# Section 1 – The Cold War and National Armament

## Chapter 1: The Cold War (1945–62)

### Introduction

The story of the Minuteman missile program is a Cold War tale. Journalist Walter Lippmann's 1947 book, *The Cold War*, first used and popularized the term "cold war" to refer to the post-World War II confrontation between the United States and the Soviet Union. Two years earlier, British author and journalist George Orwell called a world living in the shadow of a nuclear war "a peace that is no peace" and referred to it as a "cold war." [i] The term, Cold War, would come to define the political, social, and economic history of the second half of the twentieth century. More than merely a military standoff, the Cold War offered a stable international system forged by the world's emerging two superpowers–the United States and the Soviet Union–that lasted more than four decades. This system formed almost immediately following World War II, when the United States and the Soviet Union epitomized the differences between a capitalist and a communist world. The conflict that arose between these two fundamentally irreconcilable systems, paradoxically based upon stability through mutual destruction, helped spawn development of new weapons systems, including the Minuteman I and II.[ii]

The use of the atomic bomb at the end of World War II forever altered the tone of international relations. The devastation caused on 6 August 1945 at Hiroshima and 9 August 1945 at Nagasaki led the world to fear an atomic war, and to fear what atomic weapons could do, even to their inventors. As H. V. Kaltenborn, one of the most respected American broadcasters of the period, told his listeners on the night of 6 August 1945, "We must assume that with the passage of only a little time, an improved form of the new weapon we use today can be turned against us."[iii] This fear dominated the Cold War, as policymakers and pundits alike recognized that any potential conflict could escalate to the point of global destruction once both superpowers possessed these weapons. Hiroshima changed everything, the Congressional Aviation Policy Board concluded in 1948, "Militarily speaking, at that same hour the security frontiers of all nations disappeared from the map. National defense, in the traditional sense, is no longer possible. The cycle of history has turned, and once again civilization stands vulnerable to annihilation."[iv]

With the benefit of hindsight, we may now clearly state that this overt threat of nuclear annihilation kept both sides from pursuing a more aggressive or expansionistic foreign policy as the U.S. and the Soviet Union during the Cold War were very aggressive in maneuvering with third world countries in an attempt to tilt the theoretical balance of power in their own favor.

With nuclear weapons and the atomic bomb at the heart of this threat, American policymakers believed their country had to stay technologically ahead of the Soviets if it was to survive. They were determined to maintain their atomic monopoly as long as possible, and thereafter to use their technological superiority for diplomatic leverage. The Soviet Union was bent upon global domination, policymakers reasoned, and if the Soviets believed that the American force could be defeated, it seemed likely that Moscow would strike. Technological superiority, in other words, when coupled with the ability to deliver unprecedented force, was required to maintain the peace.

The Minuteman missile program and the efforts of the military and civilian personnel of the 44th Strategic Missile Wing of Ellsworth Air Force Base are each a product of this Cold War system. In order to deter communist aggression, the United States developed the Minuteman I missile system with the ability to respond to an enemy attack with immediate and massive retaliation. The origins of the Cold War help to identify how the Soviet-American relationship deteriorated and the two sides became entrenched for over four decades–this background is fundamental to understanding why such powerful military weapons were deployed in South Dakota–some thousands of miles from the Soviet border. In the Cold War, as we shall see, the front line was everywhere.

## Origins of the Cold War

***Zones of Contention***

The mutual antagonism of the Soviets and Americans, leading to the Cold War, developed after World War II as the two sides competed over a number of geographic and political zones of contention. In several confrontations and diplomatic situations, American policymakers in particular learned important lessons, including that the Soviet Union was no longer an ally, that Moscow intended to expand the physical realm of communism, and that the Soviets could only be deterred by force and the threat of force.

Two major conferences–Yalta and Potsdam–were held in 1945 with the Soviets, British, and Americans to determine the fate of Europe and defeated Germany. The Yalta Conference, at the Russian Black Sea resort in February, was the last meeting of the Big Three allied leaders–American President Franklin D. Roosevelt, British Prime Minister Winston Churchill, and Soviet Premier Joseph Stalin. At the conference, debates over Poland's postwar borders and government put Roosevelt and Churchill at odds with Stalin. Within months of Yalta, Soviet control over Poland and the rest of Eastern Europe had evolved into a serious concern for the future of Western Europe.[v]

Leaders of the three countries met again at the Potsdam Conference, outside of the captured Berlin, from 17 July to 2 August 1945. This was the last major conference of World War II, and its participants attempted to build upon the efforts of the Yalta Conference. However, the United States and Britain found themselves again unable to come to an agreement on many diplomatic issues with the Soviet Union. President Harry S. Truman, who had taken office following Roosevelt's death on 12 April 1945, and many Potsdam attendees, saw the Soviet Union shifting from a wartime ally, even a frequently difficult one, to an outright adversary.[vi]

The postwar battle over the control of Germany and Berlin demonstrates how tensions evolved dividing Europe into East versus West. Germany was physically and ideologically divided between the two sides. For the United States, a strong rebuilt Germany capable of sustaining its own redevelopment while supporting its neighbors seemed vital to the success of Western Europe, while Soviet leaders longed for a ravaged Germany, incapable of ever again attacking the East. The superpowers' division over Germany's fate was centered symbolically on the country's former capital, Berlin. The United States, Britain, France, and the Soviet Union each had military troops stationed in Berlin–110 miles into the heart of the Soviet occupation zone and the future East Germany–and their presence led to the 1948 Berlin Blockade (discussed below).

American financial assistance toward the reconstruction of Europe following the war also contributed to a deteriorating relationship between the United States and the Soviet Union. The United States emerged from the war with a strong economy, and was in the position to provide aid to Europe, a situation ultimately resented by the Soviets. Initially the United States offered aid on a country-by-country basis, with $3.75 billion going to the British in 1945-46 and $1.2 billion to France the following year.[vii] The Soviets requested $1 billion in aid in 1945, but due to crumbling East-West relations, the Truman Administration never formally approved an aid package for Moscow. State Department officials claimed to have "lost" the Soviet request, though later historians have proved their story was fabricated so as to provide justification for rejecting Moscow's plea. No matter the reason, Moscow's failure to garner American postwar aid proved a contentious issue in Soviet-American dealings.

The United States also faced conflict with the Soviets outside of Europe. The fate of China, for example, as a result of its civil war, was of crucial interest to the two superpowers if for no other reason than its status as the world's most populous country. Led by Mao Zedong, China's Communists eventually won power, leading to greater American concerns over the future of the capitalist system without its most populous member and to domestic attacks against the Truman Administration for "losing" China. Communism's victory in this crucial early Cold War battle helped American policymakers understand the growing threat of this dangerous new ideology and gave the United States a new and bitter adversary in Asia.

The Iranian Crisis of 1946 also contributed to the polarization of Soviet-American relations. Following World War II the Soviets agreed to end their occupation of northern Iran and remove their troops within six months of the conflict's end. When the Soviets did not comply with their wartime promise and continued to occupy northern Iran and use political and military pressure to gain oil concessions, President Truman threatened war and mobilized troops to the area. These actions forced the Soviets to withdraw without concessions, offering proof to American policymakers that the Soviets responded only to force. By 1947, therefore, tensions ran high between the East and West and American leaders had developed an increasingly hostile view of Russia.[viii]

***Declarations of Cold War***

Tensions between the two countries escalated during the post-World War II period and declarations by leaders on both sides, including Stalin and Churchill, and strategists, such as United States diplomat George Kennan, began to formally announce the existence of a Cold War. At the heart of their message was recognition of the posturing by the two superpowers with opposing ideologies and world views.

Such declarations of Cold War began as early as 1946. In February of that year, Stalin's Soviet Party Congress speech made the growing East-West conflict seem inevitable. Cold War historian Walter LaFeber discussed how Stalin's speech cast a pall over contemporary East-West negotiations,

> "In an election speech of February 9, the Soviet dictator announced that Marxist-Leninist dogma remained valid, for 'the unevenness of development of the capitalist countries' could lead to 'violent disturbance' and the consequent splitting of the 'capitalist world into two camps and the war between them.' War was inevitable as long as capitalism existed. The Soviet people must prepare themselves for a replay of the 1930s by developing basic industry instead of consumer goods and, in all, making enormous sacrifices demanded in 'three five-year plans, I should think if not more.' There would be no peace, internally or externally. These words profoundly affected Washington. Supreme Court Justice William Douglas, one of the reigning American liberals, believed that Stalin's speech meant 'The declaration of World War III.' "[ix]

Two weeks after Stalin's speech, in late February, United States diplomat George Kennan responded to a State Department request for an analysis of Soviet expansionism and global intentions with what became another such declaration of a Cold War. Kennan's response, later given the descriptive title "The Long Telegram," warned that Soviet policies assumed western hostility and that Soviet expansionism was inevitable.[x] Moscow would only be deterred by forceful opposition, be it political or military, and Kennan thus recommended that the United States employ a policy of "long-term patient but firm and vigilant containment."[xi] His analysis was well received by United States policymakers who felt that the telegram confirmed their views and the tougher stance the Truman administration was taking with the Soviets.

One month later, in his March 1946 speech at Fulton, Missouri, ex-British Prime Minister Winston Churchill presented his views on the East-West conflict. Churchill coined the term "iron curtain" in this speech and outlined a global alliance between Europe and the United States, "From Stettin in the Baltic to Trieste in the Adriatic an iron curtain has descended across the Continent. Behind that line lie all the capitals of the ancient states of Central and Eastern Europe. Warsaw, Berlin, Prague, Vienna, Budapest, Belgrade, Bucharest and Sofia; all these famous cities and the populations around them lie in what I must call the Soviet sphere, and all are subject, in one form or another, not only to Soviet influence but to a very high in some cases increasing measure of control from Moscow."[xii]

During the final passage of the American Treasury loan to Britain in July 1946, American Congressional leaders outlined their own declaration of Cold War, as they described the world as half free and half communist in order to win approval for the politically contested loan. Leaders, such as Speaker of the House Sam Rayburn, argued that the United States must support its longtime ally in Britain, especially as the bipolar division of the world seemed impossible to overcome. The United States committed $3.75 billion in loans to Britain for reconstruction of its economy, which was, in the words of historian Derek Leebaert, the "first distinctly postwar commitment of U.S. economic and political power."[xiii] As Rayburn

explained in defense of the loan, "I do not want Western Europe, England, and all the rest of Europe pushed toward an ideology that I despise" and "I fear that if we do not cooperate with our great natural ally [Britain] that is what will happen."[xiv] As Cold War historian Dr. Jeffery A. Engel has written, to thinkers like Rayburn, "Only a strong Great Britain, an unsinkable American island-base of anti-communism set off the coast of Europe could prevent Soviet domination of the continent, he argued, and only an economically strong Britain, a Britain strengthened by a $3.75 billion loan, could possibly remain solidly in the American camp."[xv]

***American Cold War Policy***

By 1947 it had become apparent to most observers that the world was splitting in two–East and West–leaving the inevitable conflict of the Cold War. Quickly the lines in the sand were drawn even deeper as the Soviets and Americans clashed ideologically and militarily on a number of fronts. In February, for example, Britain's decision to cease aid to Greek forces fighting a Communist insurgency prompted the Truman Administration to assume new responsibilities throughout all of Southern Europe. The ensuing "Truman Doctrine" committed $400 million in aid to Greece and Turkey–a huge sum given Congressional fiscal conservatism at the time–and offered a precedent for further American assistance to any "free peoples" engaged in a struggle against "terror and oppression" and "the suppression of personal freedoms."[xvi] Truman's Manichean worldview pitted the world in two, good against evil, for to American policymakers, Communism seemed everywhere on the march. "Like apples in a barrel infected by one rotten one," Secretary of State Dean Acheson explained, "the corruption of Greece would infect Iran, and all to the East."[xvii] Without American aid, Europe and Africa would be next, he continued and "we and we alone could break up the [Soviet] play." Western Europe subsequently received its own brand of American economic stimulus later that year, with the Marshall Plan designed to promote economic recovery and stability as a vaccine against the Communist "infection." The Soviets refused to participate in the plan, which Foreign Minister Molotov denounced as a "new venture in American imperialism."[xviii] The Soviets offered their own aid package for Eastern Europe and, with dollars flowing to one half of the continent and rubles to the other, the division of East and West grew even deeper. The Truman Administration later followed-up this aid program to Europe with "Point Four," a program similarly designed to spread American technical know-how and dollars throughout the developing world as a means of countering Soviet expansion.[xix]

Conflict continued with the Soviet Union determined to push the United States and its allies out of West Berlin. In June 1948, the Soviets imposed a blockade on West Berlin in an attempt to cut off supplies to the city. The United States and its allies began to supply the city with a massive airlift of unprecedented size, and the Soviets ended the blockade in May 1949. The United States' commitment to Western Europe's defense, exemplified by efforts during the Berlin Blockade, led to the establishment of the North Atlantic Treaty Organization (NATO) in April 1949. NATO provided for a collective defense of its members, as the organization's charter promised that an attack on one would be considered an attack on all. NATO represented the United State's commitment to its European allies and would become an important key to containing the Soviet Union in Europe.[xx]

Shortly after the lifting of the Berlin Blockade, in August 1949, the Soviet Union broke the American nuclear monopoly by developing its own atomic bomb. The Soviets had matched the United States' key technology sooner than most expected. This development forced the United States to reevaluate its defense posture and accelerated the creation of even more powerful weapons, such as the hydrogen bomb, to regain its nuclear superiority. An analysis of the United States' defense position was presented to President Truman in the National Security Council Paper Number 68 (NSC 68). NSC 68, authored largely by Paul Nitze of the State Department policy staff, would come to shape American policy for many years. NSC 68 outlined that the United States needed to be prepared globally for Soviet or communist expansionism and that containment should become a global policy. The directives outlined in NSC 68 were written prior to the North Korean invasion across the 38$^{th}$ parallel but were not adopted until September 1950, after this conflict proved to many the necessity of American military buildup.

