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CASE STUDY
National War College
National Defense University

“We Choose to Go to the Moon”

An Analysis of a Cold War Means-Developing Strategy

by David Christopher Arnold



National War College

National Defense University

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Cover

President John F. Kennedy tells a crowd of 35,000 at Rice Stadium, Houston, Texas, "We intend to become the world's leading spacefaring nation,"
September 12, 1962 (NASA)

“We Choose to Go to the Moon”

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*National War College
Case Study*



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But why, some say, the moon? Why choose this as our goal? And they may well ask why climb the highest mountain? Why, 35 years ago, fly the Atlantic? Why does Rice play Texas? We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too.

—President John F. Kennedy

September 12, 1962

Rice University

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Executive Summary

Strategists often ask "With the means available right now, what end can we achieve?" However, in strategy design it can be more appropriate to ask, "What is the desired end, and what means are available to achieve it?" The answer to this question may be, "If this is the desired end, first this new capability has to be created." Essentially, what President John Kennedy was asking Vice President Lyndon Johnson in April 1961 was, "What means do I need to generate if I want to beat the Soviets in a space race?" To succeed, the United States had to use the available instruments and elements of national power to create new means to reach the desired end within the time frame that Kennedy set. With the National War College *National Security Strategy Primer* as its guide, and using primary and secondary sources, this case study examines how Kennedy determined he could achieve his ends (beat the Soviets in the world competition) in a particular way (shape the world conversation) using means yet to be created (the moon landing).

Introduction

In April 1961, although President John F. Kennedy had been in office only a few months, the United States continued to trail the Soviet Union in winning the hearts and minds of the global population. Originally planned during the previous administration, Kennedy's poorly executed invasion of Cuba at the Bay of Pigs (April 17–19, 1961) and cosmonaut Yuri Gagarin's quick trip around the globe in a Soviet spacecraft the previous week (April 12, 1961) had only made things worse for the young President. A leaked U.S. Information Agency report had already concluded that foreign public opinion in members of the Atlantic alliance had a "declining confidence in the U.S. as the 'wave of the future' in a number of critical areas."¹ Now newspapers around the world were praising the Soviet space feats. A *New York Times* correspondent suggested that "neutral nations may come to believe the wave of the future is Russian; even our friends and allies could slough away."²

In his inaugural address, Kennedy had pledged to "pay any price, bear any burden, meet any hardship, support any friend, oppose any foe to assure the survival and the success of liberty,"³ a promise that was becoming much harder as his administration faced multiple failures early in its tenure. The U.S. space program seemed an odd place to try to even the score, because, at that time, space had not generated much international or domestic enthusiasm, or even Kennedy's own enthusiasm.

The story of the Apollo program and Kennedy's decision to go to the moon has long been discussed in myriad ways by multiple scholars. John Logsdon's 1970 book, *The Decision to Go to the Moon: Project Apollo and the National Interest*, addressed this topic even as the Apollo program was performing moon landings.⁴ Logsdon elaborated on his argument 30 years later in his book *John F. Kennedy and the Race to the Moon*.⁵ Michael Beschloss's 1997 chapter in *Spaceflight and the Myth of Presidential Leadership* is a brief overview of Kennedy's decision by a renowned Presidential historian. Numerous other papers, articles, books, Web sites, astronaut memoirs and biographies, and symposia have covered the topic of Kennedy's decision to go to the moon.⁶

What, therefore, makes the moon landing worthy of further study for national security practitioners? Often, some of the means to achieve a desired end are not immediately available (coalitions, for example); however, in the story of the moon landing, the difference is wholesale creation. In this case, Kennedy could not just fill in a few gaps with available means but had to create entirely new means to achieve his end.⁷ For example, the United States, having seen the Soviets send probes into the solar system (including to the moon), knew the Union of Soviet Socialist Republics (USSR) had an advantage in booster rockets, but they also knew that neither

side had a booster capable of putting humans on the moon.⁸ If Kennedy had looked at the means available in 1961 and only then determined which ends to achieve, as often happens in strategy, he never would have chosen going to the moon. In short, landing on the moon by the end of the decade was not a viable goal using a traditional strategic approach simply because the means did not exist. It became a viable goal only when assessed through the lens of a means-developing strategy.⁹

Successfully managing the threats of the Cold War was Kennedy's strategic end, as it was for every President from Harry S. Truman to Ronald Reagan. According to former National Aeronautics and Space Administration (NASA) historian Roger Launius, "The U.S. needed allies, and the emerging nations gaining independence after [World War II] were desired for the U.S. coalition. Strength in science and technology was critical in swaying them in that direction. Demonstration of that capability came through numerous means, but space success was an important one."¹⁰ If Kennedy had been a National War College-educated strategist, he might have evaluated the problem in this way: "The Soviet advantage in the space race threatens U.S. security interests because the USSR is using science and technology to draw non-aligned nations into its orbit."¹¹ Getting to the moon first, and thereby convincing the world that the United States was the better choice in the global competition, required *developing* the *means* to accomplish the goal.

Strategy is much more than determining a desired goal (end), deriving the applicable instruments of power to use (means), and then employing those means (ways). Strategy also involves deep consideration of context, costs, risks, and possible benefits. This analysis uses the 2019 *National Security Strategy Primer* as a framing device to analyze Kennedy's space strategy.¹²

The moon program required much more than space technology; it also required the use of diplomatic, military, economic, and information tools to achieve success. In short, Kennedy needed to harness all the instruments and elements of national power if he wanted to succeed in achieving his particular end.¹³ The U.S. space program was a way for the Nation to shape international opinion during the Cold War contest. To succeed, though, the United States had to create the means to achieve the end within the time frame that Kennedy eventually set.

Context

Created in 1958 during the Dwight D. Eisenhower administration, NASA was the public, civilian face of the U.S. space program, representing the Nation's desire for the "constructive peaceful uses of outer space."¹⁴ If "peaceful uses" meant anything short of war, then the overall U.S. space program had already achieved some success in the sense that it was developing

new technologies that would help the United States succeed in the Cold War. The American approach was methodical but slow, and the United States had been consistently behind in the “space race” since Sputnik. The USSR was first to launch an Earth-orbiting satellite, an animal, and a human into space, largely leaving the United States behind. The most important scientific discovery of the space race so far, the Van Allen radiation belts around the earth—discovered by U.S. scientists using a U.S. satellite boosted into orbit from U.S. soil—had amounted to little in the quest for international prestige.

By his own admission, Kennedy was not a “space nut” — “I’m not that interested in space,” he stated in November 1962¹⁵—but he had recognized the importance of the space program even before he took the oath of office by setting up a space committee in his Presidential “transition team.” Kennedy was the first President-elect to use transition teams to get a jump on issues he would face immediately upon assuming the presidency.¹⁶ Nevertheless, he was content to let the U.S. space program run its course, with NASA planning to eventually reach the moon sometime during the 1970s.¹⁷ Although he did not nominate a NASA administrator by inauguration day, in January 1961 Kennedy created an Ad-Hoc Committee on Space, chaired by [Massachusetts Institute of Technology] professor Jerome Wiesner.¹⁸ The report that followed summarized U.S. space activities and emphasized that ballistic missiles were the top national security priority. But the report also emphasized that “national prestige” was another way to evaluate the usefulness of a national space program, predicting that American prestige would “in part be determined by the leadership we demonstrate in space activities. It is within this context that we must consider man in space.”¹⁹

However, after outlining all the benefits of a reinvigorated space program, Wiesner’s team concluded that “a crash program aimed at placing a man into an orbit at the earliest possible time cannot be justified solely on scientific or technical grounds. Indeed, it may hinder the development of our scientific and technical program, even the future manned space program by diverting manpower, vehicles, and funds.”²⁰ The team preferred a more cautious approach: “The acquisition of new knowledge and the enrichment of human life through technological advances are solid, durable, and worthwhile goals of space activities.”²¹ The team recommended taking the emphasis off putting an astronaut in space and instead “make people appreciate the cultural, public service, and military importance of space activities other than space travel.”²² The United States was already taking this approach in its human spaceflight program, but it fell short when Soviet cosmonaut Yuri Gagarin became the first human in space on April 12, 1961.

On April 20, 1961, the day after the Cuba attack failed and 8 days after Gagarin’s flight, President Kennedy sent a memo to Vice President Johnson, chair of the Space Council, asking

for "an overall survey of where we stand in space." Specifically, Kennedy wanted to know if the United States had "a chance of beating the Soviets" by, among other activities, landing an astronaut on the moon. He also asked about potential costs and whether the United States was already fully committed to existing programs, and he wanted answers quickly.²³

Johnson's response came just over a week later, and it was an encouraging one. The team he put together acknowledged that the Soviet Union was "ahead of the United States in world prestige attained through impressive technological accomplishments in space." But, according to Johnson, the United States had greater resources, which so far it had not harnessed successfully. If the United States failed to use that advantage, "other nations, regardless of their appreciation of our *idealistic values*, will tend to align themselves

with the country which they believe will be the world leader—the winner in the long run." In Johnson's opinion, "Accomplishments in space are being increasingly identified as a major indicator of world leadership," so the United States had to act before "the margin of control over space and over men's minds through space accomplishments will have swung so far on the Russian side that we will not be able to catch up, let alone assume leadership."²⁴ In other words, the stakes were nothing less than world leadership during the Cold War.

Fortunately, the memo reasoned, the United States had "a reasonable chance of attaining world leadership in space during this decade," and the best way to demonstrate the advantages of the American system to the rest of the world was by sending astronauts to the moon. Not only would such an achievement have "great propaganda value," but it also would generate "knowledge and experience for even greater successes in space."²⁵ Johnson suggested that a big victory on a level playing field with the USSR could prove to the world that Western liberal democracy was superior to Soviet totalitarian communism.



Russian Major Yuri Gagarin, first man in space, makes 108-minute orbital flight in Vostok 1 spacecraft, April 12, 1961, as reported by *The Huntsville Times*, Huntsville, Alabama (NASA)

Realization/Achievement of Ends

The genesis of the U.S. policy of containment of the Soviet Union during the Cold War came from the strategic thinking that went on at the highest levels of Presidential administrations. But for it to be effective, the ability to implement containment was required; otherwise, it was just an academic exercise.²⁶

Dealing with the problem of the Soviet Union had been part of U.S. policy since nearly the start of the Cold War. George Kennan's "Long Telegram" from Moscow, his "X" article in *Foreign Affairs*, and eventually the Harry S. Truman administration's National Security Council Paper 68 all laid out the same basic approach: The United States must see the USSR "as a rival, not a partner, in the political arena. [The United States] must continue to expect that Soviet policies will reflect no real faith in the possibility of a permanent happy coexistence of the Socialist and capitalist worlds, but rather a cautious, persistent pressure toward the disruption and weakening of all rival influence and rival power." Embedded in Kennan's thinking—first publicly expressed in *Foreign Affairs*—was the belief that by confronting the Soviets and by containing them everywhere, the United States could lead the way to defeating them.²⁷ This bedrock of U.S. policy influenced its national security strategies challenging the Soviet Union for the next six decades.

It is also worth remembering that the goal of containment as a U.S. policy was not to cause the collapse of the Soviet Union; rather, it was to let the USSR crumble from its own internal contradictions, as the first National War College deputy for foreign affairs, George Kennan, predicted it eventually would. Containment meant preventing the Soviet Union from spreading its influence to nations around the world. Using the space race to help implement containment was perfect, too, because it was not an aggressive approach, which some strategists envisioned could lead to global thermonuclear war.²⁸ Instead, using space was an approach designed to *shape* the international context in a way that would lead nations of the world to choose "freedom over tyranny."²⁹ Author John Logsdon argued that an aggressive, militaristic attitude was too confrontational and "the moral equivalent of war."³⁰ Stated NASA Administrator James Webb, "We have to remember that we are fighting for men's minds."³¹

Considering this topic within the context of business strategy, business professor and author Richard Rumelt argued that the moon was a "carefully chosen *proximate* strategic objective," intended as a target the United States could reasonably be expected to reach quickly because "Kennedy diagnosed the problem as world opinion."³² When looking at the moon program from the perspective of the overall containment policy, which Kennedy undoubtedly was

doing, Rumelt's view makes sense. However, Kennedy still needed a strategy to achieve his end of shifting world opinion favorably toward the United States.

Facts and assumptions about the Soviet space program drove the initial stages of the Kennedy administration's approach to space and eventually the decision to go to the moon. The United States knew what capabilities the Soviets already had and could extrapolate some assumptions about what capabilities they might be developing. For example, the Soviets had demonstrated they had a rocket big enough to reach the moon when they launched an SS-6 intercontinental ballistic missile (ICBM) with an upper stage carrying Luna 2 in September 1959, the first object from Earth to reach the moon. The United States also launched probes at the moon in the late 1950s and early 1960s, with Ranger 7 eventually reaching it successfully in 1964 and sending photos of the moon back to Earth.³³

Strategies are built on *assumptions* about opponent capabilities and intent and are needed to "enable and shape the development of any national security strategy."³⁴ Although the Soviets had not yet made a soft landing on the moon, the assumption was that they eventually could. More important, the United States assumed that the Soviets did not yet have a booster capable of carrying humans to the moon and back and that they knew the United States did not either. But by the time of Kennedy's letter to Johnson in April 1961, when the Soviets had already launched Gagarin into space on his world-circling flight, the Soviets were assumed to be working on a plan to transport a human to the moon. It was a fact that the Soviets had a head start. But because they did not yet have a booster capable of sending a human to the moon and back, Kennedy's space team assumed that "with a strong effort, the United States could conceivably be first in those two accomplishments by 1966 or 1967."³⁵

Johnson, therefore, wanted to know what the Soviet Union was planning. In a White House meeting, Senator Styles Bridges (R-NH), ranking member of the Senate's aeronautical and space committee, asked James Webb, "Based on intelligence resources, how does your program compare with the achievements which are to be expected from the USSR?" Answered Webb, "They will be ahead until 1967 or 1968," when NASA expected to reach the moon.³⁶ The race was on.

