon system must be identified, found, and declassified. Most are over fifty years old and should be released so they can fill in the holes plaguing a comprehensive understanding of the Air Force's early space history.

3. SAC's operational approach to space activity, developed by Power, must be re-legitimized because gelded age thinking cannot cope with today's—and tomorrow's—space environment.

Power's vision for space, after an honest and thorough reassessment, may still be rejected by policy makers in favor of the current construct. However, his work must be relegitimized in order for Airmen to be able to search through it in order to answer today's pressing space questions. Many identified problems in the Air Force space program may in large part be caused by Shriever's limited ballistic-missile gelded age space vision. What seems very clear is that the gelded age vision is certainly insufficient to guide the Air Force successfully through tomorrow's space challenges, which potentially include asteroid mining and large scale space activity. Given Power's vision, one can only laugh that today's Air Force Space Command is worried that space is competitive, congested, and contested.

No problem encountered in space today would have batted an eye of the commander of an Orion cruiser. Perhaps revisiting General Power's work and the work he supported, including reviewing the undeveloped technologies available that would provide the material solutions he wanted realized, would offer ideas on how today's gelded Air Force space program can re-emerge as the uncontested master of the space domain.

One day, while teeing off on the first hole at St. Andrew's in Scotland, Power reminisced. To no one in particular he said, "If I had my life to live over, I can't think of much I would change."[1] Can the Air Force space program say the same thing?

Notes

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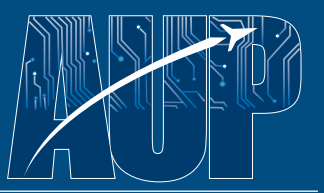

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