By the early 1950s American foreign policymakers knew that the Cold War was here to stay. Communism seemed everywhere on the move, exemplified by the crises described above and then most dramatically with the North Korean invasion of June 1950 that began the Korean War. Western policymakers believed countries at risk from Communist aggression might fall if their neighbors succumbed, like the rotten apples

of Acheson's metaphor or, more commonly, like so many dominoes: if one country was lost to the Communists, so too would be the next, and the next. Communism had to be stopped, but at what cost? The increasing conflict between the United States and the Soviet Union and the arms race would shape the United States strategic defense program and Intercontinental Ballistic Missile (ICBM) development. In the Cold War, the United States would maintain its stance that the only way to halt the expansion of communism was through development of increasingly advanced weapons systems. As we shall later see, one such system would be the Minuteman. Before that missile would be deployed, however, there would be events and developments, international and technological, which would shape this weapon and the communities that housed it.

## Eisenhower and Waging Peace

The Cold War and the directives of NSC 68 led to a significant increase in American military spending. Just over $13 billion was spent on the country's defense in 1950, while only three years later total American defense spending exceeded $50 billion, or nearly forty percent of the federal budget.[xxi] Much of this increased spending can be attributed to the Korean War; however, many United States policymakers believed that defense spending would continue at this elevated level for the foreseeable future. Their predictions ultimately proved correct, as spending on American forces dipped after the war to approximately $34-$38 billion a year, while military and financial aid delivered to allies in the name of halting communism averaged nearly $12 billion annually throughout the remainder of the decade. This level of Cold War spending became the norm until the height of the costly Vietnam War.

President Dwight D. Eisenhower took office in 1953 with a pledge to lower the cost of waging the Cold War, what he called "waging peace." He feared a prolonged military conflict and a commensurate expansion of the military and federal government might undermine the country's democratic values. President Eisenhower did not dispute NSC 68's basic principles, in particular its contention that Soviet Communism was inherently expansionistic and thus a threat to the United States, but he feared the effects of a broad Cold War fight on America's economy and society. Increased military spending could warp the marketplace, while efforts to combat Communism at home, if not carefully regulated, might ultimately undermine American civil liberties. As Eisenhower stated, his administration was charged with defending "a way of life," not just a territory and "We could lick the whole world if we were willing to adopt the system of Adolph Hitler."[xxii]

These were hardly idle concerns. During this same period, Senator Joseph McCarthy led the charge against Communism at home, popularly known as the Red Scare, with largely unsubstantiated accusations that Communists had infiltrated the federal government and the State Department in particular. McCarthy's accusations caused a sensation. Following televised Congressional hearings in 1954, where McCarthy accused the Army of harboring Communists, he was censured by the Senate for his actions. The country's rabid anti-Communist hysteria began to slow, though Cold War fears continued to color American political and cultural life for more than a generation. As Eisenhower had feared, anti-Communism, as espoused by McCarthy and others, was distorting American values.

As Commander-in-Chief and as a former Army General, Eisenhower at least exerted greater control over the military. He believed in the conservative (what earlier generations would have called republicanism or classical liberalism, terms that change over time though their meanings remain the same) ideal that democracy and militarism are forever at odds, as he held significant faith in civilian rule.[xxiii] Based on these beliefs he called for a reconsideration of the country's Cold War policies upon taking office. He initiated "Project Solarium"–named for the room of the White House where the project was discussed–which requested three blue-ribbon, top secret panels to separately consider and propose a strategy for America's Cold War policy.

Group A was headed by diplomat and Soviet expert George Kennan. Kennan's group concluded that since the Soviet threat remained strong, the previous administration's containment policy should be continued. They recommended continued expansion of defense spending and military buildup. As reported by Group A, "If we can build up and maintain the strength of the free world during a period of years, Soviet power

will deteriorate or relatively decline to a point which no longer constitutes a threat to the security of the United States and to world peace."[xxiv]

Group B was led by Air Force Major General James McCormack, an expert on atomic weapons. The members of McCormack's group proposed drawing a "line of no aggression" around the Communist Bloc and areas necessary to the United States security.[xxv] Entry or expansion beyond the line would result in an atomic attack on the Soviet Union. Group B's plan offered the advantage of limiting military spending, but featured two major obstacles: where to draw the line, and how to procure Congressional and public support for an atomic war should the Soviets cross the line.

Vice Admiral Richard Conolly headed up Group C in the discussion of the nation's future Cold War policy. His group advocated an aggressive approach to winning the Cold War and reversing Communism, a policy publicly dubbed "roll back." They stated that the United States should "prosecute relentlessly a forward and aggressive political strategy in all fields and by all means: military, economic, diplomatic, covert, and propaganda."[xxvi] Through aggressive means, Communism would be swiftly eradicated and democracy "restored."

President Eisenhower ultimately adopted none of the three options, choosing instead a combination of the first two, which were drafted into National Security Council Paper Number 162 (NSC 162), his administration's Cold War blueprint. NSC 162 advocated extensive reliance on nuclear weapons as the country's primary deterrent to Communist expansionism and aggression. It advocated vigilance against future Communist expansion but not direct roll back unless the United States was in position for victory. The policy focused on keeping America safe, but as importantly, also fiscally secure. No one in 1953 could predict how many years the Cold War would last and the administration felt strongly that it needed a policy that could be sustained for possibly a decade or more. Secretary of the Treasury George Humphrey explained, "if we mean to face this Soviet threat over a long time, we must spend less than we now are spending and do less than we now are doing."[xxvii]

Following Project Solarium and the revision of the document to NSC 162/2, the United States had a new doctrine for winning the Cold War at an affordable cost. NSC 162/2 called for the use of an atomic strike force capable of deterring the Soviets from action. To contain Communism, Eisenhower authorized the expansion of the country's nuclear arsenal and the stage was set for the continued development of nuclear weapons, including what would later be called the Minuteman missile. The number of atomic weapons grew from one thousand in 1953 to more than eighteen thousand by the time President Eisenhower left office in 1961. During this same period, America's military budget dropped from $50 billion in 1953 to an average of $34 billion with savings achieved largely through reductions in troop levels. The increase in the country's nuclear arsenal and the idea that Soviet threats and expansionism would be met with awesome power became known as the policy of "massive retaliation."

***The Problem of Massive Retaliation***

Massive retaliation limited the Eisenhower administration's policy options. The 1954 Dien Bien Phu crisis in Vietnam, for example, demonstrated the limitations of too great a reliance on the nuclear response. Since 1945 the United States had supported France's efforts to defend its colonial presence in Indochina, both militarily and economically, and in 1953, France and the United States adopted the Navarre Plan to prevent the Communist-led Viet Minh takeover of the region. That same year French General Henri Navarre established a military base at Dien Bien Phu in northwestern Vietnam in hopes of luring the Viet Minh into battle. The Viet Minh laid siege on the French and a standoff occurred, with the United States airlifting supplies to the French.

Many of Eisenhower's advisors, including National Security Council (NSC) Chairman Admiral Arthur Radford, believed the only way to save the French was by dropping atomic bombs on their opponents. Eisenhower rejected this suggestion, arguing that nuclear weapons were too destructive to use in a limited conflict, and perhaps too politically damaging to use at all. "You boys must be crazy," he said. "We can't use those awful things against the Asians for the second time in ten years. My God."[xxviii] Without support from either American ground forces or nuclear weapons, the French garrison fell to the Viet Minh on 7

May 1954.

The decision not to use nuclear weapons in Vietnam called into question the administration's policy of massive retaliation and deterrence. Massive retaliation might have been a successful policy for keeping the Cold War in balance and an option for stopping a major Soviet advance into Western Europe– although it was never put to this test–but it did not answer everything. If the administration was not ready to use nuclear weapons in all situations, Eisenhower's strategists reasoned, other options needed to be available to American leaders. Ironically, at an earlier time, Eisenhower had publicly stated that nuclear bombs were like any weapon, and could be "used just exactly as you would a bullet or anything else."[xxix] In

private, however, the president and his top advisors were each beginning to doubt the wisdom and utility of relying solely on the atomic threat. Despite their concerns, Soviet developments would soon prompt the United States to continue and even to expand its nuclear capabilities.

## Sputnik

On 4 October 1957 the Soviets launched the world's first satellite, named Sputnik I. The launching shocked much of the world, not only for its scientific importance, but also because of the implications of this technology for American and Free World security. If the Soviets had rockets to launch satellites, many concluded that they would soon be able to develop ICBMs that could reach the United States. The Soviet achievement moreover demonstrated their technological lead in this field over the United States, and began the space race. As American security was predicated on maintaining technological superiority, Sputnik terrified the nation.

President Eisenhower responded by increasing spending on missile development. In January 1958, three months after the Soviets, the United States successfully launched its own satellite, after a number of publicized failures. At this same time, the Pentagon's feasibility studies for intercontinental missiles, including the Minuteman missile, had been completed, and planning was underway for funding and development of this American military response.

## Kennedy Administration and the First Minuteman Deployment

By the end of the 1950s, many Americans believed their country needed new Cold War policies. They feared for national security in an age of ballistic missiles, and they also questioned the effectiveness of the Eisenhower administration's policies for halting Communist expansion in the Cold War's periphery–those areas outside of Europe and the United States. Many observers believed the next great Cold War conflicts would occur in just these regions. Congress asked for hearings in 1959 to review the United States position in the space race, and Democrats subsequently campaigned against Republican Cold War policies, charging that they had allowed the Soviets to get ahead of the United States in missile development, creating a missile gap. The "gap" represented the difference between the number of missiles it was believed the Soviets possessed and the number of American missiles. Ironically, a missile gap did not exist. In actuality, the Soviets possessed significantly fewer missiles than most Americans believed and Democrats had claimed. Espionage and photographs from U-2 spy planes proved the deficiencies of Soviet nuclear arms, but the administration could not publicly state this fact without compromising national security and letting the world and the Kremlin know about the American spying capabilities. In the 1960 presidential election, Democratic candidate John F. Kennedy narrowly defeated Vice President Richard Nixon. Nixon had refused to compromise national security by leading a countercharge that refuted Democratic claims of a missile gap, and a new administration took office.[xxx]

Kennedy promised to improve American Cold War capabilities, including defense. He supported the Minuteman program and the country's continued development of ICBMs. Kennedy and his administration focused on a new Cold War policy to maximize policy options beyond a massive nuclear retaliation. This new policy became known as "flexible response," and included creation of new Cold War institutions, such as highly trained combat troops known as Green Berets or Special Forces, and even the Peace Corps.

Kennedy also advocated vigilance towards the Soviets. His refusal to bend to Soviet pressure contributed to the Berlin Crisis of 1961 (when he activated his military reserves in response to Soviet demands that the West evacuate its military presence in the city, a crisis that culminated in Soviet construction of the Berlin Wall) and the Cuban Missile Crisis the following year, precipitated by Moscow's planned installation of nuclear missiles in Cuba, only ninety miles from the American coast. An American quarantine of Cuba, and a secret agreement to dismantle Jupiter missiles in Turkey in exchange for removal of the Soviet missiles from Cuba, ultimately eased tensions and avoided disaster, though the world stood closer to the brink of nuclear war than arguably at any other time. Each crisis increased nuclear tensions between the superpowers, who wielded destructive power unknown and unimaginable to previous generations. It is in this context that the Minuteman was deployed and played its Cold War role.