The Soviets already had used a rocket capable of putting 14,000 pounds into orbit. The payload capability of this rocket was the equivalent of putting several cosmonauts or even a small laboratory into low Earth orbit or soft-landing a payload on the moon. However, the United States assumed that 14,000 pounds was not enough capability to safely get a human to a moon landing and back, which could require at least 10 times the payload, or 140,000 pounds. (In the end, the entire Saturn V heavy lift vehicle that enabled the moon landing weighed 6.2 million

pounds at liftoff, including the 90,000 pounds meant for the moon landing. The Soviet moon rocket, which was called N1 and weighed just over 6 million pounds, failed four test flights.³⁷)

In a letter to Johnson, Dr. Wernher von Braun, director of the Marshall Space Flight Center in Huntsville, Alabama, added some details to the assumptions. Von Braun believed the United States could be the first to send humans to circumnavigate the moon (which it was, on Apollo 8) and the first to land humans on the moon (which it was, on Apollo 11). He knew the United States did not have a rocket with 140,000 pounds of payload capability, and he assumed the Soviets did not either because of the sizable requirements to create a booster 10 times as big as current capabilities.³⁸ But von Braun knew of the Saturn rocket program, which was mostly theoretical at that time, and was convinced that changes to the U.S. booster program could



Wernher von Braun explains Saturn launch system to President John F. Kennedy, November 16, 1963; on left, NASA Deputy Administrator Robert Seamans (NASA)

yield significant results in just a few years. He wrote that it was "unlikely that the Soviets have" a booster capable of landing humans on the moon and that "with an all-out crash program I think we could accomplish this objective in 1967/68."³⁹ If the Soviet Union did in fact have a "super" booster, however, the United States probably could not win the space race, and that might have implications for the Cold War competition. For the time being, U.S. leaders assumed the Soviet lead in the space race was not insurmountable, an assumption they needed to make to proceed.

The United States could also make assumptions about the future based on what it already had established as facts. While it was clearly behind in some of the most spectacular areas in the space race, the United States had a lead in some of the less headline-making space missions. In communications satellites and navigation satellites, the United States already had leads, albeit small ones. The first communications satellite, SCORE, launched from the United States in 1958; the first navigation satellite, Transit, launched in 1959; and TIROS-1, the first weather satellite, launched in 1960.⁴⁰ With some effort, Johnson assumed, the new weather, communications, and navigation programs "could be made operational and effective within reasonably short periods of time and could, if properly programmed with the interests of other nations, make useful strides [for the United States] toward world leadership."⁴¹ These programs, while workmanlike in their purposes and less grand than human spaceflight, were practical and stood a good chance of improving the quality of life around the world. But Johnson also assumed the United States was "neither making maximum effort nor achieving results necessary if this country is to reach a position of leadership."⁴²

U.S. leaders could also make assumptions based on what they knew about the Soviet booster program. The United States knew, for example, that a single R-7 ICBM had been used in all space launches before May 1961 and that a small group of intermediate-range ballistic missiles had been used in other configurations as boosters. The United States also knew that the Soviets had put only 14 spacecraft into space around Earth, the moon, and Venus. The United States assumed this to be evidence of long-range planning "and competent and flexible technical decisionmaking and managerial direction" in the Soviet program.⁴³ Furthermore, the United States assumed the personnel turnover in the Soviet Union was very low, as skilled cadres of development personnel remained in the programs for many years.⁴⁴

On the other hand, some of these assumptions could also have been evidence of the immaturity or even stagnation of the Soviet space program, which at the time could have driven other U.S. strategic approaches. Human capital is an important element of national power. The Soviet Union had multiple ongoing military and civilian rocket programs, and although the United States had been the proverbial tortoise to the Soviet hare, the United States also had

smart, technical people who knew what they were doing. A low turnover rate in development personnel can indicate the potential for stagnating thinking or a lack of creativity in engineering and design work.

On May 3, 1961, the day after astronaut Alan Shepard's scheduled suborbital flight was scrubbed for weather, Johnson held a meeting with the team working on reviewing U.S. space programs to the White House and the two senior members of the Senate Committee on Aeronautical and Space Science, chair Robert Kerr (D-OK) and Senator Bridges. NASA's James Webb spoke, suggesting that Americans could walk on the moon as early as 1967 or 1968, basing his conclusion on what NASA had already accomplished and what it would still have to achieve. He guessed the costs to be \$1.7 billion in fiscal year (FY) 1961, \$3 billion in FY62, and \$4.4 billion in FY63 (the total U.S. budget was \$104 billion in 1961).⁴⁵ With details yet to be worked out, Johnson tasked the team with determining what the U.S. objectives should be for its space program: "I want to know what the national effort should be in your judgment. By working together, we will achieve the national goal."⁴⁶ Just 2 days later, on May 5, NASA finally "lit the candle" and Shepard was launched on his mission, at last putting an American astronaut into space. But because it was a suborbital flight lasting just 15 minutes, the United States appeared to the world to be running a distant second place.

Johnson asked U.S. leaders to spend the weekend working on the task. Senior leaders of NASA, the Department of Defense (DOD), and the Budget Bureau met to produce what has been called "the charter for Project Apollo" but was officially titled "Recommendations for Our National Space Program: Changes, Policies, Goals," which was delivered to Johnson and Kennedy on May 8.⁴⁷ The report, signed by James Webb and Defense Secretary Robert McNamara, outlined proposed changes to the U.S. space program and the projected costs given the current status of U.S. space projects. In this report, the team went beyond simply figuring out how to land a human on the moon, proposing to beef up the entire U.S. space program with new technologies and new capabilities, which in the end affected far more people than did the moon landing. The report laid out several goals that could be achieved by "the latter part of this decade," including developing spacecraft for a lunar landing and return, new launch vehicles and upper stages, new robotic spacecraft for exploring the moon in advance of astronauts and science on the space environment, and technological developments in satellite communications and weather satellites for worldwide weather prediction.⁴⁸

Webb and McNamara also argued, as others had, that space programs were—and are—about more than just technological development: "Dramatic achievements in space . . . symbolize the technological power and organizing capacity of a nation. . . . Major successes, such as

orbiting a man as the Soviets have just done, lend national prestige even though the scientific, commercial or military value of the undertaking may by ordinary standards be marginal or economically unjustified." Acknowledging the enormous costs, marginal scientific value, and high risk, the report argued that success in space was

*a major element in the international competition between the Soviet system and our own. The non-military, non-commercial, non-scientific but "civilian" projects such as lunar and planetary exploration are, in this sense, part of the battle along the fluid front of the cold war. Such undertakings may affect our military strength only indirectly if at all, but they have an increasing effect upon our national posture.*⁴⁹

On the grounds of prestige alone, then, the team recommended, "This nation needs to make a positive decision to pursue space projects aimed at enhancing national prestige."⁵⁰ The report outlined the costs, risks, and feasibility of competing with the Soviets in an international space competition but nevertheless recommended that the "National Space Plan include the objective of manned lunar exploration before the end of this decade."⁵¹

Kennedy's public response 2 weeks later was to add into his "Special Message to Congress on Urgent National Needs" his proposed changes for the space program. Covering topics such as economic and social progress at home and abroad, national security, military, intelligence, civil defense programs, and disarmament, Kennedy left the topic of space until the end of the speech to increase the dramatic impact of the bold goal.⁵² The space portion of the speech contains many of the elements of strategic logic: context, threats, opportunities, and available ways and means to "achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."⁵³

Kennedy's speech laid out the space competition as part of "the battle that is now going on around the world between freedom and tyranny." He explained the context of "the dramatic achievements in space" that were already affecting nations that were trying to determine "which road they should take"—to follow the U.S.- or the Soviet-led world order. "We go into space," Kennedy stated, "because whatever mankind must undertake, free men must fully share." He knew that the Soviets had a head start because of their bigger booster rockets and warned that their capabilities would generate "still more impressive successes" in the months ahead. But he also laid down the threat: "We can guarantee that any failure to make this effort will make us last" in the international competition for hearts and minds and thus cause the United States to



President John F. Kennedy addresses joint session of Congress, May 25, 1961; seated behind Kennedy, from left, Vice President Lyndon Johnson and Speaker of the House Sam T. Rayburn (NASA)

lose the Cold War. And, Kennedy pointed out, the public U.S. approach to the endeavor had “an additional risk by making it in full view of the world.”⁵⁴

Kennedy went on to outline his objectives for the new space strategy: “First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth.” He also suggested aims to produce a nuclear power-propelled rocket, to expand satellite communications, and to develop a world-wide system of weather satellites.⁵⁵ He knew that, in going to the moon, “no single space project in the period will be more impressive or expensive to accomplish,” which the United States would do under the scrutiny of the world. He argued for accelerating development of new lunar spacecraft, liquid- and solid-fueled boosters, and robotic pathfinder spacecraft, all of which required resources in the form of dollars from the U.S. Treasury. While he suggested \$150 million

to accomplish those three developments, he asked for an additional \$531 million for the moon program and \$5 to \$7 billion more over the next 5 years.

Kennedy pointed out that achieving success, however, required not only money but also a "major national commitment of scientific and technical manpower, materiel and facilities," which came with the risk "of their diversion from other important activities where they are already thinly spread." Kennedy also laid out a constraint for Congress to consider as they planned to fund the program, knowing the debates could center on providing less money for a less ambitious approach: "If we are to go only half way, or reduce our sights in the face of difficulty, in my judgment it would be better not to go at all."⁵⁶ In an ad lib during the speech, Kennedy added that he was "confident" Congress would "consider the matter carefully" so that "we are prepared to do the work and bear the burdens to make it successful."⁵⁷

U.S. national interests were certainly at stake in the space race. National interests—the central, enduring ideas from which a state develops all its policies and strategies—are often summarized as physical security, economic prosperity, and preservation of national values.⁵⁸ To these three categories, author Terry Deibel has added as a national interest projecting the nation's values overseas.⁵⁹ Values projection could be added as an interest supporting an argument for Kennedy's space strategy.

The phrase *vital national interests* is often used to refer to interests that states are willing to go to war over. Kennedy defined U.S. vital national interests in his inaugural speech: "Let every nation know, whether it wishes us well or ill, that we shall pay any price, bear any burden, meet any hardship, support any friend, oppose any foe, in order to assure the survival and the success of liberty."⁶⁰ Kennedy and his administration were certain of the U.S. interests at stake in the international competition with the Soviet Union. The U.S. space program fit easily into supporting those national interests as a means to achieving victory over the Soviet Union in "the battle for men's minds" to ensure the success of liberty.⁶¹

Kennedy's approach of using the U.S. space program to support national interests addressed threats to U.S. security, economic prosperity, and values because the Soviet space program threatened the liberal, democratic values of the world order the United States had led since 1945. The Soviets had already developed larger rocket engines than the United States, developments that had directly led to dramatic accomplishments that enhanced Soviet prestige on the world stage. The United States, on the other hand, wrote Johnson in his memo to Kennedy, "had greater resources than the USSR for attaining space leadership but has failed to make the necessary hard decisions and to marshal those resources to achieve such leadership."⁶² With booster development, for example, the United States could both enhance national security and ensure success in

the moon program. In their May 8 memo, Webb and McNamara pointed out that solid rocket motor work also had “future military importance.” Thus, DOD would lead these efforts, but the work could also be useful for NASA’s needs.⁶³ (The Titan ICBM eventually became NASA’s booster for the Gemini program.) This same memo asked for more than \$500 million for NASA programs, an injection into the U.S. economy of roughly 10 percent of U.S. gross national product at a time when the U.S. economy totaled about \$500 billion.⁶⁴ Therefore, by using these greater national elements of power for a clear objective, the United States could attain “world leadership in space during this decade.” Otherwise, the United States might never be able to catch up.⁶⁵ In an April 28, 1961, memo, Johnson explained how, with the space program, Kennedy could protect U.S. national security, enhance the U.S. economy, and project American values.

As we have seen, Kennedy’s administration had determined that the Soviet Union would continue to best the United States in space for some time. Even as early as the Presidential transition, Wiesner had estimated that, “because of our lag in the development of large boosters, it is very unlikely that we shall be first in placing a man into orbit around the earth,” a prediction that turned out to be true when Gagarin orbited the earth in April 1961.⁶⁶ In his May 25 “Urgent Na-



Briefing given by Rocco Petrone to President John F. Kennedy during tour of Blockhouse 34 at Cape Canaveral Missile Test Annex, September 11, 1962; from left, in front, James Webb, Lyndon Johnson, Kurt Debus, Leighton Davis, and Robert McNamara (NASA)

tional Needs" speech to Congress, Kennedy outlined the threat by couching the confrontation as a "battle for men's minds." In the language of strategy, U.S. national interests were threatened, and the U.S. space program could help mitigate the Soviet threat.

But Wiesner had also pointed out opportunities beyond enhancing national prestige. A reinvigorated national space program could have other benefits, including enhancing national security but also, for example, offering "exciting possibilities for international cooperation with all the nations of the world," which became an aspect of the Apollo program.⁶⁷ Kennedy eventually went so far as to suggest cooperating with the Soviets in space. An enhanced space program was certainly an opportunity to wrest international prestige from the Soviet Union, but the program could also enhance U.S. national security by contributing new missile capabilities and other systems. Scientific research could also benefit from new space systems, as would "important practical non-military applications for space technology—among them satellite communications and broadcasting; satellite navigation and geodesy; meteorological reconnaissance; and satellite mapping—which can make important contributions to our civilian efforts and to our economy."⁶⁸ Each of these opportunities made its way into documents crossing Kennedy's desk during the next several months.

It became obvious that the U.S. space program had multiple aspects, such as missiles, satellites, human spaceflight, and civilian applications of technology. These capabilities had to be pursued to gain a lead in the space race and to enhance U.S. prestige in the battle for minds that was the ideological aspect of the Cold War. Thus, the moon program was also a race to develop national means for the greater Cold War in areas such as solid-fueled rocket technology for better ICBMs, improved human capital ability in science and technology, development of national unity and will at a time when the Nation seemed to be lagging in the international competition, and increased international reputation. These secondary aspects turned out to be the real, long-term achievements—putting a human on the moon was just the vehicle.⁶⁹

Thus, the *end* of going to the moon was not to test major scientific principles or to find new locations for colonization, but to use the moon landing to further contain Soviet communism and therefore make the United States more secure by shaping the world conversation about freedom and tyranny. Strategies can be used to achieve more than one end, so Kennedy also could use his strategy to develop technologies and capabilities to ensure U.S. economic prosperity.⁷⁰

Ways

Determining the *ways* to approach a national security problem addresses *how* to use the available *means*—elements, institutions, and instruments of national power—to achieve the de-

sired *ends*.⁷¹ Determining a way generally comes after determining the means available to solve the problem. Unfortunately, in strategy the discussion often begins with “What elements, institutions, and instruments do we have available?” and then proceeds to considering ends that are achievable. The discussion becomes one of “What *can* we do?” and not “What *must* we do?” or “What *should* we do?” The result can be strategic failure because the available means were not employed using an achievable way or because the proper means to accomplish the end were never discussed or built.

In strategy design, it is often more appropriate to ask “What end do we want to achieve, and what means do we need in order to do it?” Sometimes the response to that question must be “If we want to achieve this end, we first have to create that capability.” In April 1961, Kennedy asked the following:

*Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back with a man? Is there any other space program which promises dramatic results in which we could win?*⁷²

Essentially, Kennedy was asking “With the means currently available in our space programs, can we achieve this end?” Johnson’s answer to the question was “No,” but, “If we’re going to win the space race, then we need these capabilities and we don’t currently have them . . . but fortunately, neither do the Soviets.”⁷³ The grand strategic *end*, as discussed, was managing the Cold War until the Soviet Union collapsed from its own internal contradictions; one of the *ways* to achieve that end was by shaping the conversation about freedom versus tyranny through scientific and technological achievements. The *means* for this line of effort in the U.S. Cold War strategy was the race to the moon.⁷⁴ The problem with using solely a strategy of persuasion is that persuading generally works only when the two parties have interests that are similar or at least overlapping.⁷⁵ During the Cold War, the United States tried to persuade other countries, many of which did not have systems similar to either that of the United States or of the Soviet Union, of the superiority of the Western political-economic system.

Furthermore, although the Soviet Union was an existential threat to the United States, it was not an immediate threat, giving the United States time to shape the world conversation. In effect, the United States had time to develop the means, as it methodically worked through the Mercury, Gemini, and then Apollo programs, even though the Soviets displayed a massive lead

in the space race well into the 1960s.⁷⁶ Persuasion was unlikely to work in the short term, but the United States believed that it had enough time on its hands for a different approach to succeed.

Shaping is a useful approach when the threat is not immediately existential and when there is enough time to acquire the means to maneuver into an advantageous position.⁷⁷ Thus, in language from the *National Security Strategy Primer*, the real purpose of the approach was to shape the world conversation about the merits of capitalism and communism and to convince other nations that U.S.-led Western capitalism was the preferable approach. Wrote Johnson:

*This country should be realistic and recognize that other nations, regardless of their appreciation of our idealistic values, will tend to align themselves with the country which they believe will be the world leader—the winner in the long run. Dramatic accomplishments in space are being increasingly identified as a major indicator of world leadership.*⁷⁸

At first, of course, attempts to use scientific and technical achievements to shape the international discussion about which road other nations should take—tyranny or freedom—did not go very well. The Soviets had been the first to orbit an artificial satellite (1957), the first to crash a probe into the moon (1959), the first to orbit and recover animals alive (1960), and the first to put a human in space (1961). They would continue to hold the lead in the space race for some time, putting the first woman in space (1963), orbiting the first three-person crew (1964), and performing the first spacewalk (1965).⁷⁹ When one-astronaut Mercury missions finally gave way to two-person Gemini flights, the United States quickly caught up and moved ahead in the space race by performing feats essential for a trip to the moon. The United States set a record on Gemini 5 with 8 days in orbit and then broke it with Gemini 7's 14-day voyage 5 months later. Neil Armstrong and David Scott performed the first orbital docking, a task essential for landing on the moon and returning safely to Earth.⁸⁰ Even so, not all Americans thought going to the moon was worth it: A 1965 Gallup poll found that only 39 percent of Americans thought being first to reach the moon was worth the cost.⁸¹ If going to the moon was the strategic end, these 39 percent might have been right, but the real value of the moon landing came from its influence on the greater Cold War struggle.⁸²

Not everything in the strategy was about shaping the world's opinion of the Soviet Union. NASA can also be said to have *induced* government officials to achieve its end. For example, it could be argued that NASA persuaded the Texas delegation in Washington, which included Johnson and House Speaker Sam Rayburn, to support the space program by locating the

new Manned Spacecraft Center in Houston. Webb, knowing that NASA would eventually need another space center to handle crewed missions, formed a site selection team and eventually secured \$60 million from Congress to start construction. The site selection team considered locations suggested by Representative Albert Thomas (D-TX), Representative George Miller (D-CA), Senator Stuart Symington (D-MO), and Republican Massachusetts Governor John Volpe, who proposed Boston, near Kennedy's hometown of Brookline.⁸³

The site selection team preferred MacDill Air Force Base in Florida but, when the Air Force decided not to close the base, NASA recommended a second choice in Texas.⁸⁴ Congressional representatives and local leaders had lobbied NASA for months to choose the Texas location. NASA eventually selected a site near Houston on land belonging to Rice University and a few miles from Thomas's district. Thomas, who chaired the appropriations subcommittee responsible for NASA's budget (and which had cut the space budget by at least 5 percent the previous 4 years), made the announcement in the office of fellow Texan Vice President Johnson. Representative William Cramer (R-FL) had been arguing for the site in Florida and claimed that "powerful people in the Administration" had brought pressure on NASA to choose the Houston site.⁸⁵ Webb stated in an interview in the late 1960s that Kennedy had called Thomas about some bills the President wanted passed but that Thomas was not committed to support. Kennedy apparently stated, "Now, you know Jim Webb is thinking about putting the center down in Houston," and he got Thomas's support for both the bills and the location of the new Manned Spaceflight Center.⁸⁶

Modes of Action. The choice of a shaping approach to the problem of reaching the moon required multiple objectives or lines of effort to achieve the end. *Modes of action* are methods a strategist can use to build objectives into tools for success. This moon strategy had multiple objectives, of course, so the choices of modes of action depended on which objective was being referenced. The different objectives within the strategy were simultaneously employing multiple modes of action.⁸⁷ For example, NASA employed a sequential approach to developing the in-space skills necessary to get to the moon, with astronauts learning tasks such as rendezvous and docking or long-duration spaceflight during the Gemini program. Gemini 8 was the first spaceflight to rendezvous and dock with another spacecraft in Earth orbit, while Gemini 7 orbited the earth for 300 hours, or almost 2 weeks, both important steps on the moon journey. (The Apollo program itself also built skills sequentially as missions moved from low Earth orbit to lunar orbit to the landings. The first moon landing was the fifth successful crewed Apollo mission; if one of the previous four had failed, the landing would have been on a later mission.)

In another example, at first glance, the strategy appears to be unilateral when Kennedy made his appeal to Congress to land on the moon by the end of the 1960s, but the multilateral aspects of the strategy are everywhere, from the worldwide network of tracking stations, to Kennedy's offer to the Soviets to join the United States on the moon mission, to the international diplomacy the U.S. Government employed to achieve its needs for the program.

Orchestration. The elements, institutions, and instruments of power (IOPs) are rarely wielded individually—they are frequently used together and they often “overlap, interconnect, and are interdependent,” argues the *Primer* (see figure). For these reasons, they must be *orchestrated* to enhance one's abilities.⁸⁸ To accomplish Kennedy's aim, NASA, as the lead agency for the task, had to work to use the elements and instruments of power “through distinctive actions and approaches in a logical, coherent strategy.”⁸⁹ In addition, NASA had to assign priorities to the objectives it needed to accomplish to ensure the institutions, elements, and IOPs were properly aligned, coordinated, and balanced and therefore not undermining one another.⁹⁰

For example, the military's Titan ICBM was used as the Gemini booster because the huge missile's capabilities met NASA's requirements. The United States could take advantage of the training its engineers and test pilots received in the military and use them as astronauts because NASA needed that kind of experience but did not have the resources to create enough of its own astronauts from scratch. Similarly, when the astronauts went on their post-Apollo 11 world tour, these same military pilots and astronauts were delivering messages often associated with diplomatic and information professionals.

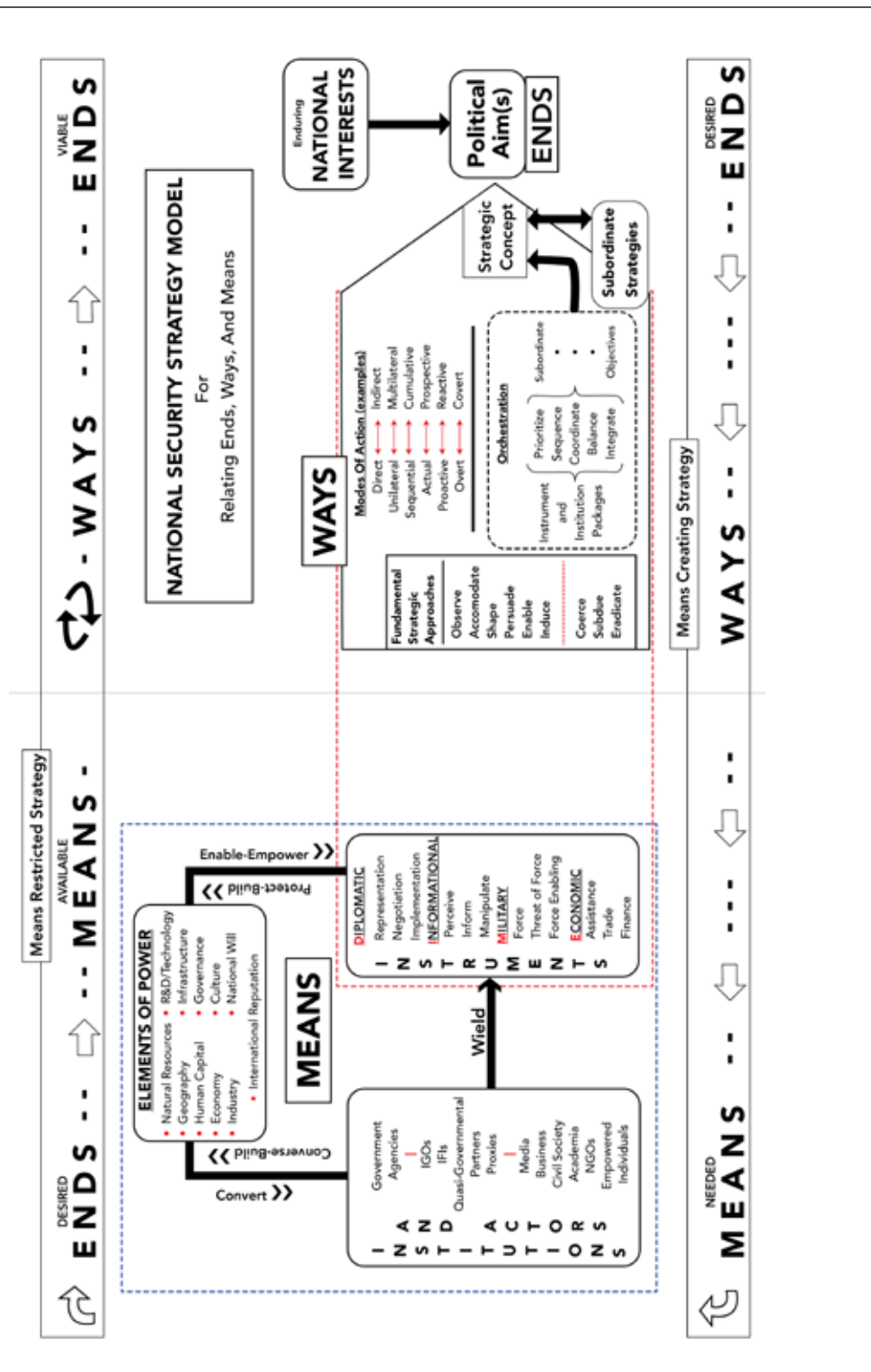
Kennedy determined his end (beat the Soviets to the moon) in this way (shape the conversation) using these means (the Apollo program). Thus, with a strategy of shaping in mind and with the assumption that there was going to be enough time to achieve the goal, it was time to choose the means necessary to reach the end—and as it turned out, some of those means had to be invented.

Means

While the Kennedy administration was analyzing the strategic situation and developing the aims and objectives for the response during its first 4 months in office, it was also identifying the means needed to achieve the lofty goal of a moon landing in less than 10 years. *Means* are the capabilities—some of which the United States had to develop—and resources the United States would eventually bring to bear on the problem.

Means are often accepted to be the instruments of national power—the diplomatic, information, military, and economic instruments; but by examining means with a broader view by

National Security Strategy Model for Relating Ends, Ways, and Means



Source: Steven Heffington, Adam Oler, and David Tretler, eds., *A National Security Strategy Primer* (Washington, DC: NDU Press, 2021), appendix B.

thinking about institutions and actors and the elements of national power as the *Primer* does, one can see just how the Kennedy administration was thinking about its chances in beating the Soviets to the moon. The United States possessed some adequate means for the space race, but it had to develop others to beat the Soviets to the moon, which the administration concluded it could do.⁹¹ And more important, the United States needed a strategy to implement these means in a coherent fashion, or else they were just expensive hardware.