Plate 1. The Big Three Conference at Yalta, 12 February 1945, from left to right: British Prime Minister Winston Churchill, United States President Franklin D. Roosevelt, and Soviet Premier Joseph Stalin
*(AP/Wide World Photos)*

Plate 2. British Prime Minister Winston Churchill, United States President Harry S. Truman, and Soviet Premier Joseph Stalin meeting at the Potsdam Conference, August 1945 *(AP/World Wide Photos)*

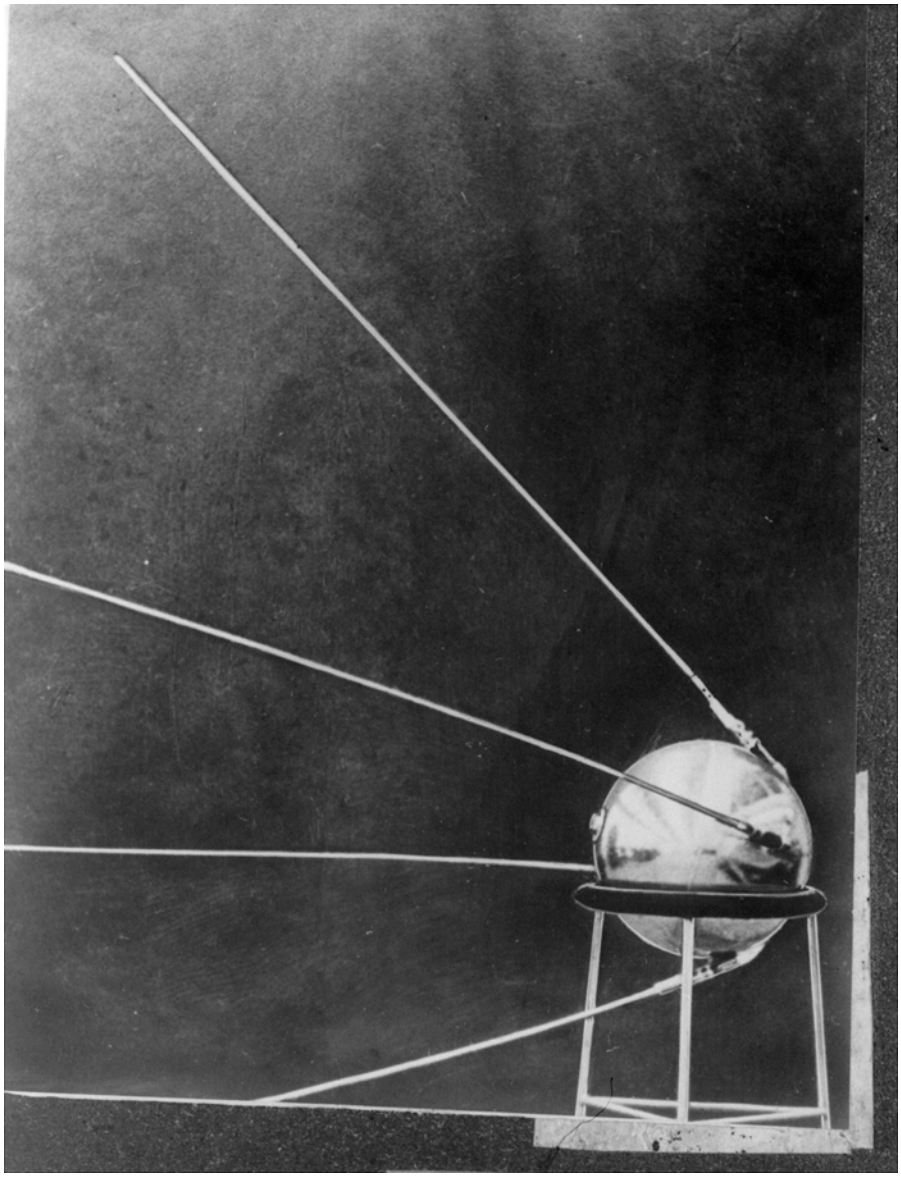

Plate 3. First official picture of the Soviet satellite Sputnik I, issued on 9 October 1957, showing the four-antennaed baby moon resting on a three-legged pedestal *(AP/World Wide Photos)*

Plate 4. President Kennedy (*center*) with Secretary of Defense Robert McNamara (*far left*), SAC Commander General Thomas S. Power (*right*), and Lt. General Howell M. Estes, Jr. (*right background*) at Vandenberg Air Force Base, California, March 1962 *(Courtesy U.S. Air Force, History Division)*

# Chapter 2: U.S. Strategic Missile and Armament Systems (1950s–60s)

## Intercontinental Ballistic Missile Program Beginnings

The Minuteman program was a Cold War story, but development of the missile system offers its own history. This section explores the evolution of America's ballistic missile program, of which the Minuteman would play a vital role. By the time of the Cuban Missile Crisis in 1962 the United States had succeeded in developing nuclear missiles with intercontinental range. However, America's early forays into strategic missiles suffered from a lack of funding, bureaucratic infighting, and interagency tensions that slowed early research into missile armament systems.[xxxi] Although the progression from piloted weapons systems to missiles seems obvious in retrospect, that conclusion remained uncertain at the onset of the Cold War.

Many high-level politicians and military officers began to think more seriously about Intercontinental Ballistic Missile (ICBM) development in response to these tensions, leading the Air Force to initiate a crash program in ICBM development through the newly formed Air Research and Development Command (ARDC).[xxxii] The ARDC and the new crash program built on previous missile research conducted by the Consolidated Vultee Aircraft Corporation (Convair) for Air Force contract MX-774. Convair's contract had been canceled in 1947 as part of the Air Force's post-Word War II cuts in military spending.[xxxiii]

The news in 1949 that the Soviets had tested an atomic bomb sparked revived interest in air defense systems, though of course, in an age of aerial warfare, the potential for long-range Soviet strikes upon American soil had never been far from the minds of Washington strategists.[xxxiv] "Attacks can now come across the arctic regions, as well as across oceans, and strike deep…into the heart of the country," General Carl Spaatz, commander of American strategic bombing in World War II told a Senate Committee in 1945. "No section will be immune," he warned, "the Pearl Harbor of a future war might well be Chicago, or Detroit, or Pittsburgh, or even Washington."[xxxv] North Korea's 1950 invasion of South Korea–an attack perceived by many Western strategists as part of a concerted global strategy by the Soviets–made Western fears of attack seem all the more prescient.

***Air Research and Development Command***

The Air Force established the ARDC in 1950 specifically for development of the Air Force missile program.[xxxvi] Many issues remained to be solved before the ICBM could get off the ground. Development of the ICBM program was hampered by resistance on the part of one branch of the Air Force, the Air Force Air Staff (Air Staff), and inefficient cooperation between different branches of the military.[xxxvii] The Air Staff was the planning body within U.S. Air Force Headquarters. As a Major Command, the ARDC (later known as the Air Force Systems Command) was below the Air Staff in the hierarchy of the U.S. Air Force.[xxxviii] Initially the Air Force opposed further research and development on the grounds that available technology was not advanced enough for the successful development of missiles with intercontinental range. Members of the Air Staff questioned the reliability and effectiveness of ICBMs.[xxxix] Additionally, the culture within the Air Force at the time favored development of bombers and the integration of missiles with aircraft development. Achievement of high rank in the service required pilot training and command of squadrons or wings, and only officers could be pilots. These flyers were thus naturally hesitant to endorse a new and potentially significant weapons system that carried the potential of diminishing the value of their skills (as pilots) to the Pentagon. Indeed, the Air Force went so far as to designate its missiles "pilotless aircraft," implicitly signifying that any real aircraft carried a human commander. The lack of an integrated development plan further hampered missile research and development and budgetary issues resulting from President Truman's economy drive compounded the problems of developing the ICBM program. Only after the Air Force began to integrate its missile program with its aircraft program did it become apparent that missile development needed a separate, focused effort.[xl]

The Air Force had competition in missile development from both the Army and the Navy. Missile development programs underway at the beginning of the 1950s included the Army's Redstone project, headed by Wernher von Braun and the Jupiter Intermediate Range Ballistic Missile, as a joint venture between the Army and Navy.[xli] The Air Force found itself in a position of losing its defensive capabilities

and therefore stature in the armed forces if it did not keep up with missile technology.

Rather than allowing themselves to fall behind technologically, the Air Force overcame its reticence and approved a contract with Convair in January 1951 for development of a ballistic missile carrying a heavy nuclear payload with a five thousand-mile range and a circular error probable (acceptable radius of target error) of 1,500 feet.[xlii] This new missile project, known as the MX-1593 or Atlas, was largely based on Convair's earlier Air Force project, the MX-774. Convair now built on earlier engineering efforts to create the Atlas ICBM.[xliii]

In 1952 Trevor Gardner, Special Assistant for Research and Development to Air Force Secretary Harold E. Talbot, asked the Air Force for performance specifications and a justification of the deployment schedule for the Atlas. The response from the ARDC asserted that "the ballistic rocket appears, at present, to be the ultimate means of delivering atomic bombs in the most effective fashion."[xliv] Funding for the Atlas remained limited, however, and important logistical problems had to be overcome in its development before it could meet the Air Force's requirements.

Bomb weight, maximum range, and nose cone design to withstand reentry were three formidable early problems faced by missile developers. However, scientific advances created thermonuclear devices that were lighter than earlier generations of nuclear weapons while possessing more destructive capability–in 1952 the validity of thermonuclear detonation was proven. During this same period, more powerful liquid-fuel engines became available and it became clear that ICBMs with a range of over five thousand miles could be built. The combination of more powerful engines and lighter bombs solved the problem of limited missile range. The development of a blunt, copper heat-sink in 1952 to absorb the fierce heat of the reentry vehicle solved the third problem.[xlv] Now the ARDC and Convair needed to transfer these new technologies to its Atlas missile system

The Air Staff did not agree with the ARDC on Atlas development and funding and refused to commit the necessary funds for full-scale development. The ARDC refused to give up, citing the urgent need for an ICBM in the interest of national security. The ARDC favored full-scale development on an accelerated schedule, whereas the Air Staff preferred additional research before committing more funding to the program. After two years of political maneuvering, the Air Staff and ARDC reached a compromise in 1953. This agreement produced a development plan that called for the research and development phase for the Atlas to be completed by "sometime after 1964" and for an operational missile by 1965.[xlvi]

***Teapot Committee and RAND Report***

While American leaders worked to develop their own strategic missile force, they also strove to evaluate United States military defense capabilities in relationship to their closest rival. Two committees were formed during this period to study the Soviet Union's potential threat. The Strategic Missiles Evaluation Committee, code name Teapot Committee, was formed in 1953 by Trevor Gardner and was chaired by famed mathematician Dr. John von Neumann of the Institute for Advanced Studies. The Teapot Committee was developed to evaluate current programs and the level of technology of potential enemies

(mainly the Soviet Union), and to recommend solutions for identified problems. A concurrent study focusing on similar questions was conducted by the RAND Corporation, a security studies think-tank with long ties to the Air Force.[xlvii]

Both studies produced alarming findings. They each independently determined that Soviet missile technology had advanced significantly in the short period since World War II, and that only a major push in missile development in the United States could overcome this technology gap. Policymakers of this period fervently believed that falling technologically behind the Soviets in the defense arena would be inviting the disaster of a Soviet attack.[xlviii] The reports also concluded that development of an operational ICBM system within six years was an attainable goal if the Air Force would commit the appropriate talent, funds, and management strategies to the project.[xlix] According to Teapot, the Atlas program in particular–as the most advanced American missile program then under development–had to be accelerated for the sake of national security. President Eisenhower took these findings most seriously, and ordered work on the ICBM program accelerated by assigning it "the highest national priority."[l] The Western Development Division

(WDD), an extension of the ARDC, was created and assigned to spearhead the development of ICBMs.

***Western Development Division***

Trevor Gardner, Air Force Chief of Staff General Nathan F. Twining, and Lieutenant General Donald Putt received approval for a management agency within the Air Force, the WDD, whose primary purpose would be to develop an ICBM.[li] The WDD was created "solely for the prosecution of research, development, test, and production leading to a successful intercontinental ballistic missile."[lii]

The WDD facilitated the rapid development of the Atlas system, and its employees worked long hours to get the job done. For example, Lieutenant General Otto Glasser reported that a normal work-week consisted of ten-hour days, six days a week, with extra time often being put in on Sundays.[liii] The main function of this working group was not to actually build an ICBM, but to work together with private contractors to design the new weapon as quickly and cheaply as possible.[liv] The project became a race against time, with the goal of an operational ICBM by the end of the 1950s–the estimated date for an operational Soviet ICBM.[lv] To many of the workers, the very safety and security of the United States seemed to hinge on the success of their program.

To help meet its goals, the WDD contracted with the Ramo-Wooldridge Corporation of Los Angeles, California to provide technical direction. This joining of forces speaks to the increased size and importance of the ICBM program in the Air Force's eyes. The number of Ramo-Wooldridge staff members assigned to assist the WDD on the ICBM project started with 170 staff members at the beginning of 1954 and grew to 5,182 by the end of 1960.[lvi]

The WDD opened its office in a former elementary school in Inglewood, California, in 1954 with General Bernard A. Schriever, a forty-three year-old well respected brigadier general, appointed as its head. In an attempt to maintain a low profile for this top-secret project, military staff stationed at the WDD wore civilian clothes.[lvii] ICBM chronicler and journalist Roy Neal described the WDD headquarters in these words, "No sign identified the white schoolhouse as the Western Development Division… The windows were frosted and heavily barred. All outside doors, except one, were locked. The only entrance was across a chain-link fenced parking lot. A security guard manned the door… Some of the old-timers recall… the comment of the school boy who was sauntering by the school buildings. Eying the frosted glass and steel-barred windows, he said to a chum, 'Boy am I glad I don't go to school here.' "[lviii]

The WDD staff began their work designing and coordinating the construction of the Atlas ICBM. In 1955, the WDD requested and received Air Force approval to develop a second ICBM, the Titan, concurrently with the Atlas. The WDD initiated the research and development on the Titan in the hope that if Atlas was delayed, Titan with slightly different engineering could be made operational by the end of the 1950s and keep the United States from falling behind in the missile race.[lix]

## Liquid-Fuel Intercontinental Ballistic Missiles: Atlas and Titan

One of the most important early problems tackled by missile developers working with the WDD was that of fueling the rocket, or more accurately, of finding a fuel that would be effective in flight, but also safe on the ground. Early ICBMs were powered by a highly volatile liquid-fuel mixture of liquid oxygen and kerosene or nitrogen tetroxide.[lx] This mix powered both the early ICBMs–Atlas and Titan. Problems with liquid fuel were evident from the early days of development and posed challenges and safety issues for on-site crews. Liquid fuel was heavy and unstable and dangerous to handle and store. Other practical issues included the need to store the fuel outside the missile, loading the fuel just prior to launch. This complication made it necessary to develop a safe system of pumps, storage tanks, and mixing chambers to store the fuel.

The other option for powering the new ICBMs was solid fuel, which was only in the beginning stages of research and development when the Atlas missile program began in earnest in 1954.[lxi] Given the mission of the WDD to produce a working ICBM in the shortest possible timeframe, liquid fuel was the only viable

option for the first ICBMs.[lxii]

***Atlas***

The Atlas missile was the first ICBM activated by the Air Force. The development and deployment of this ICBM was the result of a massive, fast-tracked effort on the part of the WDD, the ARDC, and its contractors. By December 1955, one year after the Atlas development program was taken over by the WDD, there were fifty-six contractors working on the Atlas program.[lxiii] By 1957 the list of contractors had grown to 157.