The elements of national power are, as Joseph Nye pointed out, "the capacity to do things and in social situations to affect others to get the outcomes we want." But, Nye argued, "having the resources of power does not guarantee that you will always get the outcome you want," as the United States found out in Vietnam, where its overwhelming military power did not defeat the North Vietnamese.⁹² There is no definitive list of the elements of national power, but the *Primer* points out that any list for the space program should include at least national economy, industry, research and development (R&D), human capital, infrastructure, culture and national will, and international reputation.⁹³

In another way of looking at means, to borrow from Ross Harrison's book *Strategic Thinking in 3D*, if the instruments of national power are the muscles of strategy, then "resources can be thought of as the nutrients that feed and enable that muscle." The instruments can be said to have a "muscular nature"—that is, an ability to act—while "resources are inert." Once a strategist has "integrated, organized, and leveraged [resources] on behalf of creating capability," then they are the means to achieve an end.⁹⁴ Harrison suggested, therefore, that the Kennedy administration needed to ask itself "*Are our current capabilities and resources—our MEANS—able to support a SHAPING strategy to beat the Soviets to the Moon—our END—or do we need to create new means?*"⁹⁵

The most obvious place to start when thinking about available resources is simply the economic foundation of the Nation. In 1962, the U.S. economy was a \$500 billion post-World War II behemoth. After a brief recession during the previous administration, the economy was back on track, achieving a growth rate of 4.6 percent over 5 years. What enormous advantage the Soviet Union had over the United States in geography was offset by its much smaller economy, which was half that of the United States at the time, according to Congress's estimates.⁹⁶

Another one of the most important resources a nation possesses is its people. Human capital, as the *Primer* points out, "encompasses demographics, which can include population size, birth rates, immigration trends, and levels of education."⁹⁷ The populations of the two countries were similar in 1961, with the United States at 179 million people and the Soviet Union at 219 million. But as Carl von Clausewitz cautioned, "Superior numbers, far from contributing every-

thing, or even a substantial part, to victory, may actually be contributing very little, depending on the circumstances.”⁹⁸ For example, half the population of the Soviet Union still lived in rural communities compared with 30 percent in the United States. In addition, twice as many Americans (8.6 million) as Soviet citizens (4.6 million) were attending college in 1970, the earliest date for which data are available to compare the nations. Since the end of World War II, U.S. military veterans had been using funding from the GI Bill to achieve their educational goals. To further enhance funding for both public school and university education after the shock of Sputnik in 1954 precipitated an inferiority complex in the American educational system, during the Eisenhower administration the United States began pouring money into science and technology education through the National Defense Education Act.⁹⁹

Still, U.S. leaders initially worried somewhat about human capital because of the lack of focus of American “technical talent . . . on difficult tasks.” Developing multiple space and missile systems at once and then choosing the best, often called concurrency, “over-encouraged the development of entrepreneurs and the proliferation of new enterprises.” Webb and McNamara worried that key personnel were thinly spread, arguing that “the turnover rate in the U.S. defense and space industry has had the effect of removing many key scientific engineering personnel from their jobs before the completion of the projects for which they were employed.” These approaches had led to a doubling of engineering costs since the early 1950s.¹⁰⁰

NASA was also unprepared for managing a program the size of Apollo and needed to borrow the human capital from the military to accomplish the task. Before Apollo, NASA management gave tasks and authority to engineers who generally acted without management review. Von Braun’s team was small, and his group worked informally but expensively. By contrast, General Bernard Schriever, the U.S. Air Force (USAF) rocket program boss, bypassed traditional engineering lines of communication and management processes to get his ICBMs built. General Schriever handled cost and schedule using configuration management, which acted as “a proxy for technical knowledge,” according to historian Stephen Johnson. Now management could track all aspects of a project, including budgets, baselines, and changes, instead of relying on a project’s engineers. When USAF Major General Samuel Phillips arrived at NASA to take over management of the whole lunar landing program, he came with some contempt for the current program: “NASA had developed to be a very, very professional technical organization, but they had almost no management capability nor experience in planning and managing large programs.”¹⁰¹ According to Johnson, General Phillips asked for 55 more Air Force officers to join the NASA team, on top of the 94 already serving with NASA. He prevailed after some bureaucratic wrangling, and hundreds of officers went on to serve with NASA for brief periods

while others even left the military to remain at NASA or with one of its contractors.¹⁰² Von Braun opposed General Phillips's attempt to bring configuration management with him, arguing that a handful of Saturn boosters was not like building hundreds of Minuteman ICBMs. But General Phillips was not swayed, eventually bringing military-like discipline to NASA.¹⁰³

Even with the introduction of the new system, poor configuration control probably contributed to the Apollo 1 fire in 1967. Accident investigators found that some changes had been approved but not implemented, while other changes had been implemented but not approved. Apollo program manager Joe Shea recalled 8,000 failures or irregularities his team was following before the fire.¹⁰⁴ According to Apollo 11 astronaut Michael Collins, "In the space business, paper is *the* most important material. Without paper, chaos results."¹⁰⁵ The new approach eventually succeeded, according to Stephen Johnson, because of the similarities in Apollo and ICBM programs and the stability of NASA's funding in this case and because experienced people with management skills, many of whom were in the military, led the programs.¹⁰⁶

Although General Phillips went so far as to bring in USAF officers to implement the "new" management system for the lunar landing program, NASA had been borrowing the military personnel it needed from DOD since 1959. For example, U.S. Navy Commander Albert Kelly was director of electronics and control in the Office of Advanced Research and Technology, USAF Major Victor Hammond led the national range support in the Office of Tracking and Data Acquisition, and U.S. Army Major Rocco Petrone served in the Heavy Space Vehicle Systems Office.¹⁰⁷

Petrone joined NASA in 1960 as the Saturn program project officer, also bringing rocket program experience with him from the military. Described in a *Washington Post* profile as "a broad-shouldered tree of a man who in his line of work is treated with the same mixture of awe and respect football players give Vince Lombardi," Petrone retired from the Army in 1966 and became director of launch operations at Kennedy Space Center. Under his responsibility for everything launch-related, the first five crewed space launches were late a total of less than a second. According to one reporter, Petrone saw the beauty in teamwork and was good at his job: "If Petrone says he wants it that way, then do it that way," stated NASA headquarters. But even he was still "a little in awe of the men and machines who will be making the quest" to the moon, because human capital meant much more than astronauts.¹⁰⁸

A strategist considering a technological response to a national security problem should consider that nation's ability to develop new means to achieve the desired end. "A nation's level of research, development, and technology encompasses a state's ability to innovate," says the *Primer*.¹⁰⁹ Kennedy had a great deal of national technological ability to consider when thinking about responding to the Soviet challenge.

Every year for decades, the Aerospace Industries Association of America (AIAA), the industry's arm for lobbying Congress, had produced the *Aerospace Year Book*. The 1962 edition reached nearly 500 pages and was full of advertising for hundreds of companies and aerospace programs. The 1962 book included sections on 1961's noteworthy events and records; aerospace operations and R&D; military, civilian, and government activities; and photos of aircraft, missiles, and engines in production. The first 200-plus pages alone offered dozens of descriptions of the accomplishments of aerospace companies running not quite from "A" to "Z" but close: from jet engine manufacturer Aero Commander to the Wyman-Gordon Company of Worcester, Massachusetts, a company "forging components for major missile, rocket and space vehicle programs in the United States from virtually every metal alloy known."¹¹⁰ The Wyman-Gordon Company had large manufacturing facilities at three locations. Even while it was "increasing employment and intensifying production to meet the soaring requirements of top contractors in an industry rapidly expanding into space," the company also established "a special Research Center apart from production . . . to experiment with new materials and processes with a view to production possibilities."¹¹¹ The point, of course, is that the U.S. aerospace industry appeared to be healthy.

A range of aerospace achievements in space and advanced aviation and missile technology occurred in 1961. Yes, the Soviet Union had two successful human spaceflights in 1961—following Gagarin's April flight, Vostok 2 orbited the earth for a full day in August—while the United States managed only two brief 15-minute suborbital missions. But the United States successfully orbited 39 satellites in 1961 compared with the Soviet Union's 6, and by the end of the year, of the 40 satellites in Earth orbit, 37 had been launched successfully from U.S. soil. Meanwhile, American industry also made substantial progress in fielding new ICBMs for both land- and water-based deterrents.¹¹² According to one estimate, R&D "reached approximately one-third of the total industry effort in terms of contract dollar volume."¹¹³ Employment also grew in the aerospace industry, climbing over 5 percent to 675,000 people, whose average hourly wage in September 1961 was \$2.80 at a time when the average hourly wage in the United States was \$1.15.¹¹⁴

Organizationally, the military stepped up to refine its approach to space R&D. On March 6, 1961, Secretary McNamara assigned responsibility for military space development to the U.S. Air Force. With the Air Force's establishment of Air Force Systems Command (AFSC) in April 1961 under the leadership of General Schriever, who had been the service's ICBM head for many years, the Air Force took on leadership, spending almost a third of its budget for 1961 on programs AFSC managed, according to the AIAA. The new command, located close to Washington, DC, merged the R&D responsibilities with the procurement and production responsibilities to

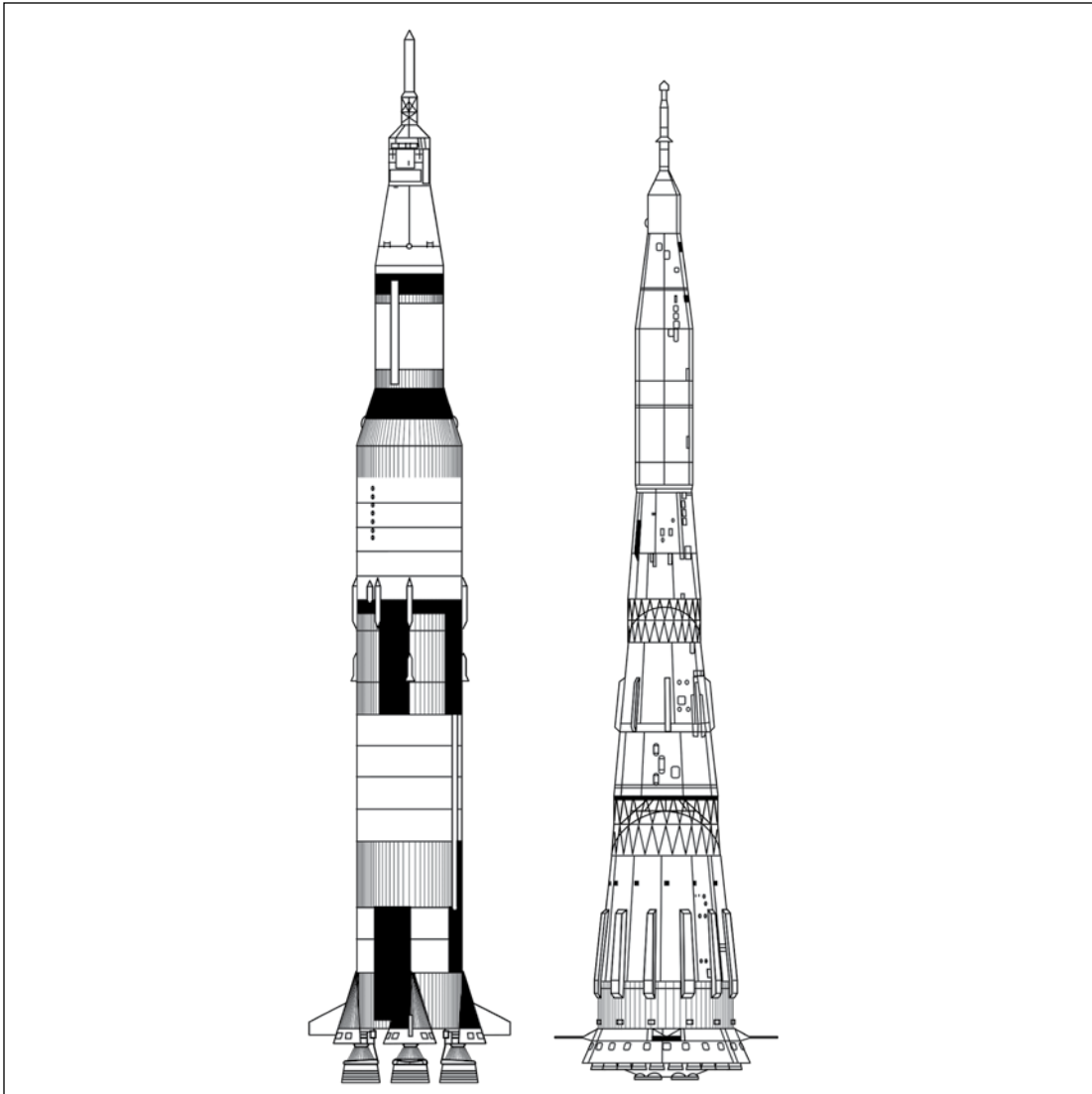
create a command capable of delivering "complete, timely, and operable weapon systems to using commands" in the Air Force. AFSC leaders were supposed to provide "progressive management policies" to speed up programs, ensure efficiency, and enable close coordination with the other military services. They led development of three new ICBM systems and continued the X-15 rocket plane program and its follow-on, Dyna-Soar, a piloted spaceship planned for launch aboard a Titan III rocket.¹¹⁵

The U.S. Army also continued its development of the Nike-Zeus antiballistic missile as well as the Pershing and Sergeant battlefield missiles. The U.S. Navy focused on development of the Transit navigational satellite system, a forerunner of the modern global positioning system, placing three satellites in orbit. The Navy also continued to improve the deployed Polaris submarine-launched ballistic missile by increasing its range, as well as working on other shorter range missile systems.¹¹⁶

NASA was also hard at work at its own R&D centers around the Nation and in cooperation with private industry and colleges and universities, where NASA worked on issues such as reentry techniques, spacecraft rendezvous procedures, navigation, and guidance and control of spacecraft, among other problems that needed to be solved before humans could walk on the moon.¹¹⁷ In 1961, NASA also successfully flight-tested the Saturn I booster, a critical step on the way to the Saturn V moon rocket. Engine company Rocketdyne delivered a successful static test of a 165,000-pound thrust engine a mere 4 months after signing a contract with NASA in 1958, and in September 1961, a booster clustering eight of those engines and delivering 1.3 million pounds of thrust launched successfully.¹¹⁸ With these tests, the United States moved ahead of the Soviet Union in booster capability.

It helped that U.S. leaders knew what the Soviet Union was up to, of course—the United States had developed a successful space-based reconnaissance system to keep an eye on the closed, totalitarian nation. By 1966, the United States already had photos of the Saturn V-like Soviet N1 booster on its launch pad in Kazakhstan. James Webb used the information in 1967 to argue for more appropriations, claiming before the House of Representatives in August that the Soviets "will shortly, I believe, in calendar year 1968, be flying a booster larger than the Saturn V."¹¹⁹

Another element of national power is infrastructure, and the United States had plenty in the early 1960s because of its previous work in space and because of the methodical approach NASA was taking to space programs. Being a space power requires more than rockets boosting spacecraft into orbit. Space capabilities include launch sites, safety systems, tracking ranges, and recovery capabilities. By 1961, the United States had launch sites at Cape Canaveral, Florida,



Side by side comparison of Saturn V (left) and N1 manned lunar rockets, March 1995 (NASA/Mir Hardware Heritage Report 1357)

and Vandenberg Air Force Base, California, and multiple tracking ranges. NASA had a satellite tracking and data acquisition system and a manned spaceflight tracking system. Ships and airborne systems supplemented the networks and filled in gaps in the ground-based networks.¹²⁰

Even national will and culture are elements of national power. National will can be “the population’s mood, its view of what the nation’s aims and objectives ought to be, and what sacrifices it is willing to make to achieve them.”¹²¹ Kennedy’s soaring rhetoric and challenge to Congress and the American people encouraged an outpouring of national treasure into the Apollo

project. But a 1961 poll cited by sociologist William Sims Bainbridge revealed that "Americans were evenly split on whether the United States or Russia 'is further ahead in the field of space research'—38 percent versus 38 percent, with 24 percent holding no opinion." Just as important, Bainbridge wrote:

The majority of [Americans] never demanded an aggressive program of space exploration. At the end of May 1961, a Gallup press release reported, "Kennedy Must Convince Public of Value of Moon Shot Project," because 58 percent of Americans did not want the estimated \$40 billion spent on this, compared with 33 percent who did. In January 1962, 22 percent of Americans believed there was a "great and urgent need for action" to "land an American astronaut on the moon." Another 30 percent saw "some need," meaning that a slim majority of 52 percent saw a need to go to the Moon. In contrast, 42 percent saw "little or no" need.¹²²

Even in late 1962, 41.6 percent agreed with Kennedy's goal of reaching the moon by 1970, but 42 percent disagreed (16.4 percent were "not sure").¹²³ So, while there was a will, Kennedy still had to find a way, and it was going to have to be without the entire nation committed to the goal—certainly not the first time a leader had executed a strategy without overwhelming public support.

Engineers are an important subculture in the context of national will. Although those who work on space programs are often referred to as rocket scientists, the reality is that many of those workers are not scientists at all but engineers. Each professional field has its own culture, and in the 1960s that was no different. The history of engineering, argued professor of civil engineering and history Henry Petroski, "may be told in its failures as well as in its triumphs" because "engineering students understand early on that there is a great deal to be learned from a mistake."¹²⁴ This approach of allowing mistakes did reach into NASA as people learned through testing and simulations in which a trainee could crash a simulator as many times as needed to get a skill right. Apollo flight director Gene Kranz argued that in their program, getting it right became an important driving force: "Technology and training were pushing us to the ultimate standard: failure was not an option." Thus, by the time Apollo 13 had its catastrophic accident on the way to the moon in April 1970, "Failure [did] not exist in the lexicon of a flight controller. The universal characteristic of a controller is that he will never give up until he has an answer or another option."¹²⁵ Apollo 13 was thus a "successful failure," characteristic of a culture that pushed NASA to reach the moon before the decade was out.

Space historian Roger Launius breaks the cultures down even further, arguing the two most identifiable groups at NASA were engineers and scientists. Engineers, often working in teams, built the hardware that eventually put humans on the moon. The primary goal of the engineers was to build “vehicles that would function reliably within the fiscal resources allocated to Apollo.” The scientists, often working alone, were more interested “in pure research and were more concerned with designing experiments that would expand scientific knowledge about the Moon.” The two groups often clashed over time, money, or vehicle constraints but eventually achieved enough consensus to reach the moon.¹²⁶ (These cultures combined in Apollo 17’s geologist-astronaut Harrison Schmitt, the only nonpilot to walk on the moon.)

Which of the means to reach the moon were already available? Which needed to be developed or converted from others?¹²⁷ These were questions Kennedy had asked NASA to think about to achieve his strategy. But having the elements of power provides only “the foundation for building and sustaining the power of a state.”¹²⁸ The strategist still must identify which instruments of power should be used to achieve the desired ends.

Instruments of Power

The instruments of national power are often simplified to the diplomatic, information, military, and economic capabilities of the nation-state. For a strategist, determining which instruments to use, which instruments to develop, and how to wield the instruments independently or together are fundamental tasks.¹²⁹

The *diplomatic* instrument of national power is a nation’s ability to represent itself on the international stage, to negotiate for what it wants, and then to implement any agreements it has reached. A nation that does not have something another nation wants will find that negotiating is a tough road. The diplomatic instrument often takes a broader view of international engagement because it encompasses more than just a single act or ongoing interaction between two or more nations. A nation with a strong diplomatic instrument has capabilities that enable it to represent itself, to negotiate for itself, and to implement agreements it has made.¹³⁰ A nation with a brilliant public speaker as a leader or ambassador may find it has an easier time representing itself to other governments or foreign populations. For example, Kennedy’s speech in Berlin in June 1963 firmly cemented the United States as an ally of West Germany with the words “Ich bin ein Berliner.”¹³¹

In the moon race, diplomacy could be found nearly everywhere. Kennedy’s NASA Administrator Jim Webb had been undersecretary of state from 1949 to 1951.¹³² But even before Kennedy, the NASA Act of 1958, in fact, allowed the space agency to seek out international cooperation.

The secretary of state, the top U.S. diplomat, sat on the National Aeronautics and Space Council created by the act. Section 205 of the NASA Act dealt with international cooperation by allowing NASA to "engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof."¹³³ President Eisenhower interpreted that to mean that although treaties between nations may be forthcoming, "less formal arrangements for cooperation were also allowed"—that is, administrative arrangements such as a memorandum of agreement between two space agencies from different nations.¹³⁴ Historian Walter McDougall argued that the clause about cooperation was actually something new "in the history of state technology policy" but ultimately did not amount to much because U.S. allies "had little to contribute to a free-world missile and space effort."

While that may have been true for military programs, NASA took advantage of its authority for the civilian space program.¹³⁵ For example, NASA's Arnold Frutkin, who had worked with the State Department during the 1953–1954 International Geophysical Year on scientific cooperation with foreign governments, secured land for Mercury tracking stations in Nigeria and Tanzania in 1959. Mexico also committed to hosting a tracking site after President Eisenhower's brother, Milton Eisenhower, convinced the country's government that the United States had "good—that is, civilian—intentions for Mercury."¹³⁶ T. Keith Glennan, Eisenhower's NASA administrator, allowed Frutkin to establish a "little state department" inside NASA, resulting in NASA building seven Mercury tracking stations overseas. Frutkin also expanded international space cooperation by negotiating for the United States to launch other nations' satellites, put foreign experiments on U.S. spacecraft, and work out details for foreign technicians to participate with NASA and for foreign students to attend U.S. universities. Eventually, of course, European nations went their own way by developing their own spacecraft and then their own boosters, choosing to cooperate more with one another than with the United States.¹³⁷

Traditional diplomacy for space also occurred, for example, at such institutions as the United Nations (UN). In December 1961, the UN General Assembly adopted a resolution on "International co-operation in the peaceful uses of outer space," which resulted in resolutions in 1962 and 1963 and eventually in the 1967 Outer Space Treaty. The 1961 resolution recognized several principles, including "the common interest in furthering the peaceful uses of outer space and the urgent need to strengthen international cooperation in this important field." The 1963 resolution requested that astronauts be regarded "as envoys of mankind," worthy of "all possible assistance" when in distress or landing in the wrong place.¹³⁸

Kennedy also tried using traditional forms of diplomacy in looking for a way to cooperate with the Soviets early in the moon race. Coming less than 6 months after he challenged the

Soviet Union in the race to the moon to help the people of the world choose between freedom and tyranny, Kennedy's formal invitation to cooperate with the Soviet Union on space probably came as a surprise. In a speech to the UN in September 1961, Kennedy had proposed extending the rule of law into space by creating new rules for space operations (the Outer Space Treaty went into effect in 1967) and cooperation on weather research and communications satellites. He extended the offer twice more, in March and May 1962. At one point in September 1962, the State Department was preparing to announce that the two world powers were going to cooperate on space but shelved the announcement in October because of the Cuban Missile Crisis.¹³⁹ In July 1963, Kennedy offered up the idea of cooperation on a joint moon mission but acknowledged that such cooperation "would require a breaking down of a good many barriers of suspicion and distrust and hostility" between the two nations.¹⁴⁰ Nevertheless, he suggested in front of the UN General Assembly in September 1963 that a joint U.S.-USSR effort to the moon could be a place for "new cooperation."¹⁴¹ "Surely," Kennedy stated to the UN General Assembly, "we should explore whether the scientists and astronauts of our two countries—indeed all of the world—cannot work together in the conquest of space, sending some day in this decade to the moon not the representatives of a single nation, but representatives of all our countries."¹⁴² The Soviets responded favorably to the idea of working with the United States on weather satellites and communications systems.

In proposing a joint mission to the moon with the Soviets, however, Kennedy ran into some opposition from within the U.S. Government. He had not coordinated the proposal with Congress and had apparently inserted it into the speech a day or two before as "the personal initiative of the President and a few of his closest advisors," according to Logsdon.¹⁴³ Three days before the public announcement of the proposal, Houston space center chief Bob Gilruth "publicly stated joint cooperation with Russia was incredible," according to *The Washington Post*,¹⁴⁴ and the day before the speech, NASA's Jim Webb stated the United States would not conduct a joint project with the Soviets because the United States was interested in "the military uses of outer space."¹⁴⁵ Kennedy also earned the wrath of Representative Thomas, who saw the proposal as driving money away from Houston, and from Senator Dick Russell (D-GA), who did not want to cooperate with the Soviets, anyway. Despite these obstacles, Kennedy may also have made the cooperation proposals, the *Post* suggested, because he was looking for another international success after August 1963's Nuclear Test Ban treaty signing.¹⁴⁶

At any rate, the Soviets eventually rejected the idea of a joint mission to the moon.¹⁴⁷ A few weeks after Kennedy's UN proposal, Soviet premier Nikita Khrushchev rejected the idea of moon cooperation, stating, "We are not at the present planning [a] flight by cosmonauts to the

moon."¹⁴⁸ (The Soviets were, but more on that later.) While the moon cooperation did not happen, Kennedy got his point across, using the diplomatic instrument in his role as the Nation's top diplomat.¹⁴⁹

Sometimes diplomacy can be used to convey messages, as well. For example, on the day Fidel Castro seized the Cuban government in 1961, NASA shut down its Minitrack space tracking site at Batista Military Airfield. The U.S. Embassy did not learn the fate of the station director, his family, or the U.S. military personnel there until noon the next day. Although NASA waited for word to reopen the station, eventually NASA told the station personnel "to close out the station, remove the assets and leave the country."¹⁵⁰ In another example, following the 1961 construction of an 85-foot antenna in South Africa, NASA did not want to hold a public opening ceremony for the station "in light of the United States' attitude toward the political situation [apartheid] then emerging in that country. . . . Some years later, this issue would intensify and ultimately lead to the closure of the station as a part of the Deep Space Network."¹⁵¹

The *information* instrument of national power might be the hardest to fully understand because it encompasses so many different aspects of a state's functions: intelligence, strategic communications, cyber operations, propaganda, and so on. There is also a huge range of actors who wield the instrument's tools, including the government, media, business, and even individuals. But whatever the function or the actor, the information instrument is most often used to help perceive the world more clearly and to inform or manipulate an audience.¹⁵²

For example, Kennedy had limited intelligence information to go on when making the call on whether to go to the moon. In 1958, the Central Intelligence Agency (CIA) admitted it did not know much about the emphasis the Soviets had placed on their space program, although from what Soviet leaders and engineers had stated publicly, the CIA believed "the Soviet space program has been assigned a very high priority."¹⁵³ But still the CIA struggled to understand the Soviet program, as evidenced in its April 1961 report that claimed a "front" agency was running Soviet space efforts.¹⁵⁴ One author suggested that, because the first-known NASA-CIA meeting did not even occur until November 1962, and because the President did not know what the Soviets were really up to in early 1961, Kennedy had to make his decision to go to the moon in the "blind."¹⁵⁵ The December 1962 report from the CIA was just as indeterminate, stating, "On the basis of present evidence, we cannot say definitively at this time that the Soviets aim to achieve a manned lunar landing ahead of or in close competition with the U.S., but we believe that the chances are better than even that this is a Soviet objective."¹⁵⁶ Therefore, assumptions had to be made about the U.S. program and the Soviet program, in this case because of gaps in the information available to Kennedy's team.¹⁵⁷

Kennedy also was using aspects of the information instrument when he gave his Rice University speech over a year after his speech to Congress. While the speech can be simply called strategic communications, it was much more than that, given the venue and the words. The Rice speech is full of context, goals, and the instruments of power as Kennedy tried to make his argument to the American people while delivering a strategic goal. Thus, the speech is worthy of a deeper exploration.