Early specifications for the Atlas missile required a 240,000 pound vehicle with two 135,000 pound booster engines and a sixty thousand pound sustainer engine. Although Atlas development utilized certain elements of existing technology, including propulsion systems designed for the canceled Navaho cruise missiles, the Atlas design was state-of-the-art.[lxiv] The Atlas missiles had to be pressurized while on alert, because the stainless steel shell was so thin–a requirement of flight–that only pressure kept it in place while on the ground. If the missile was fueled and launched, the liquid oxygen fuel inside the missile created the necessary pressure to hold the missile's shape. This system allowed for a much lighter airframe, but required continual maintenance to prevent structural collapse. In layman's terms, an unpressurized Atlas missile might best be understood as a deflated balloon.[lxv]

The first Atlas ICBM was tested successfully on 17 December 1957 and the first Atlas missile went on alert at Vandenberg Air Force Base in California on 31 October 1959.[lxvi] Atlas missile crews were in place at numerous air force bases by 1961, and a year later, twelve Atlas squadrons were on alert, in addition to the missile at Vandenberg.[lxvii]

Three generations of the Atlas missile were deployed by the Air Force–Atlas D, E, and F. Technological advances would be seen in each new generation of Atlas produced, most notably through improvements in thrust, launch, and guidance system. As the Atlas is the direct predecessor of the Minuteman missile, some key details of the progression of this system will shed useful light on the Minuteman's origins.[lxviii]

*Atlas D*

- First deployed in 1959.
- First deployed at Vandenberg Air Force Base in California, F.E. Warren Air Force Base in Wyoming, and Offutt Air Force Base in Nebraska.
- F.E. Warren Air Force Base had two squadrons with six missiles. Vandenberg Air Force Base and Offutt Air Force Base had three squadrons for a total of nine missiles at each base.
- Possessed 360,000 pounds of thrust and measured eighty-two feet long.
- Propelled by a one-and-one-half stage liquid-fuel rocket.
- The missile was stored horizontally and housed aboveground in soft complexes with gantries or "coffins."
- To launch, the missile roof was pulled back, the missile raised to a vertical position, fueled, and fired.
- The launch sequence began when the two boosters and the sustainer engine were lit. Two small vernier engines above the sustainer ignited shortly after lift-off (2.5 seconds). Booster engines burned once in flight, and these, along with the turbo-pumps, were discarded quickly once a signal was received from the ground station. The sustainer engine was the last to extinguish and the vernier engines were responsible for course and velocity corrections.[lxix]

- Three missiles, a control center, and a radio guidance system were controlled by a single missile crew.
- The radio guidance system was accurate to one and one-half miles and could only control one missile at a time.
- Armed with a one-megaton thermonuclear warhead.
- Range of approximately 6,400 miles.

*Atlas E*

- First deployed in 1961.
- First deployed at Fairchild Air Force Base in Washington, Forbes Air Force Base in Kansas, F.E. Warren Air Force Base, and Vandenberg Air Force Base.
- Nine missiles comprised a squadron. Fairchild, Forbes and F.E. Warren Air Force Bases had three squadrons. Vandenberg had one squadron.
- Atlas E was more powerful than Atlas D, with 389,000 pounds of thrust.
- Range of approximately 9,400 miles.
- Controlled by a self-contained, automatic inertial guidance system accurate to within one and one-half miles.
- Armed with a one-megaton thermonuclear warhead.
- Missiles were stored in aboveground coffins.
- To launch, the Atlas E was raised to a vertical position and fueled.
- A separate launch crew staffed each missile site.

*Atlas F*

- Placed on alert in 1962.
- First deployed at Schilling Air Force Base in Kansas, Lincoln Air Force Base in Nebraska, Plattsburg Air Force Base in New York, Altus Air Force Base in Oklahoma, Dyess Air Force Base in Texas, and Walker Air Force Base in New Mexico.
- Twelve silos and a support base formed a squadron.
- One squadron was deployed at each of the six bases mentioned above.
- More powerful than Atlas E, with 390,000 of thrust.
- Range of approximately 9,400 miles.
- Armed with a one-megaton thermonuclear warhead.
- Controlled by self-contained, automatic inertial guidance system accurate to within one and one-half miles.

- Missile stored vertically in hardened underground silo.
- Missile raised to surface on elevator during launch sequence.
- A single missile was housed in the Atlas F silo with an adjoining underground launch control facility.[lxx]

By 1962 the number of Atlas missiles scattered across the country had grown to 126.[lxxi] Though first, the Atlas was never intended to be the only American strategic missile. It was destined to be eclipsed in its role by the more advanced Titan and Minuteman systems to follow. The last Atlas missile was launched at Vandenberg on 24 March 1995. Rather than a nuclear payload, this Atlas E carried a Defense Meteorological Weather Satellite to orbit.[lxxii]

***Titan I***

The development of the Titan missile resulted from the decision of the WDD and the Eisenhower administration in 1955 to move forward with the development of a second ICBM, in case the Atlas ran into delays.[lxxiii] The WDD developed Titan ICBMs concurrently with the Atlas.[lxxiv] Titan I had several distinct advantages over the Atlas, including greater range, speed, and warhead size. As with the information detailed on the Atlas above, some key moments and statistics for the Titan program will help provide context for the more exhaustive Minuteman discussion to follow. Features of the Titan I include:

- Combat crews began working at the Titan I missile sites in 1961.
- First Titan I went on alert in 1962 at Lowry Air Force Base in Colorado.
- In 1962 Titan I ICBMs were deployed in six squadrons having three missiles each.
- Deployments were located at Beale Air Force Base in California, Ellsworth Air Force Base in South Dakota, Larson Air Force Base in Washington, Mountain Home Air Force Base in Idaho, Vandenberg Air Force Base in California, and Lowry Air Force Base.
- Measured ninety-eight feet long and possessed a self-supporting frame.
- Three missiles were housed in adjacent silos and controlled by a single launch control facility, thereby making this system more efficient for the Air Force to operate.
- A single Titan I, with a range of over 6,300 miles, was capable of launching fifteen minutes after the order was received.
- Two additional Titan I ICBMs in the squadron launch at seven-and-a-half-minute intervals after the first missile.
- Propellant consisted of a two-stage liquid oxygen and kerosene system.
- Missile housed in a 165-foot-deep silo and was raised to the surface for launch.
- Armed with a single four megaton thermonuclear warhead.
- Used to successfully test a “hot” launch directly from the silo. The ability to launch directly from the silo without raising the missile to the surface resulted in a quicker launch time.[lxxv]

Titan I remained on alert for only three years–from 1962 until 1965–before being replaced by the Titan II.

***Titan II***

Titan II was approved for development in 1959 and was designed to correct some of the perceived shortcomings of the Titan I system. Fifty-four Titan II ICBMs, deployed at Davis-Monthan Air Force Base in Arizona, Little Rock Air Force Base in Arkansas, and McConnell Air Force Base in Kansas, remained on active duty until deactivation began in 1982 and was completed in 1987.[lxxvi]

Features of Titan II include:

- Improved inertial guidance and fuel systems.
- Armed with a nine megaton thermonuclear warhead.
- A maximum range of nine thousand miles.
- Employed storable propellants.
- Ability to launch in two minutes.
- Improved rocket engines featured 432,000 pounds of thrust in the first stage and a second stage with 100,000 pounds of thrust.
- Based on the successful tests conducted with Titan I, the Titan II could be launched directly from the silo without having to be raised to the surface.
- Squadrons consisted of nine missiles, each in an underground silo and controlled by a neighboring underground Launch Control Center.
- Two officers and two enlisted combat crew staffed the Launch Control Facility. Beginning in 1978 the first female crewmembers served on the crew of Titan II, setting the precedent for the later mixed-gender Minuteman crews.

As the above discussion demonstrates, both the Atlas and Titan programs offered significant improvements over the manned strategic weapons systems that preceded them. However, each had its shortcomings. The Minuteman was designed to overcome these deficiencies. It is to the Minuteman itself that we next turn.

Plate 5. Air Force Assistant Secretary for Research and Development Trevor Gardner (*left*) and Major General Bernard Schriever (*right*)–two champions in the development of the ICBM
*(Courtesy U.S. Air Force, History Division)*

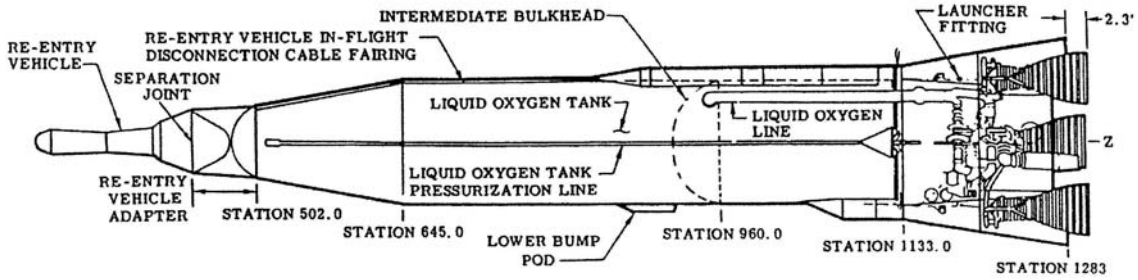


Plate 6. Cutaway drawing of an Atlas D ICBM. Later Atlas E and F missiles used the same airframe but added more powerful engines *(John C. Lonnquest and David F. Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program (Washington, D.C.: Department of Defense, Legacy Resource Management Program, 1996), 210)*

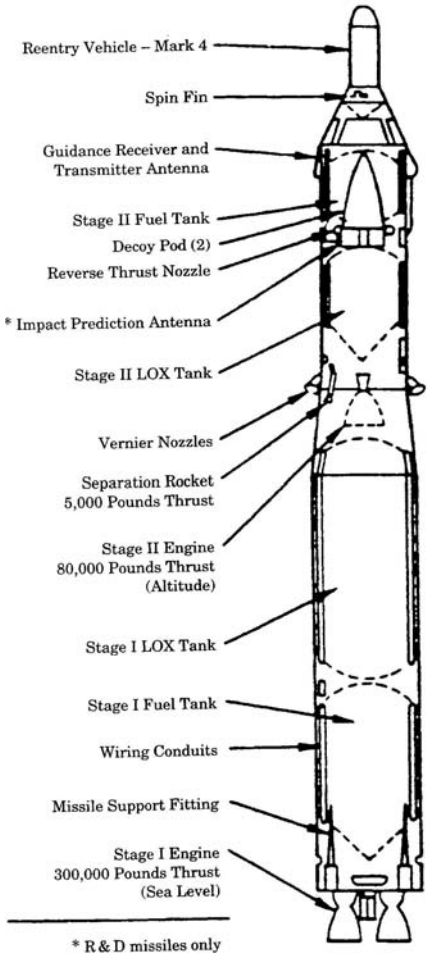


Plate 7. Drawing of Titan I, the United States' first two-stage ICBM *(Lonnquest and Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 228)*

Plate 8. Titan I missile with crew *(Photograph No. B-13-026-2, "Guided Missiles–Martin Titan," U.S. Air Force Photo, Record Group 342, National Archives, College Park, Md.)*

## Chapter 3: Minuteman and the Next Generation (1960s–present)

### The Missile Gap and Minuteman

Although the liquid-fueled Atlas and Titan systems were operational by the early 1960s, the Air Force actively sought to develop another Intercontinental Ballistic Missile (ICBM)–one powered by solid fuel that would be more cost-effective, smaller, and better suited to mass production. This push for improved technology was largely driven by the desire to surpass Soviet missile technology and overcome what seemed a growing "missile gap." The Soviet Union's successful launch of "Sputnik," the world's first man-made orbiting satellite, in 1957, had rattled American policymakers and military strategists to their core.[lxxvii] Sputnik seemingly demonstrated that the Communist World was clearly in the lead in missile technology, and on 23 October 1957, a board of civilian consultants told Central Intelligence Agency (CIA) Director Allen Dulles that the United States trailed the Soviets in this vital field by "two to three years." Production of a Soviet ICBM capable of striking the United States was "nearly" a reality, they warned, and they predicted Soviet deployment of a dozen such missiles by the end of 1958. In their words, the United States was entering "a period of grave national emergency." Within two years, Congressional hearings concerning the "missile gap" provided the public with a view into the superpower race for rockets, whole they simultaneously offered the Air Force opportunity to promote expensive new missile systems. Estimates of Soviet capabilities varied widely through these years. The Kremlin did not publicize its military plans and what claims it did make were rarely trusted in the West, nor did it need to endure the public process of Congressional funding as the Pentagon. Senator Stuart Symington, formerly the first Secretary of the Air Force, used CIA estimates to inform Eisenhower during the Summer of 1958 that the Soviets might have as many as 500 ICBMs by 1961. Flights by high-altitude spy planes such as the U-2 in 1959 and 1960 later fostered lower estimates of Soviet capabilities, though no one in the West could know for certain the true measure of Soviet missile strength.[lxxviii]

Though Democrats would make the "missile gap" an important political issue in the 1960 election, later records disproved its existence. The United States actually possessed greater nuclear strike capabilities at this time. Not only did Western forces field larger bomber forces, but though exact numbers of Soviet capabilities remain impossible to state with accuracy, a problem compounded by their varied range and destructive capabilities, so too was the West ahead in missiles. Before departing office, for example, the Eisenhower Administration increased the scope of its second-generation missiles to 384 Polaris and 540 Minuteman, as opposed to less than one hundred fully capable Soviet ICBMs. Everyone expected both sides to only increase their nuclear strike capabilities in the years to come–just as American policymakers planned to deploy systems such as the Minuteman for decades at least, though in the final analysis, domestic politics and budgetary restraints (or opportunities) affected American missile deployments as much as estimates of Soviet capabilities. As historian Peter Roman has concluded, "ironically, the administration had finally initiated the buildup that the missile gap critics had clamored for–and did it just as intelligence estimates of Soviet missiles were being revised downward." Indeed, the Air Force took advantage of the political atmosphere fostered by the Congressional inquiries and public concern over the missile gap to present an initial plan to Congress for accelerating the Minuteman program beginning in 1960, calling for 445 Minuteman missiles to be operational by January 1965 and eight hundred missiles by June 1965, leaving an exasperated Eisenhower to exclaim "perhaps we should go crazy and produce ten thousand Minutemen." In an era of Cold War fear, the only proper number of nuclear arms seemed the number capable of installing confidence in one's own public, and confidence of an assured retaliation in one's enemy.[lxxix] The new Minuteman missile, designed to be hidden and protected in a hole in the ground, was referred to by President John F. Kennedy following the Cuban Missile Crisis as his "ace in the hole."[lxxx] This was also the title of Roy Neal's 1962 history that chronicled the development of the Minuteman missile.