The President began by presenting the context for his audience: “The exploration of space will go ahead, whether we join in it or not . . . and no nation which expects to be the leader of other nations can expect to stay behind in the race for space.” Kennedy then laid out his end: “For the eyes of the world now look into space, to the moon and the planets beyond, and we have vowed that we shall not see it governed by a hostile flag of conquest, but by a banner of freedom and peace.” He explained the ways he planned to achieve the goal: “Space can be explored and mastered without feeding the fires of war, without repeating the mistakes that man has made in extending his writ around this globe of ours.” Then Kennedy revealed the means as he talked about the new rockets, facilities, and capabilities under development. But he went one step further by discussing the strategy’s suitability and desirability by touting the benefits to science and education, the creation of new technologies, and how universities such as Rice would benefit, adding that the space program “had already created a great number of new companies and tens of thousands of new jobs.” He stated NASA planned to invest billions of dollars in the Houston, Texas, area in the next 5 years. Then he restated his timeline for the moon landing as “in the decade of the sixties.”¹⁵⁸ Kennedy’s entire strategy was laid out in that one speech—ends, ways, and means—and delivered eloquently and passionately.¹⁵⁹

The United States did have a series of space “firsts,” and it took advantage of the information instrument to make sure the world knew about them. For example, following John Glenn’s three-orbit flight on February 20, 1962, New York City held a ticker tape parade for the astronaut that included 4 million people and 3,500 tons of paper. Glenn’s spacecraft, *Friendship 7*, went on a world tour of its own after landing—the tour was called the capsule’s “fourth orbit”—and then was sent to the Smithsonian alongside the Wright Brothers’ first airplane and Charles Lindbergh’s *Spirit of St. Louis*.¹⁶⁰ Glenn gave a speech before a joint session of Congress a week later in which he expressed his belief that the key principle at stake in the space race was the scientific method. “What benefits are we gaining from the money spent?” he asked the chamber. “They are probably not even known to man today. But exploration and the pursuit of knowledge have always paid dividends in the long run—usually far greater than anything expected at the outset.” But Glenn also contrasted his flight with Gagarin’s mission: “The launch itself was con-



President John F. Kennedy, John Glenn, and Leighton Davis ride together during parade in Cocoa Beach, Florida, February 23, 1962, after Glenn's historic first U.S. human orbital spaceflight (NASA)

ducted openly and with the news media representatives from around the world in attendance. Complete information is released as it is evaluated and validated. This is certainly in sharp contrast with similar programs conducted elsewhere in the world and elevates the peaceful intent of our program.”¹⁶¹ In his speech, which he wrote himself, Glenn carefully wove the functions of the information instrument together.

NASA's astronauts referred to their mandatory public affairs time as “the week in the barrel,” during which they made “appearances before professional audiences, press, and the adoring public.”¹⁶² Armstrong's week in July 1964 started with a visit to the National Youth Science Camp in Bartow, West Virginia, followed by visits to NASA headquarters and congressional offices and meetings with reporters. He then traveled to New York to the World's Fair's Space Park for photos and another press conference. From there he spoke before groups at Iowa State University and Drake University. He gave five presentations on 1 day in Iowa and then headed back to Houston after his “week in the barrel.”¹⁶³

Astronaut Mike Collins had a better experience in May 1967 when the Gemini 10 astronaut and Gemini 8 astronaut Dave Scott traveled to Paris for the annual air show, where they met cosmonauts Pavel Belyaev and Konstantin Feoktistov. After the mandatory joint public

appearances, the four settled into conversations with their translators that ranged from inquiries about the widows of space farers to vodka toasts to “increased cooperation between our two nations, and we drank toasts to a couple of other things that slip my mind,” Collins wrote.¹⁶⁴ The astronauts learned that the Soviets were training cosmonauts on helicopters and planning “several Earth orbital flights and then . . . a circumlunar flight.”¹⁶⁵ According to Collins, “Belyaev himself expected to make a circumlunar flight in the not-too-distant future,” which prompted Collins to wonder in his 1974 memoir, *Carrying the Fire*, “If the Russians weren’t interested in a manned lunar landing, if—as they subsequently stated—they were not racing us to the moon, then why on earth (no pun intended) were they training astronauts to fly helicopters in 1967?”¹⁶⁶ Collins then mused, “On the other hand, the Russian program was hidden from view, secret and mysterious, and if our side knew what was going on, the information never trickled out of the CIA files down to us working troops in Houston.”¹⁶⁷ Yet the air show appearance was worthwhile because Collins and Scott, who would eventually be visited in the United States by the same two cosmonauts, “left Paris feeling like diplomats carrying a signed treaty.”¹⁶⁸



Portrait of prime crew of Apollo 11 lunar landing mission; from left, Commander Neil A. Armstrong, Command Module Pilot Michael Collins, and Lunar Module Pilot Edwin E. Aldrin, Jr., Johnson Space Center, April 30, 1969 (NASA)

Although the astronauts' time in the barrel was a useful way to spread information about the space program, the world tour of the crew of Apollo 11 was a masterful stroke in the use of the information instrument. Whether one thinks of the information instrument as useful for public diplomacy, strategic communications, influence operations, or even propaganda, sending the crew of the first mission to land on the moon on a tour of the earth worked brilliantly.

The plan for the world tour, called "Great Step," included 23 countries in 45 days using the Vice President's blue-and-white Air Force Two with a support team from the State Department, U.S. Information Agency, Voice of America, and the White House. The astronauts wanted the tour "to emphasize the willingness of the United States to share its space knowledge."¹⁶⁹ Starting in Houston, the team went to "Mexico City, Bogotá, Buenos Aires, Rio de Janeiro, Grand Canary Island, Madrid, Paris, Amsterdam, Brussels, Oslo, Cologne, [West] Berlin, London, Rome, Belgrade, Ankara, Kinshasa, Tehran, Bombay, Dacca, Bangkok, Darwin, Sydney, Guam, Seoul, Tokyo, Honolulu, and back to Houston."¹⁷⁰ At each stop they held a press conference, usually attended by "a thousand or more people," and then met crowds outside often numbering in the hundreds of thousands.¹⁷¹

Of note is that the only nation behind the Iron Curtain that was visited was Yugoslavia, which was not particularly friendly with Moscow at the time. Armstrong did visit the Soviet Union in 1970 but was not greeted by multitudes of people because the Soviet government did not announce he was coming. When he met with Soviet premier Alexi Kosygin, Armstrong "presented him with some chips of a Moon rock and a small Soviet flag that had been carried aboard Apollo 11."¹⁷²

For many national security strategists, the *military* instrument is the easiest IOP to understand because it entails using force or threatening to use force to achieve a political aim.¹⁷³ In May 1961, Kennedy authorized sending 500 Special Forces troops to Vietnam and "by the end of 1962 there were approximately 11,000 military advisors in South Vietnam."¹⁷⁴ The United States was not prepared to use armed force in August 1961 to achieve its political ends when the Soviets began construction of the Berlin Wall, and thus the United States made no aggressive moves to stop them. By late 1962, however, Kennedy made the decision to threaten using armed force over nuclear missiles in Cuba until the Soviets backed down. These actions are examples of the use of the military instrument of power to coerce or subdue enemies.

Kennedy was not prepared to use force or threaten the use of force to beat the Soviets to the moon. He was trying to inform the world about the evils of communism, not defeat it on the battlefield. Nevertheless, Kennedy was willing to use the military instrument to achieve his

ends in a *shaping* strategy by using military tools to enable NASA's capabilities and improve the agency's ability to reach the moon.¹⁷⁵

For example, NASA from the very beginning took advantage of capabilities in the U.S. Armed Forces to augment its own capabilities. In fact, several of the agencies transferred to NASA came from the U.S. Army, including von Braun's Huntsville team. The booster used in the Gemini program was a modified, nuclear-capable Titan ICBM. Many of the early astronauts were either military pilots or, like Armstrong, military-trained pilots, and many of NASA's team were military personnel. The Air Force provided NASA support for range operations, recovery operations, launch operations, and more, much of it reimbursable to DOD by NASA. Astronaut water recovery personnel were members of the U.S. Navy. According to a DOD estimate, Gemini 9 required the use of 11,301 military personnel, 92 aircraft, and 15 ships. During the Gemini program, DOD estimated that it provided NASA support worth over \$500 million.¹⁷⁶

In understanding the role of *economics* in strategy, one must understand that the economic elements of national power and the economic instrument of power are not the same. The United States had a large amount of economic strength for use in the space race connected to its population, gross domestic product, natural resources, and productivity. The use of this economic power comes when a strategist uses the economic IOP to provide assistance, to trade, or to participate in the financial system.¹⁷⁷ For example, Secretary McNamara had another motivation for supporting Kennedy's moon decision, according to historian Beschloss: An increase in NASA's budgets meant the "companies in the aerospace industry that were already irate over the cutbacks McNamara was planning in the U.S. defense program" would get off his back.¹⁷⁸ Indeed, as jobs increased in the rush to get Apollo to the moon, many businesses looked for new opportunities in the civilian space program.

International trade is the exchange of money, goods, or services between countries.¹⁷⁹ In the Apollo program, the United States used trade as a means to achieving its end.¹⁸⁰ As the United States built its worldwide tracking network sites in locations around the world, including countries in Latin America, the Caribbean, Africa, the Indian Ocean, and elsewhere, each tracking station was a boost to the local economy and provided prestige for struggling governments.¹⁸¹ Take, for example, NASA's Satellite Tracking and Data Acquisition Network site in Santiago, Chile. Initially built in the late 1950s under a contract with the University of Chile, NASA spent \$1.2 million to refurbish the site in 1963, including installing a new 40-foot antenna, building a new 4,000-square-foot operations facility, and adding other new antennas. From its original complement of 38 people (16 Americans and 22 Chileans), the station staff in 1963 reached 62, including an additional 12 Chileans.¹⁸²



At 9:32 AM (EDT), swing arms move away and plume of flame signals liftoff of Apollo 11 Saturn V space vehicle from Kennedy Space Center Launch Complex 39A, Merritt Island, Florida, July 16, 1969 (NASA)

A member of the President's Science Advisory Committee staff summed up the economic key to the Kennedy strategy when he argued to chair Jerome Wiesner that the moon race was contributing "in a *non-belligerent* way to imposing major strains on the Soviet economy and their ability to carry out expansionist objectives. *Our technological challenge*, along with the steadfastness over Cuba exactly a year ago, *has been successful in getting them to trim their sails*."¹⁸³ Thus, another result of the U.S. use of the economic instrument in the moon race was the pressure it put on the Soviet economy.

Other Factors

However, as with the elements of national power, the instruments of power do not wield themselves. As the *Primer* points out, "Institutions and actors wield the instruments of power on behalf of the state."¹⁸⁴ Institutions can run the gamut from government agencies to international government and nongovernment organizations, businesses, or academia. Actors can include government leaders or other individuals, proxies, the media, or the institutions themselves.¹⁸⁵ Institutions are often associated with an instrument of power, as the DOD is with the military instrument, but that association should not be taken literally. DOD also wields the diplomatic instrument in its interactions with foreign militaries and the economic instrument in its management of foreign military assistance programs, for example. Similarly, other agencies of the U.S. Government wield instruments and use elements of national power that are not necessarily associated with their traditional roles.¹⁸⁶

In strategy, it helps if a lead agency is assigned to take on the task, and NASA clearly fits that bill in the case of the moon race, with its ability to leverage U.S. instruments and institutions to meet its goal. As the lead agency, NASA could effectively decide when to sequence objectives and when objectives could be accomplished in parallel.¹⁸⁷ For example, goals set for the Gemini program, such as rendezvous and docking, spacewalks, and so on, needed to be accomplished before going to the moon, but the Saturn V necessary for the trip had to be developed during the Gemini program or it would not have been ready when space crews were ready to go to the moon, an example of parallel objectives.

The choice of which route to use to get to the moon was also an important decision that NASA needed to make. The choices included direct ascent, Earth-orbit rendezvous, and lunar-orbit rendezvous.¹⁸⁸ Actually, many NASA leaders, such as NASA Langley Research Center chief Robert Gilruth, were "aghast" at Kennedy's choice to go to the moon and back by the end of the decade.¹⁸⁹ At the time of his speech to Congress, according to NASA's official history of the events, "nobody had any really firm idea about how NASA was going to implement Kennedy's

decision. Techniques for leaving the earth and flying to the moon—even more, landing there and returning—were open to considerable debate and much speculation.”¹⁹⁰ The choice of the route, described in NASA’s official history of the Apollo program as “the single greatest technical decision of the entire Apollo program,” ultimately determined how fast the United States could get to the moon, and the Soviet choice ultimately led to the long-term viability of their Earth-orbit program but the failure of their moon program.¹⁹¹

The Soviet space program, by contrast, had no single agency like NASA keeping all the contractors and subcontractors on schedule. As early as 1954, the Soviets had 200 institutes and design bureaus in 25 ministries working on their ICBM, a program that historian Asif Siddiqi estimates was second only to the development of nuclear weapons. Siddiqi argued in *Challenge to Apollo* that there was no Soviet space program in the 1950s. They had no long-range goals, no governing body, no financial planning, no agenda, and no direction.¹⁹² By 1959, there was still no official macro-level policy or priority on the Soviet space program, and the Soviet army’s artillery generals still were very influential.¹⁹³ Space programs simply did not fit into the Soviet military’s concept of defense of the country.¹⁹⁴ By the time the United States announced Project Mercury, the Soviet leaders committed themselves to the first piloted Vostok missions because it was a race the Soviet Union had started, and they either would not or could not call it off.¹⁹⁵ In Siddiqi’s view, because the Soviet space program derived from the power of “chief designers” such as Sergei Korolev, interpersonal rivalries and political expedience drove Soviet decision-making on space, so the Soviet space program advanced in fits and starts but not systematically, like the U.S. program, which moved smoothly from Mercury to Gemini to Apollo.¹⁹⁶ By 1963, when the United States was moving into the Gemini program, the Soviet Union was actually reacting to American moves so that in 1964, Siddiqi argues, when Korolev committed to a moon landing, it was an attempt to restart his stalled N1 rocket program because Soviet designers were “scared to the bone” by Apollo.¹⁹⁷ And when Korolev died in 1966, there was no single person to follow him who had both a vision for space exploration and an ability to broker deals within the Soviet system.¹⁹⁸

Therefore, in developing the means to achieve the objective of landing a human on the moon by the end of the decade, the United States enhanced its own instruments of power, its institutions, and even elements of its national power. The United States developed new international relationships, military and civilian technologies, and critical infrastructure for spaceflight and national power, and it put 400,000 people to work, many in very technical, well-paying jobs, while millions of others provided support in education, the media, and elsewhere.¹⁹⁹ All these developments helped the United States use the space program to shape the

international conversation about the advantages of American-style freedom over Soviet-style tyranny, because the space race was itself a line of effort in the overall American strategy of containment of the Soviet Union.

Costs are, of course, an important factor in any strategy; if they are too high, a strategy may be unachievable. Costs can include resource costs, political costs, opportunity costs, and/or the costs of inaction.²⁰⁰

“No single space project . . . will be so difficult or expensive to accomplish,” Kennedy stated to Congress in his May 1961 speech announcing the goal of reaching the moon by the end of the decade.²⁰¹ Initial estimates for the program were rather low by modern standards of big government projects—Kennedy asked for \$531 million in FY62 and an additional \$7 to \$9 billion over the next 5 years. By 1963, the Apollo budget alone was over \$2 billion, and it held steady over that amount until 1970, eventually costing nearly \$20 billion in then-year dollars, which



Moon limb with Earth on horizon, Mare Smythii Region, taken before separation of lunar module and command module during Apollo 11 mission, July 1969 (NASA)

is close to \$132 billion in 2020 dollars.²⁰² As a comparison, the total U.S. budget in 1970 dollars was \$195 billion.²⁰³

Leaders can impose their own costs, too. As the movie character NASCAR driver and philosopher Ricky Bobby once stated, "If you're not first, you're last," a sentiment that Kennedy felt at his core. Kennedy had pledged during his election campaign to make the United States "first PERIOD."²⁰⁴ This emotion was something that Kennedy did not just feel but that he expressed, too. As we have seen in his speech to Congress in May 1961, Kennedy suggested that the United States could not make a half-hearted attempt at the moon: "If we are to go only half way, or reduce our sights in the face of difficulty, in my judgment it would be better not to go at all."²⁰⁵ In short, not acting presented a risk to national security.

Yet the pressure that Kennedy put on NASA to be first in the space race added some cost to the program. Recall that NASA was on a slow, methodical trajectory to a moon landing in the 1970s until Kennedy's speech to Congress. After Kennedy's speech to Congress, Hugh Dryden, deputy NASA administrator, stated, "We could make some of these decisions [about rockets] better two years from now than we can now, if the program had gone along at the ordinary pace. But if we are going to accelerate this we have got to do some parallel approaches [in booster development], at least for a time."²⁰⁶ That approach added cost due to some duplication of efforts.

Additionally, the moon program was diverting some resources from other NASA missions. By the mid-1960s, the Apollo program was consuming over half of NASA's budget, prompting some scientists to come out against the program in favor of research into other areas, such as air pollution. An April 1963 editorial in the well-respected journal *Science* argued that "the lasting propaganda value of placing a man on the moon has been vastly overestimated. The first lunar landing will be a great occasion; subsequent boredom is inevitable."²⁰⁷ In 1964, sociologist Amitai Etzioni coined the phrase *moon-doggle*.²⁰⁸ By the late 1960s, even members of Johnson's Science Advisory Committee were calling for more balance in the space program. Environmental scientist Gordon MacDonald argued for more spending on science overall, rather than taking from the human spaceflight program and giving it to robotic spacecraft programs.²⁰⁹

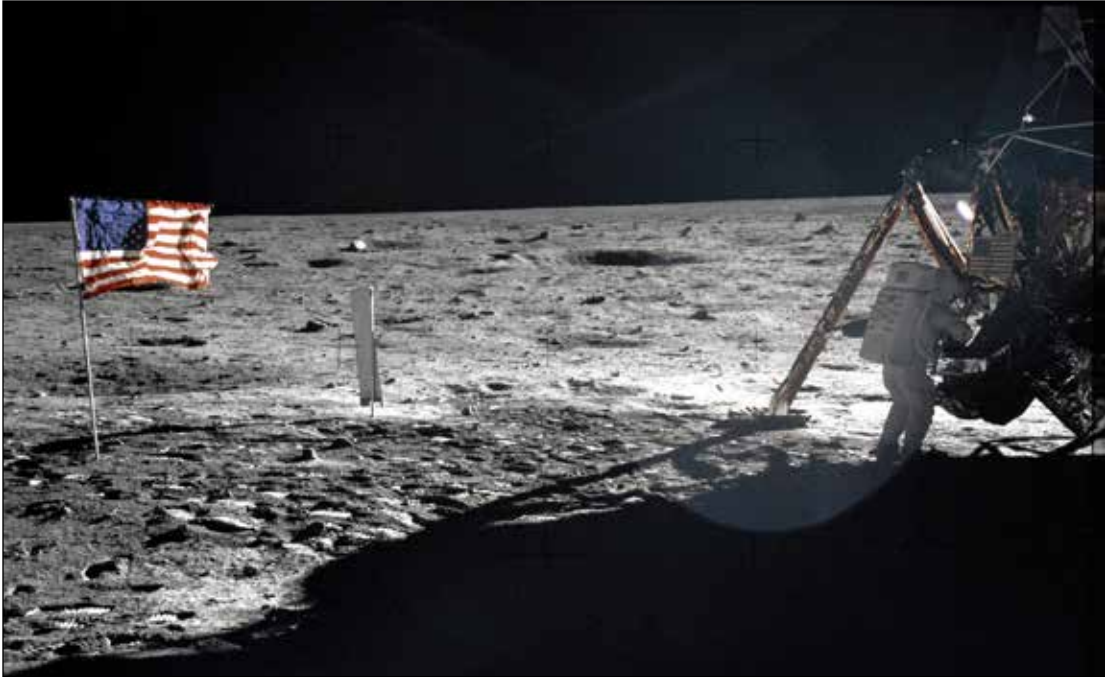
Risks are important because they stem from "undesired consequences caused by a strategy's implementation."²¹⁰ Risks can be *to* or *from* a strategy. The biggest risk to Kennedy's moon strategy was that the Soviets could hold their lead and eventually beat the United States to the moon, relegating the United States to a perpetual status of "also-ran" in the international competition. Another risk was being unable to land safely on the moon. President Nixon had two

speeches prepared for the event—one in case of a successful landing and one in case the astronauts died on or near the moon, which would have been a very public failure.

Risks from the strategy included a more aggressive Soviet Union that tried to match the United States in the race to the moon. To mitigate this risk, Kennedy invited the Soviets to join the United States on a trip to the moon in a shared program. Another risk that was not considered was what to do after reaching the moon—and as it turned out, this may have been the greatest failure of the Apollo program. After reaching the moon, there was nowhere else to go. A much more serious risk was that, by pushing the Soviet Union harder on space, the United States could drive them to make bigger rockets, the technology of which could eventually be transferred to Soviet strategic missile systems.²¹¹

Furthermore, how does one evaluate the cost of a human life or measure the risk of losing lives in pursuit of an end to help understand cost and risk? According to historian Launius, Kennedy advisor Wiesner argued that Kennedy “should distance himself from NASA’s astronaut program since any failure there would reflect poorly on the new administration.”²¹² Kennedy chose to take the risk, reasoning that the costs and risks of reaching the moon before the Soviets were worth paying. (Had he not died in 1963 and had the Apollo 1 fire not occurred in 1967, NASA was on a path to land on the moon before the end of Kennedy’s second term in January 1969.) The astronauts also understood the risks in what they were doing. Stated Astronaut Gus Grissom, “If we die, we want people to accept it. We’re in a risky business, and we hope that if anything happens to us it will not delay the program. The conquest of space is worth the risk of life.”²¹³ Grissom, the second American in space; Ed White, the first American space walker; and rookie astronaut Roger Chaffee were killed in a fire on the launch pad on January 27, 1967, during a launch rehearsal test.

The Apollo 1 fire, along with the investigation into its causes, was a devastating blow to the U.S. space program and probably resulted from some invalid technical assumptions in the development process. For example, NASA had redesigned the emergency hatch for the capsule after Grissom’s accident on his first mission when Liberty Bell 7’s hatch opened unexpectedly and the capsule sank, almost taking the astronaut with it. NASA had always pumped pure oxygen into the space capsule, but no one had ever questioned what might happen if a spark occurred in the pressurized environment. A pad fire was considered so unlikely that the capsule did not even carry a fire extinguisher on board. These assumption failures all led to the death of the three astronauts. The solutions to these and other problems ensured that “the unspoken promise on everyone’s part to the three astronauts that their deaths would not be in vain” could



Neil Armstrong at modular equipment storage assembly of lunar module "Eagle" before first extravehicular activity on lunar surface (Edwin E. Aldrin, Jr./NASA)

be kept.²¹⁴ Although the fire set back the lunar landing by at least 18 months, by the time of the next crewed flight in October 1968 (Apollo 7), the program was set up for success.

Similarly, the Soviets experienced a catastrophic accident in April 1967 that killed cosmonaut Vladimir Komarov when a parachute failure caused his spacecraft to crash. Siddiqi argues that the Soyuz 1 impact probably crippled the Soviet moon program even more than the Apollo 1 fire hurt NASA's efforts. In their efforts to catch up to the United States, which was leading in the space race by then, Soviet leaders Leonid Brezhnev and Dmitri Ustinov exerted pressure on the space program, leading to a Soviet form of NASA's "Go fever" in a "technological culture that considered high risks acceptable in the cause of satisfying political imperatives."²¹⁵

Time is also an important consideration for a strategist. Time can be a resource when there is enough of it, a constraint when there is too little of it, a cost if more of it is needed, or a threat if it is running out. Kennedy's "before this decade is out" is a phrase that rings with ambition and pressure. Logsdon stated in *Race to the Moon* that there is some "uncertainty" about where the phrase came from, given that NASA was using 1967 as a goal in its planning documents, that the Webb-McNamara memo had suggested the end of the decade was a good target, and that Webb tried to talk Kennedy's speechwriter Ted Sorensen out of targeting a specific year.

Sorensen recalled in his memoir that Kennedy chose the phrase “to exert pressure on NASA” but also to allow “some flexibility—it could mean within the decade of the sixties or within the next ten years.”²¹⁶

Having enough time to accomplish a goal is also an asset because it provides the opportunity to reevaluate the strategy. By late 1962 Kennedy was questioning NASA’s commitment to the moon landing. NASA was absorbing more and more of the budget, and the goal did not appear much closer than the original planning date of late 1967. In a November 1962 meeting in the Oval Office, Kennedy tried to reiterate to Webb that the lunar landing should be NASA’s top priority after Webb had suggested it was merely one among many top programs:

Kennedy: But this is important for political reasons, international political reasons. This is, whether we like it or not, in a sense a race. If we get second to the Moon, it’s nice, but it’s like being second any time. . . . So I think we have to take the view that this is a top priority with us. . . . Everything we do ought really to be tied to getting on the Moon ahead of the Russians.

Webb: Why can’t it be tied to preeminence in space?

Kennedy: Because, by God, we keep, we’ve been telling everybody we’re the preeminent in space for five years and nobody believes it because they [the Soviets] have the booster and the satellite. . . . Now this [discussion about priorities] may not change anything about the schedule but at least we ought to be clear, otherwise we shouldn’t be spending this kind of money, because I’m not that interested in space. I think it’s good, I think we ought to know about it, we’re ready to spend reasonable amounts of money. But we’re talking about these fantastic expenditures which wreck our budget and all these other domestic programs and the only justification for it in my opinion to do it in this time or fashion is because we hope to beat them and demonstrate that starting behind, as we did by a couple of years, by God, we passed them.²¹⁷

With the successes and successful failures of the Gemini program, and with Kennedy’s death, NASA felt the pressure of time and developed “Go fever.” Although Armstrong and Scott had nearly been lost in space when a thruster malfunctioned on their capsule and White had nearly died during his extravehicular activity, NASA grew overconfident and missed accidents

waiting to happen, such as the Apollo 1 fire—even though Grissom himself had hung a lemon on the outside of the capsule to signal its unworthiness for spaceflight. Time became an important ally of the moon program following the January 1967 Apollo 1 fire when NASA shut down all crewed spaceflight for 18 months. Apollo 1 was supposed to be the first crewed Apollo mission, set for low Earth orbit. It was going to be the third spaceflight for Grissom, who would be the first person to accomplish that feat. By taking the time to reevaluate the whole Apollo program, and by spending hundreds of millions of dollars adjusting the spacecraft and many aspects of the entire program, NASA could still meet Kennedy's goal.²¹⁸ Time turned out to be an advantage for the United States, even if it did not always look that way.

Throughout the strategy development process, thought must be given not only to what is being done but also to what the object of the strategy is doing. As the military is fond of stating, "The enemy gets a vote." In this case, the enemy, the Soviet Union, also had a space program that, when Kennedy came into office, was ahead of the American program and got further ahead of the United States over the next few months. The Soviets were racing the United States despite what Soviet propaganda said over the years.



Pararescueman Lieutenant Clancy Hatleberg closes Apollo 11 spacecraft hatch as astronauts Neil Armstrong, Michael Collins, and Edwin Aldrin, Jr., await helicopter pickup from life raft, July 24, 1969, approximately 900 miles southwest of Hawaii (NASA/U.S. Navy/Milt Putnam)

An assessment of Soviet capabilities that included a lot of embedded assumptions was made early in the U.S. discussion about what to do. The United States knew, for example, what capabilities the Soviets had already used, where they had launched them from, and how many times. U.S. planners then assumed (mistakenly, as it turned out) that the Soviets were working from a long-term plan and that “the next decade will be marked with Soviet achievements in space which will be well planned, well directed, and executed with deliberateness and skill.”²¹⁹ This May 8, 1961, estimation reinforced Kennedy’s decision to go for the moon as an option for getting ahead of the Soviets.