### Development of Solid-Fuel Intercontinental Ballistic Missiles

The development of solid fuel for ICBMs occurred simultaneously with the deployment of the Atlas and Titan ICBMs. The liquid fuel that powered these rockets added weight to the missile reducing its range, while the extreme volatility of liquid fuels made them dangerous to work with. Solid fuels promised to

allow for smaller and cheaper missiles with greater effective range, while simultaneously eliminating the need for a problematic liquid-fuel system.[lxxxi]

By 1955 missiles propelled with solid fuel proved practical for shorter flights and two years later solid-fuel technology had progressed sufficiently for scientists to recommend large-scale development of a solid-fuel ICBM. Buoyed by these results, the Air Force authorized a series of studies that same year to develop a solid-fuel ICBM that was smaller than either the Atlas or Titan. Contracts to study solid-fuel missiles were finalized in 1956, and, rather than being completed in-house by the WDD, the work was awarded to the Wright Air Development Center (WADC), a private corporation contracted by the Air Force for missile development. The WADC directed the work of companies such as Aerojet-General, Thiokol, and Phillips Companies as they proceeded with solid-fuel feasibility studies.[lxxxii] General Bernard Shriever, who headed the Air Force Ballistic Missile Division (the WDD prior to renaming in 1957) during the first years of the Minuteman program, felt that the transition from liquid to solid fuel, with its more powerful engines, greater range, and increased safety, was the most significant advancement in ICBM development, allowing the United States to jump ahead of the Soviets in missile technology.[lxxxiii]

## Minuteman I

***Development***

The Minuteman grew from this massive effort, and a further illumination of the role played by its principal designers in the early years of development offers valuable insights into the Minuteman's initial design. While WADC oversaw its solid-fuel studies, Lieutenant Colonel Edward (Ed) Hall of the Ballistic Missile Division (BMD) had been transferred from the faltering Thor Intermediate Range Ballistic Missile program to his own office within the BMD. General Shriever gave Hall the freedom to design a solid-fuel missile, designated at that time Weapons System Q. Hall distilled the growing mass of information produced by the variety of contracted studies on solid fuel and other missile technologies. Hall generally worked alone, at first without even an administrative assistant. The one person Hall collaborated with regularly was Barney Adelman of Ramo-Wooldridge. Hall and Adelman worked to produce a design for a solid-fuel missile.[lxxxiv]

Hall ultimately incorporated technologies developed by a series of recent Air Force studies, including new swivel nozzles to control missile direction and an accurate method of shutting off the engines. In addition, he used previous studies to calculate warhead size and weight and research on solid fuel to determine the distance the missile could travel. Hall's final feasibility study, produced in 1957, outlined a series of missiles powered by the new fuel technology he named the "Minuteman" as a symbolic reminder of the country's military past and to reflect the quick response time of the missile system. Minuteman was designed to be an efficient, reliable weapon that could be mass-produced, stand unattended for long periods, be operated and maintained by small crews, stored and launched from underground silos, and automatically monitored for condition and combat readiness. It offered, in short, the solution to the troubling missile gap.[lxxxv]

The Air Force accepted Hall's design–retaining the name Minuteman–in March of 1958, and began planning for funding and developing a Minuteman force.[lxxxvi] The Pentagon initially planned to deploy one hundred Minuteman missiles by 1964 and another four hundred by 1965.[lxxxvii] Delays and budget troubles plagued the early development of the Minuteman, however. Though the Air Force positioned itself solidly behind the development of the Minuteman, the Joint Chiefs of Staff (JCS) did not share their enthusiasm for the Minuteman program, preferring other strategic defense options, such as the Intermediate Range Ballistic Missiles, Thor and Jupiter. Rumors of stalling tactics on the part of the JCS began to circulate. The Air Force Ballistic Missile Committee and the Office of the Secretary of Defense backed the Minuteman development, but a request for $150 million for fiscal year 1959 was initially reduced to $50 million.[lxxxviii] Without those extra funds, the Minuteman's supporters warned, the missile would not be ready for operational deployment by the early 1960s.

Funds were not forthcoming until the BMD and the Air Force persuaded General Sam Anderson, commander of Air Research and Development Command (ARDC), Chief of Staff General Thomas D. White, Vice Chief of Staff General Curtis LeMay, and Secretary of the Air Force James Douglas of the

viability of the Minuteman.[lxxxix] General Schriever asserted to these men that there were no problems with either the concept or design of the new missiles and he asked for flexibility in carrying out the first part of a development program. He stated that he could prove his point within six months, if given the funding.[xc]

After the general finished convincing his immediate superiors of the viability and utility of the program, he turned his attention to the three men who would make the final decision on Air Force program funding– Secretary of Defense Neil McElroy, Assistant Secretary of Defense William Holaday, and Deputy Assistant Secretary of Defense Donald Quarles. General Schriever arranged a deal whereby the BMD received $50 million for the first six months of 1959. If in that time the BMD could prove the efficacy of the Minuteman, the remaining $100 million would be released for Minuteman development.[xci]

By 7 January 1959, the Air Force established an operational schedule for the Minuteman. The first flight test was to take place in December 1960 with an operational weapon system in place by 1963. This ambitious schedule generated a great deal of skepticism on the part of outside scientists and government officials, but Schriever and his team were certain that the program could succeed. To close the "missile gap," and more importantly to prove that they were the best service to do so, the Air Force needed the Minuteman, and in a hurry.[xcii]

***Testing***

The BMD successfully launched a "tethered" Minuteman I prototype on 15 September 1959. This test showed that the Minuteman could be fired directly from an underground silo, prompting the Air Force to fast-track the program in the hopes of having the first Minuteman I on duty by 1962.[xciii] The production of the first operational Minuteman I force was approved in March 1960 and consisted of 150 missiles assigned to a single missile wing at Malmstrom Air Force Base in Montana. The wing had three squadrons with fifty missiles each. Construction on the operational facility to house the missile wing at Malmstrom began in March 1961.[xciv] The previous month at Cape Canaveral, the first full test of a Minuteman I proved successful–the missile deposited its warhead 4,600 miles from the launch site.[xcv] During these tests the missiles did not employ armed atomic warheads. *TIME* magazine reported that an awed observer murmured "Brother, there goes the missile gap" and described the successful test flight as follows, "Even for sophisticated missile watchers, the men who have marked the flight of so many of Cape Canaveral's great fire-breathing birds, last week's show was a dazzling spectacle. The blast-off was swift and sure; there was none of that heart stopping hover of other tests when liquid-fueled monsters seemed to balance in uncertain equilibrium before they picked up the momentum of flight."[xcvi]

Secretary of Defense Robert McNamara, a longtime advocate of a strong strategic defense and the elimination of the missile gap, became a leading advocate, within the new Kennedy Administration, of the Minuteman program following a March 1961 visit to the BMD. During this visit scientists demonstrated their advances in solid-fuel technology. McNamara walked away from this meeting more convinced than ever of the need, and of the value, of the new Minuteman missile system.[xcvii] The production of the Minuteman I proved successful, and by 1964 McNamara determined the Minuteman missile force would consist of one thousand missiles. As with any program of this size (and expense), his determination of this number was reached only after lengthy consultations with the JCS, the National Security Council, the White House, think tanks such as RAND, and congressional leaders. By June 1965 the Air Force was on the way to meeting this target, with an operational force of eight hundred Minuteman I missiles located at Malmstrom Air Force Base, Ellsworth Air Force Base in South Dakota, Minot Air Force Base in North Dakota, Whiteman Air Force Base in Missouri, and F.E. Warren Air Force Base in Wyoming.[xcviii]

***Design***

Minuteman I was designed to be a "highly reliable, three-stage, solid-propellant weapon" that could endure long periods in storage and travel over five thousand miles to reach its target.[xcix] This was further than any of the earlier generations of ICBMs. Yet the Air Force required more than simply a new missile to make the Minuteman system work. Launch Facilities (LFs) and other support structures had to be designed in order for the Minuteman to prove an effective deterrent to Soviet aggression.

The initial Minuteman I force was divided into five missile wings of either three or four missile squadrons per wing. Fifty missiles made up a squadron, and each squadron was further divided into five flights of ten

missiles. A flight had its own Launch Control Center (LCC) that monitored ten LFs. To reduce its vulnerability to enemy attack, each flight was dispersed across several miles, with the LCC located a minimum of three miles from any missile and the missiles similarly distanced from each other.[c]

In Minuteman I wings I and II electrical and environmental support equipment were initially located aboveground in the Launch Control Facility (LCF) support building. The missile system was constructed during a time when the doctrine of "massive retaliation" directed strategic planning–the military expected to launch the entire Minuteman I force in retaliation for a Soviet attack, and though a grim prospect, post-attack survivability of more than several hours for the crew was consequently not considered an essential feature of the design.[ci] This strategy changed with the construction of Minuteman I wings III to V, and LCC support equipment moved underground as part of the new "controlled response" strategy, which called not only for the possibility of a limited or controlled American nuclear response, but also consequently for post-attack missile survivability. No one thing prompted this change in American strategic thinking. Rather, "controlled response" developed organically by the close of the 1950s as a potential answer to the limitations of "massive retaliation," most specifically the way an all-or-nothing nuclear response to potential superpower conflicts threatened to too severely limit the options available to policymakers engaged in a crisis. By developing the ability to strike with limited components of their nuclear arsenal, American policymakers hoped to achieve not only greater flexibility in the international arena, but also greater success as well, as "controlled response" led to the Kennedy Administration's famed "flexible response" policies, which called for non-nuclear and even irregular (such as the Special Forces) applications of military might. Not every crisis warranted a full-scale nuclear response, after all, and by the 1960s, American leaders demanded the tools necessary to meet the changing needs of a Cold War fought increasingly in the global periphery.[cii]

***Contractors***

Boeing received the original contract for the design, assembly, and testing of Minuteman I in October 1958 and later contracted to develop hardware and electronics and check operational facilities.[ciii] Other associate contractors for the Minuteman system included AVCO and General Electric for reentry vehicles designed to deliver nuclear warheads to their targets, Autonetics Division of North American Rockwell for guidance systems, and Bell Aerosystems for post-boost control and a navigation system for the reentry vehicle. The post-boost controls served the critical function of controlling the reentry vehicle after it had separated from the missile and began to descend to its target. Sylvania won the contract for the ground electronics system and TRW Systems headed up systems engineering and technical direction.[civ]
Three contractors were chosen to develop the three solid-propellant stages for Minuteman I. Each of these three stages performed specific functions. The first stage launched the missile, the second stage provided additional thrust as the missile traveled towards the target, and the third stage propelled the reentry vehicle with its nuclear payload back into the atmosphere and to its designated target.[cv]

The Thiokol Chemical Company built the first stage–the M55 motor. The M55 produced two hundred thousand pounds of thrust using a combination of Thiokol synthetic rubber, powdered aluminum, and ammonium perchlorate (AP). Its steel casing utilized four small, swiveling nozzles for propulsion and navigation. Aerojet-General constructed the sixty thousand-pound thrust second-stage engine, which was fueled by polyurethane and AP, while also employing swiveling nozzles and a steel casing. Aerojet-General replaced the steel casing initially employed in its engine with lighter and stronger titanium in 1962. The third stage was constructed by Hercules and consisted of a thirty-five thousand pound thrust motor with a composite AP propellant and a technologically advanced glass-fiber filament-wound casing.[cvi] By employing so many contractors for the Minuteman I project, the Pentagon managed to spread earnings from the lucrative missile program throughout the American aerospace industry, providing jobs for thousands of workers and profits for even more investors, and pleasing politicians with companies in their home districts. The variety of contractors also ensured the wide-spread dissemination of advanced technologies and procedures throughout the industry, in what was effectively a Pentagon-sponsored investment in the education and research of its most vital defense firms.

***Minuteman Production Board***

Boeing and a group of other associate contractors managed the design and building of the Minuteman I missiles. Because of the large number of contractors involved in the project, contract management for

Minuteman production became quite cumbersome and in 1962 Major General Thomas Gerrity, head of the Ballistic Systems Division of the BMD, brought the associate contractors together to seek a more efficient production program in order to ensure a timely completion.[cvii] Representatives from Boeing, Thiokol, Hercules, Aerojet-General, AVCO, Space Technology Laboratories, and Autonetics were invited to the meeting, which ultimately established the Minuteman Production Board. This group of associate contractors had unprecedented direct participation in assembling the Minuteman system. Each associate contractor had a member on the board. Board members also had the authority to commit to corrective measures to address any production problems that arose.[cviii] By putting their reputations on the line, and by simultaneously providing each contractor with the flexibility and opportunity to solve any unforeseen problems in their own product, Gerrity's production board managed the Minuteman program with impressive efficiency.

***Capabilities***

The missile the Air Force and contractors produced was a marvel for its time. Minuteman I stood 55.9 feet long and, when fueled and armed, weighed sixty-five thousand pounds with a maximum speed exceeding fifteen thousand miles per hour. The first Minuteman I, model IA, could travel approximately 4,300 miles, which fell short of the expected range of five thousand miles due to a problem with the swivel nozzles that controlled the missile's propulsion. The Air Force subsequently produced the Minuteman IB, which had an improved second-stage motor housing made of titanium. The new housing improved on the steel housing used for the Minuteman IA, lightening the missile and increasing its range over the Minuteman IA.[cix] The Minuteman IB traveled approximately six thousand miles to its target. Both missiles featured an inertial guidance system designed to deliver a single warhead to a preprogrammed target halfway around the world in less than half an hour after launch.[cx]

***National Site Selection***

The Air Force went through a rigorous process of selecting sites to house its Minuteman missiles. During the early stages of Minuteman I deployment, the site location was restricted by the maximum flight distance of the Minuteman IA. This range led the Air Force to search for sites in the northern United States, bringing the missiles within closer range of the Soviet Union.[cxi]

Other factors restricted site selection for the new Minuteman. For example, sites had to be within the continental United States lest foreign states argue that the housing of missiles on their territory gave them a say in their use. In the early days of the Cold War, for instance, the Truman and Eisenhower administrations encountered the British government's insistence that nuclear weapons aboard American bombers based in the United Kingdom could only be used with London's approval.[cxii] Additionally, the Air Force required that Minuteman I ICBMs be spaced far enough apart to be considered separate targets, so that one Soviet strike would not debilitate a significant number of American missiles. The missiles also had to be far enough inland to be outside the range of sea-launched Soviet missiles, yet still within effective range of identified enemy targets. To reduce the expense of deploying Minuteman I, the Air Force located the command and support facilities for the new Minuteman weapon system at existing Strategic Air Command (SAC) bases.[cxiii] (For a discussion of SAC, see Section II, Chapter 2: U.S. Air Force, Strategic Air Command, and Ellsworth Air Force Base). By using existing bases, the Air Force took advantage of existing infrastructure, and avoided the need to develop a site from the ground up.

***Army Corps of Engineers***

The Army Corps of Engineers (Army Corps) held the responsibility for construction administration and construction of the Minuteman LFs and LCFs. Once the support bases were identified by the Air Force, the Army Corps, the BMD, and SAC Headquarters at Offutt Air Force Base in Nebraska sited the individual silo sites. The team worked together, conducting soil analyses and topographical and geographical surveys to help locate the specific locations for the missile silos.[cxiv] By 1960 decisions on site locations had been made and the construction of the Minuteman I LFs and LCFs was well under way.[cxv]

Given the location of most Minuteman sites on the upper plains, the Omaha District of the Army Corps of Engineers (Omaha District) oversaw the construction of the Minuteman LFs and LCFs. The construction of the LFs was, in the words of historian Ernest Schwiebert, "the largest financial outlay of the ballistic missile program."[cxvi] However, the construction of the facilities for Minuteman I at Minot Air Force Base

in North Dakota in the early 1960s were estimated by the Army Corps to cost $400,000 per silo, which was significantly cheaper than the cost of the earlier Atlas and Titan systems in the late 1950s and early 1960s at $2 million per silo. The special fueling facilities required for the liquid-fuel ICBMs and smaller size of the Minuteman I resulted in this difference in price, further proof of the Air Force's claim that the Minuteman would save money while providing a more powerful nuclear deterrent.[cxvii]

Typically, the Omaha District supervised the Minuteman installations and planned for their specific location, and then hired private contractors to build the facilities. Omaha's Peter Kiewit Company won the right to serve as prime contractor for construction at many of the missile sites. The Omaha District provided design services and contract management for construction of Minuteman's ground facilities at F.E. Warren Air Force Base in Wyoming, for example, as well as Ellsworth Air Force Base in South Dakota, Minot Air Force Base in North Dakota, and Grand Forks Air Force Base in North Dakota.[cxviii] The construction at Minot Air Force Base displays the scope of the effort required to construct the LFs and LCFs for the Minuteman missile. The Minot site demanded construction of 150 silos and fifteen LCFs in a twelve thousand-square-mile area. During peak construction, Kiewit and its subcontractors employed six thousand workers, 1,100 vehicles, and 115 cranes to keep construction on pace to meet the aggressive project schedule.[cxix]

By December 1962 Minuteman IA had been deployed at Malmstrom Air Force Base in Montana. The Air Force also deployed the upgraded Minuteman IB with a titanium second-stage engine case at Ellsworth Air Force Base, Minot Air Force Base, F.E. Warren Air Force Base, and Whiteman Air Force Base in Missouri. The Minuteman I missiles at these bases were clustered around former Atlas complexes. By June 1965, eight hundred silos across the country housed the new Minuteman I ICBMs.[cxx] The complete installation of the Minuteman I LFs eventually took ten years and faced a range of challenges dependent on the specific conditions at each site. Adverse conditions varied from particularly trying winters to soil conditions that required special engineering techniques to construct structurally sound missile silos and underground LFs.[cxxi]

Once activated, the Minuteman missile was always in a state of readiness requiring less maintenance than earlier missiles and this impact was described by Lt. Col. George V. Leffler, commander of the 100th Strategic Missile Squadron, "The Minuteman is like getting a new car and not getting the keys. You can't drive it. You have no sense of ownership. With a liquid missile, you can run it up out of the silo on the elevator, fuel it, go into the countdown. We can't touch a thing."[cxxii]

## Minuteman II

### *Development and Design*

Even as the Air Force began deploying Minuteman I missiles in 1962, research and development into the Minuteman II had already begun. The new Minuteman was created to improve on the missile guidance systems, payload capacity, and anti-missile defenses of the Minuteman I. Minuteman II facilities offered survivability more in line with the Kennedy administration's "controlled response" doctrine. The first test launch of Minuteman II occurred at Cape Canaveral in 1964 and the first operational launch occurred one year later. As part of the Force Modernization Program begun in 1966 to modernize the Air Force missiles, the Minuteman II ICBMs eventually replaced the entire fleet of Minuteman I ICBMs. In 1968, just three years after the first test launches, 350 Minuteman II ICBMs were in the ground. Between 1969 and 1975, the program replaced the Minuteman I with Minuteman II missiles, and upgraded LCFs and silos to accommodate the more sophisticated missile.[cxxiii]

### *Capabilities*

The second generation of the Minuteman missile, Minuteman II, differed from its predecessor in several important ways. It was a larger missile designed to accommodate increased engine and warhead size, measuring 57.6 feet long and weighing seventy thousand pounds. As with its predecessor, Minuteman II was capable of reaching speeds in excess of fifteen thousand miles per hour. Minuteman II offered an improved second-stage engine manufactured by Aerojet-General, improved targeting system, extended range, electronic autopilot, all-inertial guidance system, and an Avco Mark IIC reentry body with a one- to

two-megaton nuclear warhead.[cxxiv] These improvements allowed the Minuteman II to strike targets from a greater distance with greater precision. New anti-missile technology increased the chances of the missile avoiding an enemy's defenses and delivering its warhead. The missile gap had become a thing of the past by the mid-1960s, as American intelligence proved beyond doubt the superiority of American missiles over their Soviet counterparts. However, this fact did not keep the Air Force from continuing to improve its product.[cxxv]

***National Site Conversion***

Much of the work for site selection had already been completed with Minuteman I. When Minuteman II was ready for deployment, the Air Force established priorities for replacement of the Minuteman I missiles, and the first Minuteman II was deployed at Grand Forks Air Force Base, North Dakota, in August 1965. The first operational Minuteman II squadron, the 447th Strategic Missile Squadron, went on alert at Grand Forks Air Force Base in 1966. Minuteman II ICBMs eventually went in the ground at another five SAC bases (Malmstrom Air Force Base, Ellsworth Air Force Base, Minot Air Force Base, F.E. Warren Air Force Base, and Whiteman Air Force Base). Malmstrom Air Force Base was also selected as the location for an additional Minuteman squadron, and LFs and LCFs were consequently constructed at this base.[cxxvi]

## Minuteman III and the Next Generation

In July 1965, after the entire Minuteman I force was declared operational and prior to Minuteman II deployment, the Air Force contracted with Boeing for research and development for the next phase of Minuteman, Minuteman III.[cxxvii] Minuteman III represented a change in the United States' strategic planning, and consequently resulted in additional advancements in missile technology. Minuteman I was designed based on the theory of "massive retaliation" which required the missiles to launch at one time in retaliation to an attack. Minuteman II was designed based on the theory of "controlled response" which required some of the missile fleet to survive a nuclear attack. Minuteman III was designed under a theory of "flexible response" which required the missile to be able to fire independently and target multiple potential aggressors.[cxxviii] Like the earlier Minuteman missiles, Minuteman III underwent rapid development. Five hundred fifty Minuteman IIIs were in the ground by 1977 and Minuteman III sites were later located in Colorado, Nebraska, Wyoming, Montana, and North Dakota. Four hundred fifty Minuteman II and fifty-four Titan II ICBMs remained on alert at this time, after retirement of Atlas and Titan I.[cxxix]

***Capabilities***

Minuteman III stands 59.8 feet long and weighs 76,000 pounds. The new generation of Minuteman employed an upgraded third-stage engine, post-boost navigation control of the reentry vehicle, and an MK12 reentry vehicle possessing three nuclear warheads that could be independently delivered to multiple targets. The upgraded engine and the greater navigation control enabled the weapon to reach multiple targets more quickly and accurately than the previous generations of Minuteman. Previous Minuteman missiles carried a single nuclear warhead and therefore could only strike a single target.[cxxx]

***Advancements in Missile Technology and the Cold War***

Much of the research and development effort to improve missile technology in the later part of the twentieth century centered on increasing the sophistication of the Minuteman III system. Efforts to increase the accuracy of Minuteman reentry vehicles and to design these vehicles to be less detectable by radar were ongoing in the 1970s[cxxxi] Today the Minuteman system is commonly thought of as part of a "triad" defense system involving land-based missiles, submarine-launched ICBMs (known as SLBMs) controlled by the Navy, and Air Force manned nuclear bombers. When analysts use the term triad, they refer to these three independently operated nuclear systems (land-, air-, and sea-based), reasoning that three such disparate systems would collectively prove less vulnerable to enemy attack than any solitary system might be.[cxxxii]

The purpose of America's nuclear program was, at its most basic, one of deterrence. With the ability to launch unprecedented destruction, American strategists reasoned that no foreign foe would dare strike at Western vital interests. Throughout the Cold War, none did. The superpowers fought bitter and brutal

wars on the Cold War's periphery, through proxy states and powers. Korea, Vietnam, and Angola provided stark examples of Cold War geopolitics played out on a local stage, often with deadly results. Minuteman was never designed for such conflicts; it was instead a product built and deployed for one purpose: to deter a direct Soviet strike at Europe or at the United States itself. Its was a global mission.

Ultimately, the Cold War system that spawned Minuteman and the doctrine of mutual assured destruction through nuclear deterrents came to an end. The details of the Cold War's final chapters will be discussed in greater depth in later sections. For now, it is important to note that the Minuteman II system lasted through the end of the Cold War, but not long after. The international system experienced dramatic changes throughout the 1980s. Renewed American military spending following the pain of Vietnam, initiated by the Carter Administration but later taken to new heights by President Ronald Reagan, helped exacerbate East-West tensions following the period of relative détente of the 1970s. Simultaneously, Communist leaders behind Europe's Iron Curtain faced a new spirit of change and reform. Such calls for reform were prompted in part by outside forces (such as Reagan's vitriolic anti-communist rhetoric, improved access to Western media including television broadcasts, and calls for change from prominent human-rights advocates such as Pope John Paul II), but found their greatest expression in domestic reform movements such as Poland's Solidarity. The tide of discontent, when coupled with a growing awareness of their country's inability to match American military spending (and technological advancement more broadly) prompted dramatic changes in the Soviet system by a group of political reformers led by Mikhail Gorbachev. As we shall see, Gorbachev prompted political, economic, and social reforms at home, and helped create a new atmosphere of East-West cooperation, in particular following Reagan's departure from office. The Cold War informally ended in 1989, when West and East Germans spontaneously gathered in Berlin to tear down the hated wall that had divided them for a half-century. It formally ended two years later, when a failed coup attempt in Moscow led ultimately to the dissolution of the Soviet empire in favor of a democratic regime headed by Russia's first post-Cold War president, Boris Yeltsin.

Whether the threat of nuclear annihilation had safeguarded superpower relations during the Cold War, keeping them from mutual assured destruction, can never be fully known or determined. What is clear is that deterrence worked, in the sense that the two sides never came to direct nuclear blows (though as we shall see, they came close), in no small part because of the fear of widespread nuclear war. Minuteman was one such deterrent….against global communism. As we shall see, it was a weapon that came to shape the American landscape, leaving a mark on the men and women who operated it.

Plate 9. Minuteman test launch, Vandenberg Air Force Base, 1963 *("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.012-40, in USAF Collection, AFHRA)*

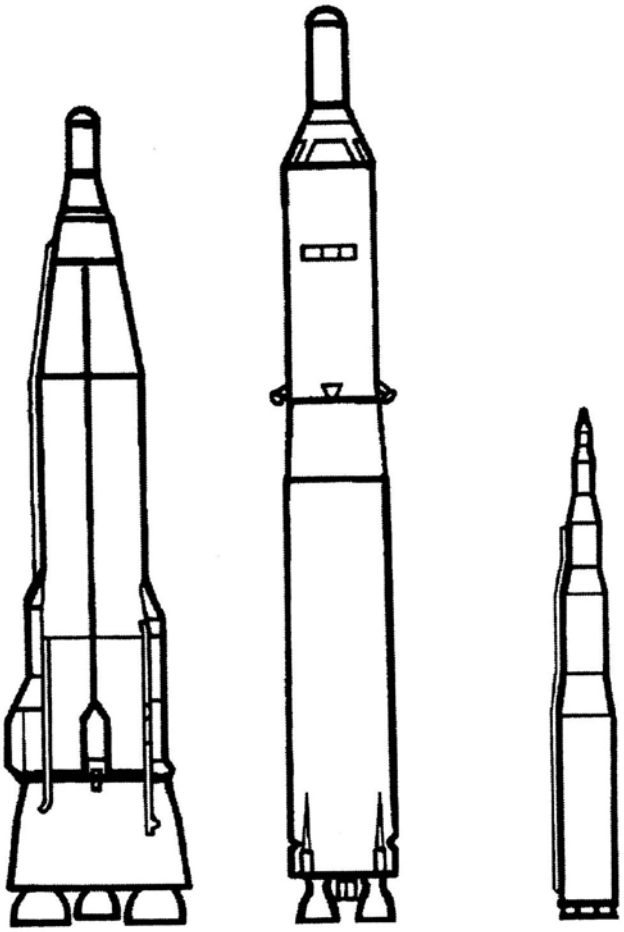

Plate 10. From left to right, scale drawings of Atlas, Titan I, and Minuteman I ICBMs *(John C. Lonnquest and David F. Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 65)*

Plate 11. Full-scale test of Minuteman I missile, Edwards Air Force Base, California, 1960 *(Photograph No. B-08-018-1, "Guided Missiles – Boeing SM-80," U.S. Air Force Photo, Record Group 342, National Archives,, College Park, Md.)*

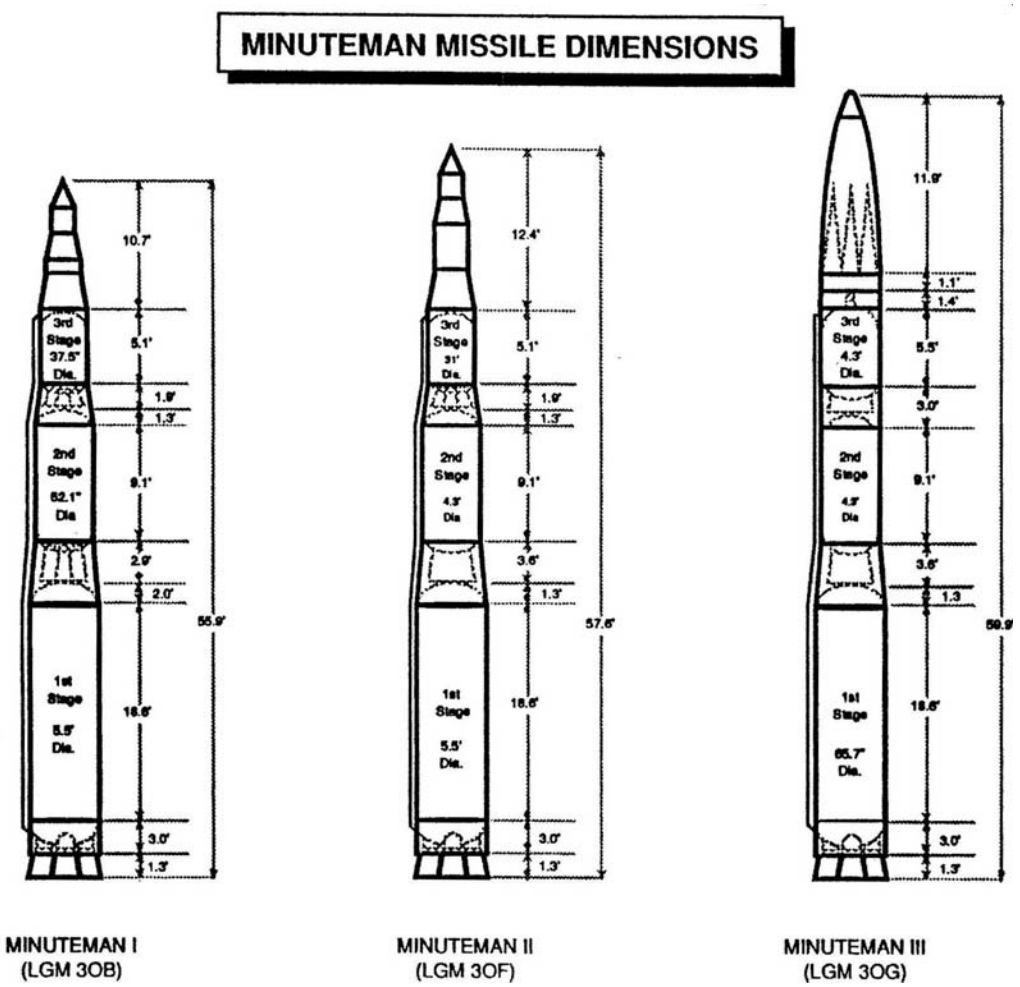


Plate 12. Line drawings showing the evolution of the Minuteman ICBM *(Lonnquest and Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 243)*

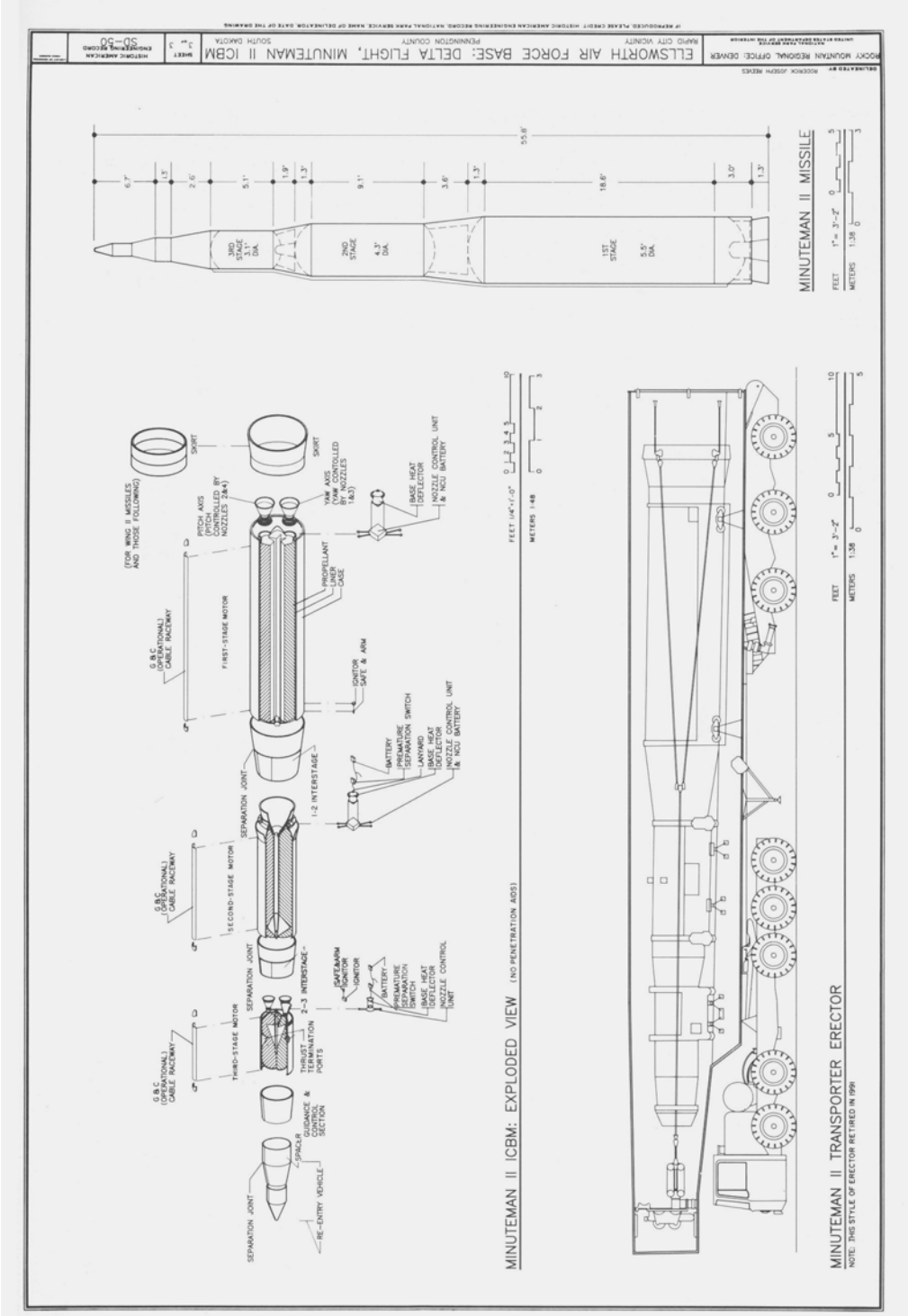


Plate 13. Line drawing showing an exploded view of Minuteman II and the Minuteman II Transporter Erector *(Library of Congress, Prints & Photographs Division, HAER SD-50-sheet 3)*

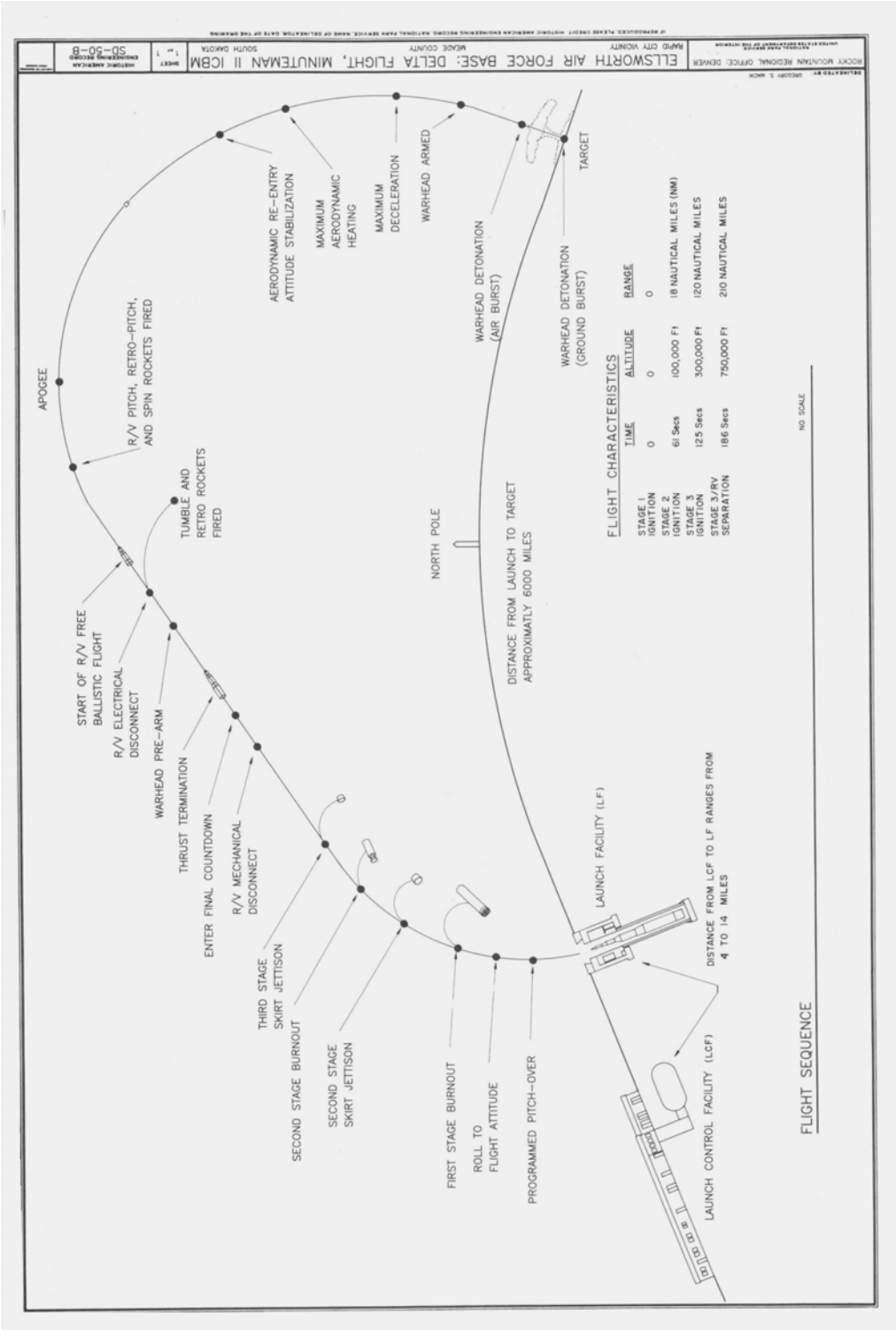


Plate 14. Flight sequence of Minuteman II ICBM
*(Library of Congress, Prints & Photographs Division, HAER SD-50-sheet 4)*

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[i] Michael Kort, *The Columbia Guide to the Cold War* (New York, N.Y.: Columbia University Press, 1998), 3.

[ii] The history of The Cold War was compiled using the following sources: Kort, *Columbia Guide to the Cold War*; Walter LaFeber, *America, Russia, and the Cold War: 1945-1984*, Fifth ed. (New York, N.Y.: Newbery Award Records, Inc., 1985); Derek Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 1st ed. (Boston, Mass.: Little, Brown & Company, 2002), Thomas J. McCormick, *America's Half-Century* (Baltimore, Md.: Johns Hopkins University Press, 1995); and Melvyn P. Leffler and David S. Painter, eds., *Origins of the Cold War: An International History* (New York, N.Y.: Routledge, 1994).
[iii] Paul S. Boyer, *By the Bomb's Early Light* (Chapel Hill: University of North Carolina, 1994), 5.
[iv] Eugene Emme, *The Impact of Air Power* (New York, N.Y.: Norstrand Company, Inc., 1959), 623-626.
[v] Kort, *The Columbia Guide to the Cold War*, 180; LaFeber, *America, Russia, and the Cold War: 1945-1984*, 14-15.
[vi] Kort, *The Columbia Guide to the Cold War*, 160.
[vii] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 25.
[viii] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 23.
[ix] LaFeber, *America, Russia, and the Cold War: 1945-1984*, 38.
[x] Kort, *The Columbia Guide to the Cold War*, 138.
[xi] Kort, *The Columbia Guide to the Cold War*, 138.
[xii] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 26; David Cannadine, ed., *Blood, Toil, Tears and Sweat: Winston Churchill's Famous Speeches* (London: Cassell Publishers Limited, 1990), 303-304.
[xiii] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 25.
[xiv] Jeffery A. Engel, "'Every Cent from America's Working Man': Fiscal Conservatism and the Politics of International Aid after World War II," *The New England Journal of History* 58, no. 1 (2001): 20.
[xv] Engel, "'Every Cent from America's Working Man': Fiscal Conservatism and the Politics of International Aid after World War II," 22.
[xvi] For Truman Doctrine, see Melvyn Leffler, *A Preponderance of Power: National Security, The Truman Administration, and the Cold War* (Stanford, Calif.: Stanford University Press, 1992), 121-127.
[xvii] For Acheson, see Walter LaFeber, *The American Age: United States Foreign Policy at Home and Abroad Since 1750* (New York, N.Y.: W. W. Norton & Company, 1989), 477.
[xviii] Kort, *The Columbia Guide to the Cold War*, 151.
[xix] For "Point Four," see David Baldwin, *Economic Development and American Foreign Policy, 1942-1962* (Chicago: University of Chicago Press, 1966).
[xx] Kort, *The Columbia Guide to the Cold War*, 102, 157.
[xxi] H. W. Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," *The American Historical Review* 94, no. 4 (October 1989): 965.
[xxii] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 970.
[xxiii] On classical liberalism, see Louis Hartz, *The Liberal Tradition in America* (New York, N.Y.: Harcourt, 1985). For republicanism, see for example, Bernard Bailyn, *Ideological Origins of the American Revolution* (Cambridge: Harvard University Press, 1992), and Daniel Rodgers, "Republicanism: The Career of a Concept," *The Journal of American History*, Vol. 79, No. 1. (Jun., 1992), 11-38.
[xxiv] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 966-967.
[xxv] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 967.
[xxvi] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 968.
[xxvii] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 969.
[xxviii] LaFeber, *The American Age: United States Foreign Policy at Home and Abroad Since 1750*, 522.
[xxix] LaFeber, *The American Age: United States Foreign Policy at Home and Abroad Since 1750*, 515.
[xxx] On Nixon and the Missile Gap, see Peter Roman, *Eisenhower and the Missile Gap* (Ithaca, N.Y.: Cornell University Press, 1995), 112-149; and Christopher Preble, ""The Political Economy of National Security in the Nuclear Age: John F. Kennedy and the Missile Gap" (Ph.D. diss., Temple University, 2002).
[xxxi] Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), 239.
[xxxii] G. Harry Stine, *ICBM: The Making of the Weapon that Changed the World* (New York, N.Y.: Orion Books, 1991), 147-149.
[xxxiii] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 240-241.

[xxxiv] John C. Lonnquest and David F. Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program* (Washington, D.C.: Department of Defense, Legacy Resource Management Program, 1996), 29.
[xxxv] M. J. and Mason R. A. Armitage, *Air Power in the Nuclear Age* (Chicago, Ill.: University of Illinois Press, 1983), 16.
[xxxvi] Ernest G. Schwiebert, *A History of the U.S. Air Force Ballistic Missiles* (New York, N.Y.: F.A. Praeger, 1965), 70, 78.
[xxxvii] "Big Week for Pushing Missile Buttons: U.S. Tries Hard to Catch Up," *LIFE* 43, no. 19 (4 November 1957): 31.
[xxxviii] See Lonnquest and Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 30 and Bernard C. Nalty, ed. *Winged Shield, Winged Sword: A History of the United States Air Force*, vol. 2 (Washington, D.C.: Air Force History and Museums Program, 1997), 206 and U.S. Air Force organizational chart at the end of Section II, Chapter 2.
[xxxix] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 31.
[xl] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 66-67.
[xli] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 151, 210.
[xlii] Charles Simpson, "Special History Issue - Land Based USAF Missiles," *AAFM Newsletter* 5, no. 1 (June 1997): 3.
[xliii] Stine, *ICBM: The Making of the Weapon that Changed the World*, 143-144, 152.
[xliv] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 70.
[xlv] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 60-61, 69.
[xlvi] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 31.
[xlvii] Luther L. Stenvick, *The Agile Giant: A History of the Minuteman Production Board* (Seattle, Wash.: Boeing Company, 1966), 19.
[xlviii] Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 19.
[xlix] Stine, *ICBM: The Making of the Weapon that Changed the World*, 166; Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 19-20.
[l] Simpson, "Special History Issue - Land Based USAF Missiles," 3.
[li] Stine, *ICBM: The Making of the Weapon that Changed the World*, 169.
[lii] Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 20.
[liii] Lieutenant General Otto J. Glasser, interview by Lieutenant Colonel John J. Allen, typed transcript, 5 January 1984, 55.
[liv] Stine, *ICBM: The Making of the Weapon that Changed the World*, 170.
[lv] Stine, *ICBM: The Making of the Weapon that Changed the World*, 171.
[lvi] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 90.
[lvii] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 79-80.
[lviii] Roy Neal, *Ace in the Hole* (Garden City, N.Y.: Doubleday & Company, 1962), 64-65.
[lix] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 70.
[lx] Neal, *Ace in the Hole*, 27; Stine, *ICBM: The Making of the Weapon that Changed the World*, 230.
[lxi] Neal, *Ace in the Hole*, 27.
[lxii] Stine, *ICBM: The Making of the Weapon that Changed the World*, 230.
[lxiii] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 93.
[lxiv] The Air Force canceled the Navaho cruise missile in 1957 in favor of developing a supersonic, air-breathing guided missile. For more information on the engineering of the Atlas, see Stine, *ICBM: The Making of the Weapon that Changed the World*, 191.
[lxv] Charles Simpson, "Atlas - Then and Now," *AAFM Newsletter* 7, no. 1 (March 1999): 7.
[lxvi] Simpson, "Atlas - Then and Now," 7.
[lxvii] "The ICBM Force in the Early 1960s," *AAFM Newsletter* 9, no. 4 (December 2001): 1.
[lxviii] Unless otherwise noted, these statistics come from Simpson, "Special History Issue - Land Based USAF Missiles," 1, 7.
[lxix] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 211.

[lxx] Simpson, "Special History Issue - Land Based USAF Missiles," 4.
[lxxi] Stine, *ICBM: The Making of the Weapon that Changed the World*, 227.
[lxxii] "Vandenberg Launches Last Atlas E," *AAFM Newsletter* 3, no. 2 (April 1995): 1.
[lxxiii] Colonel Edward N. Hall, interview by Jack Neufeld, typed transcript, 11 July 1989, 8.
[lxxiv] Simpson, "Atlas - Then and Now," 1.
[lxxv] Stine, *ICBM: The Making of the Weapon that Changed the World*, 229.
[lxxvi] Simpson, "Special History Issue - Land Based USAF Missiles," 1; Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 194, 239; Stine, *ICBM: The Making of the Weapon that Changed the World*, 230.
[lxxvii] William Leavitt, "Minuteman: Ten Years of Solid Performance," *Air Force Magazine* 54, no. 3 (March 1971): 24.
[lxxviii] Roman, *Eisenhower and the Missile Gap*, 30-63. For Symington, see Roman, *Eisenhower and the Missile Gap*, 37.
[lxxix] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 229. Roman, *Eisenhower and the Missile Gap*, 192. For Eisenhower, see Roman, *Eisenhower and the Missile Gap*, 186.
[lxxx] Malmstrom Air Force Base's Alfa Flight was brought to alert status in conjunction with the origins of the Cuban Missile Crisis. Reportedly President Kennedy referred to Malmstrom's Alfa Flight as America's "First Ace in the Hole." The squadron used this as their motto. "10th Missile Squadron," http://www.globalsecurity.org/wmd/agency/10ms.htm (6 October 2003).
[lxxxi] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 186; Neal, *Ace in the Hole*, 28.
[lxxxii] Neal, *Ace in the Hole*, 77.
[lxxxiii] General Bernard A. Schriever, interview by Major Lyn R. Officer and Dr. James C. Hasdorff, typed transcript, 20 June 1973, 8.
[lxxxiv] Neal, *Ace in the Hole*, 82-88.
[lxxxv] Glasser, interview, 67; Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 227; Leavitt, "Minuteman: Ten Years of Solid Performance," 26; Ogden Air Logistics Center, "Minuteman Weapon System History and Description," (Hill Air Force Base, Utah, 1990), 26.
[lxxxvi] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 227; Neal, *Ace in the Hole*, 78.
[lxxxvii] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 227.
[lxxxviii] Neal, *Ace in the Hole*, 95-96.
[lxxxix] Neal, *Ace in the Hole*, 297; Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 228-229.
[xc] Neal, *Ace in the Hole*, 97.
[xci] Neal, *Ace in the Hole*, 97.
[xcii] Neal, *Ace in the Hole*, 103.
[xciii] Leavitt, "Minuteman: Ten Years of Solid Performance," 26.
[xciv] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26.
[xcv] Stine, *ICBM: The Making of the Weapon that Changed the World*, 239.
[xcvi] "Closing the Gap," *TIME* (10 February 1961), 16.
[xcvii] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 186.
[xcviii] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26.
[xcix] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 36.
[c] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 250.
[ci] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 25.
[cii] For the evolution of American military strategy from Truman through Kennedy, David Alan Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960, *International Security*, 7, no. 4 (Spring, 1983), 3-71. For "controlled response" and "flexible response," see Andrew Butfoy, "The Marginalisation of Nuclear Weapons in World Politics? The Case of Flexible Response," *Australian Journal of Political Science* 28, no. 2 (1993): 271-289; and Francis J. Gavin, "The Myth of Flexible Response, United States Strategy in Europe During the 1960s," *International History Review* 23, no. 4 (2001): 847-875.

[ciii] Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 48.
[civ] William, "Minuteman: Ten Years of Solid Performance," 25.
[cv] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 18-19.
[cvi] Stine, *ICBM: The Making of the Weapon that Changed the World*, 239.
[cvii] Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 32-33.
[cviii] Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 32-33.
[cix] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 246-247; Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 77.
[cx] Leavitt, "Minuteman: Ten Years of Solid Performance," 25.
[cxi] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 77.
[cxii] For more detailed treatment of the Churchill-Truman understanding of this issue, see Alan P. Dobson, "Informally Special? The Churchill-Truman Talks of January 1952 and the State of Anglo-American Relations," *Review of International Studies* (vol. 23) 27-47.
[cxiii] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 78.
[cxiv] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 201.
[cxv] Neal, *Ace in the Hole*, 169.
[cxvi] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 139.
[cxvii] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," (Omaha, Nebr.: U.S. Army Corps of Engineers, 1985), 193.
[cxviii] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," 193.
[cxix] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," 193.
[cxx] Stine, *ICBM: The Making of the Weapon that Changed the World*, 240.
[cxxi] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," 194.
[cxxii] James Atwater, "How the Modern Minuteman Guards the Peace," *The Saturday Evening Post* (9 February 1963).
[cxxiii] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 24, 26, 33.
[cxxiv] Some Minuteman II missiles may have been upgraded to Mark 12 reentry body. Stine, *ICBM: The Making of the Weapon that Changed the World*, 240; Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 31.
[cxxv] Stine, *ICBM: The Making of the Weapon that Changed the World*, 240; Leavitt, "Minuteman: Ten Years of Solid Performance," 25.
[cxxvi] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26, 33; Leavitt, William, "Minuteman: Ten Years of Solid Performance," 25.
[cxxvii] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26.
[cxxviii] Irving Stone, "Minuteman: The Best is Yet to Be," *Air Force Magazine* 54, no. 3 (March 1971): 29-30.
[cxxix] Stine, *ICBM: The Making of the Weapon that Changed the World*, 240.
[cxxx] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26; Stone, "Minuteman: The Best is Yet to Be," 29.
[cxxxi] Edgar Ulsamer, "Minuteman: First Among Equals," *Air Force Magazine* 54, no. 3 (March 1971): 35.
[cxxxii] Stone, "Minuteman: The Best is Yet to Be," 30; Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 21.