An October 1963 CIA analysis titled “A Brief Look at the Soviet Space Program” did not reach any firm conclusions about whether the Soviet Union even had a moon landing program, but it “estimated that a competitive program aimed at the 1968–1970 time period is somewhat less likely than” a previous estimate made in 1962.²²⁰ However, by 1964 analysts believed the Soviets were planning a moon mission using a giant new rocket they had observed rolling on and off the launch pad in Kazakhstan.²²¹ When the analysts then saw evidence of a huge explosion of a rocket comparable in size to the Saturn V booster, they knew the Soviets were reaching for the moon but were having some very difficult issues. By 1969, the American press was reporting that the Soviet Union had a moon landing program, but Moscow denied it. According to Mstislav Keldysh, then president of the Soviet Academy of Sciences, there were “no immediate Soviet plans to land on the moon,” although they were “systematically” studying “the moon and other planets with unmanned spaceships.”²²² In late 1968, though, the Soviets had launched Zond 5 toward the moon with two turtles on board. The spacecraft went around the moon and splashed down safely in the Indian Ocean after the long trip, with the turtles safe and sound. But a series of on-Earth and in-orbit failures followed, and as the Soviets fell further behind, they began denying that they had a moon landing program at all.²²³

The Soviet moon program likely failed for several reasons, including technical issues, poor leadership, a deadly accident, and a debate focused on first developing a low Earth orbiting space station.²²⁴ (A similar debate occurred in the United States but was resolved quickly in favor of getting to the moon as fast as possible.) The Soviets made some bad strategic choices along the way and never landed humans on the moon, despite some clear efforts.

Strategists must consider the likelihood that a strategy will successfully achieve its desired ends, also known as *viability*. If a strategy is not viable, it will not achieve its planned ends. Take the space shuttle program, which was intended to be part of a larger program that included an Earth-orbiting space station; the shuttle was meant to be the “truck” to transport people and cargo from Earth to orbit. Instead, when the Nixon administration canceled the space station

portion of the program, the shuttle became a low Earth orbit-and-return vehicle far less capable than a space station of performing in space. Only when the United States committed to building the International Space Station using the shuttle to ferry the largest parts to orbit did it finally achieve its promise. But the shuttle program was not a means to an end—that is, a way to shape the conversation about freedom or tyranny.

To assure the administration that the moon strategy could achieve its desired end of shaping the world conversation about tyranny or freedom, the Apollo program needed to have its viability judged, which can be broken down into several other concepts, like suitability, feasibility, desirability, acceptability, and sustainability.²²⁵ Given that Kennedy intended the strategy to shape the conversation about the differences between freedom and tyranny and that the Soviet threat at the moment was not verging on open warfare between the two states, he had an opportunity to execute a long-term strategy to create a situation that was to the United States's advantage.

First, was Kennedy's space strategy *suitable*—that is, did it work to advance U.S. interests without working against other American strategies?²²⁶ Kennedy could not have used the Apollo program to coerce, subdue, or eradicate Soviet communism. While he did try to induce the Soviets to join the United States on the moon trip, if he had been successful, this action would not likely have had the desired effect of shaping or persuading the people of the world to choose freedom over tyranny. So, Kennedy's strategy was suitable as he laid it out originally.

The *feasibility* of a strategy "examines whether the strategy presents a reasonably likely path toward achieving the political aim"—that is, whether sufficient means are available to achieve the end, or its likelihood of success.²²⁷ Clearly, the United States did not possess the capability to reach the moon in 1961 when Kennedy proposed his goal, so NASA set out to create the means using the available elements, institutions, and instruments of national power. In other words, the strategy was feasible if NASA could generate the means.

Desirability examines whether the cost of achieving the political end will be worth it.²²⁸ Estimates of the final costs incurred to reach the moon first range from \$20 billion to \$40 billion in then-year dollars. Defeating the Soviet Union in the international race for technological leadership, shaped through the moon race, was far more desirable in terms of costs in lives and national treasure than the stalemate in Korea, the defeat in Vietnam, or an attack on the Soviet Union might have been. But, as has been noted, not everyone thought going to the moon was desirable.

Acceptability judges whether the strategy is tolerable to the nation, its leaders, or its allies.²²⁹ In choosing a shaping approach, Kennedy increased the acceptability of the Apollo program by projecting a public, peaceful, technologically successful U.S. space program and contrasting it with the secret, aggressive Soviet space program. So, even if the approach was not desirable, it

was acceptable to many people. Others did not see it that way, though, instead believing that Apollo was diverting resources from other American needs.

Sustainability examines resources, but not just available means or means that need to be created. The notion of sustainability also includes consideration of enduring political will or popular support.²³⁰ While American popular support for the moon landing never actually exceeded 50 percent, the program was not so reviled that Congress cut off all funding for it, even if the program never achieved the levels of funding it asked for each year. Kennedy's political will seemed to lag after some time, leading to his proposals to invite the Soviets into the program so they could jointly share the costs of going to the moon. But after Kennedy's death, people in the program saw reaching the moon as their homage to Kennedy's memory. Wrote Kranz some years after Kennedy's death, "At Mission Control and throughout NASA, in our hearts we resolved to honor John Kennedy's memory by meeting the challenge he had set for us."²³¹ Sustaining the program became a matter of faith for some.

By the 1970s, with the moon landing achieved and the Soviet space program in NASA's rearview mirror, a new President had new priorities, and a predecessor's legacy was not one of them. Instead, Nixon canceled Apollo 18, 19, and 20 and required NASA's programs to compete with other discretionary spending programs, including defense. As Nixon put it in 1970, "What we do in space from here on in must become a normal and regular part of our national life."²³² Slowly, the viability of the moon program began fading away. The program was no longer desirable or acceptable or possibly even sustainable. With the coming budget reductions, as historian Joan Hoff wrote about the space program of the 1970s, "the budget begat space policy instead of space policy begetting budget, as had been the case during the heyday of Apollo in the Kennedy and Johnson administrations."²³³ In other words, the space program fell into "What can we achieve with our available means?" instead of "What is our end, how should we achieve it, and what do we need to accomplish it?"

Results and Conclusions

"Many years ago," Kennedy stated during the Rice speech, "the great British explorer George Mallory, who was to die on Mount Everest, was asked why did he want to climb it. He said, 'Because it is there.' Well, space is there, and we're going to climb it, and the moon and the planets are there, and the new hopes for knowledge and peace are there."²³⁴ Soaring rhetoric indeed, but not entirely true: Kennedy did not set the United States off on an accelerated path toward the moon "because it is there." He did it because he needed to demonstrate to the world that the United States was the right choice in the debate between freedom and tyranny. His space



President Richard M. Nixon welcomes Apollo 11 astronauts, already in Mobile Quarantine Facility, aboard USS *Hornet*, prime recovery ship for lunar landing mission; from left, Neil Armstrong, Michael Collins, Edwin Aldrin, Jr., and Richard Nixon, July 24, 1969 (NASA)

program was not an aggressive one with coercive elements. It was a program intended to shape the people of the world into considering which political system was the right choice. Along the way, Kennedy also used some elements of national power, such as a strong U.S. economy, to build other elements of power, such as the nation's human capital, infrastructure, political will, public spirit, R&D capabilities, and so on, helping create means that could be used in the greater overall strategy of containing the expansion of the Soviet Union.

If Kennedy was looking for a program that would enhance American industry and the U.S. economy or solve conflicts overseas, he could probably have found a different approach. Many of the 400,000 people working in the Apollo program needed to find other work when the program ended. Landing humans on the moon had little relevance to the violence or decay in the cities of the late 1960s, and the space program did little for crises in Berlin, Cuba, or Vietnam.

If Kennedy was looking for a program to enhance understanding of the origins of the moon, he could have used more robots. Not until Apollo 15 did NASA begin publicizing the scientific aspects of the program. Geologist-astronaut Harrison Schmidt flew aboard the last mission, Apollo 17, the only nonpilot of the Apollo program. Stated another geologist to *The Washington Post*, "I'm not sure the public would have understood science as a rationale for Apollo . . . [but] . . . that was the payoff."²³⁵ Maybe science was part of the \$35 billion payoff, but it was not considered in the early thinking about this strategic approach to the Cold War.

If Kennedy was looking for a program to unite the American people in a task, he never succeeded. In July 1969, on the eve of the first lunar landing, opinions remained divided. Owen Gingerich, a Harvard astronomer, mused to William Burrows of *The Wall Street Journal* about the lasting relevance of the landing, suspecting "that historians of the year 2050 will view the moon landing as the most dramatic single achievement of this time—more spectacular than a cure for cancer would be. Who now marvels about the conquest of the bubonic plague?"²³⁶ Stated novelist Kurt Vonnegut, Jr., to Burrows, "Man should be humbled by his own waste and stupidity. This is simply another perfectly feasible technical operation."²³⁷ To Burrows, Pulitzer Prize-winning poet Mark Van Doren stated, "We have lost sight of one question; we think that knowing how to do something means you should do it."²³⁸ Science fiction writer Isaac Asimov saw things differently. Burrows quoted him as stating, "The world is being Americanized and technologized to its limits, and that makes it dull for some people. Reaching the moon restores the frontier and gives us the lands beyond," what Kennedy referred to as "this new ocean" in his Rice speech.²³⁹ Or, stated scientist Vannevar Bush to Burrows, the landing was justifiable simply based on its ability to generate "a tremendous rise in enthusiasm in this country, and it may be justified in terms of the rise in public spirit."²⁴⁰ But the landing certainly helped Nixon's poll

numbers: A November 1969 poll conducted during the second lunar mission showed a 12-point rise in his job approval ratings from the previous 56 percent; the new 68 percent number was his highest yet, and the poll revealed that only 19 percent of the public disapproved of Nixon's performance.²⁴¹

Presidential historian Beschloss argued that Kennedy's decision to go to the moon captured the American imagination and the congressional support it needed. NASA could not spend congressional appropriations fast enough in the first few years of the program. But in Beschloss's opinion, the Soviet Union was never really the threat the West made it out to be, and the money spent going to the moon could have been better spent elsewhere in the U.S. economy in convincing Moscow that it could not defeat the United States.²⁴² Logsdon had a similar take, arguing that the lunar landing achieved Kennedy's goal of acquiring more prestige for the United States but in the long run probably hurt the U.S. space program because it was a short-term political decision and not part of a longer term strategy to advance technology.²⁴³ This view is consistent with that of historian Mel Kranzberg, who argued that "although technology might be a prime element in many public issues, nontechnical factors take precedence in technology-policy decisions."²⁴⁴ Therefore, the decision achieved Kennedy's political objectives, but because he did not fully consider the long-term consequences, the decision does not stand up very well since the end of the Cold War.

The program did have some practical benefits for some of humanity, even if the benefits were not achieved for all of humanity. According to a 1969 *Wall Street Journal* article, new rescue rafts (astronaut recovery), methods of tracking fathers behind in child support (computer systems in California), and jumbo jet inertial navigations systems (lunar landing module) all originated at NASA during the Apollo program. So, too, did thermal mapping and space-based environmental monitoring as well as new plastics, new fireproof fabrics, and smaller batteries.²⁴⁵ Could these advances have been achieved for less than the cost of the Apollo program? The answer is probably yes.

Was Kennedy's push for the moon by the end of the decade a strategy? Yes, absolutely, and it succeeded in shaping the world conversation about tyranny and freedom. When Apollo 11 landed on the moon, though, millions in the international community gave their impressions of the shape of the argument. The National Broadcasting Company stated 123 million Americans watched the landing on TV in their homes, part of an estimated half billion viewers across the world. Muscovites cheered and congratulated the United States. "It's a great day," *The Washington Post* quoted one as saying. More than 500 Poles went to the U.S. Embassy in Warsaw to hear the news of the landing. "There was euphoria in the crowd when they landed," stated



New York City welcomes Apollo 11 crewmen in shower of ticker tape down Broadway and Park Avenue, August 13, 1969 (NASA/Bill Taub)

an Embassy spokesperson. In the Middle East, “Arab radio stations interrupted their bulletins about a major air battle over the Suez Canal to acclaim the event and praise” the astronauts.²⁴⁶ The Soviet government did not broadcast the moon landing live, acknowledging the event with a congratulatory message to the United States but only a small story in the Soviet press. “But no less than Nobel laureate Andrei Sakharov and two colleagues issued an open letter to the Soviet government in 1970, calling for democratization of the USSR, specifically citing the American moon landing as evidence of the superiority of democracy.”²⁴⁷ But it was not a strategy intended on its own to trigger the Soviet Union’s collapse because it was not a stand-alone strategy. Rather, it was a strategy intended to be a part of a greater whole, with a grand focus on the eventual collapse of the Soviet Union.

The moon appears in the night’s sky, and even though no one stares back at Earth from there, Americans did walk on the moon during the Apollo program. However, that is not the

point. Kennedy got the Soviets to spend huge amounts of money they could have spent elsewhere. Instead of spending money in their state-controlled economy to produce consumer goods, the Soviets diverted money to their space program. The United States beat the Soviet Union to the moon at a time when no nation was beating the Soviet Union anywhere on Earth. In turning its attention to the moon in July 1969, the world acknowledged the success of Kennedy's strategy.

The moon program was not just about climbing the highest mountain or flying solo across the Atlantic. If viewed exclusively as a plan like climbing Mount Everest, going to the moon makes little sense. But when plugged into the overall U.S. grand strategy of facing the Soviet Union during the Cold War, "landing a man on the moon and returning him safely to the Earth before the end of the decade" makes all the sense in *this* world.²⁴⁸

Notes

¹ Warren Unna, “U.S. Prestige Slip Seen in Poll of 5 Major Allies: Based on Polls,” *Washington Post*, October 29, 1960, A1; quoted in John M. Logsdon, *John F. Kennedy and the Race to the Moon* (New York: Palgrave Macmillan, 2010), 369.

² Hanson Baldwin, “Flaw in Space Policy: U.S. Is Said to Lack Sense of Urgency in Drive for New Scientific Conquests,” *New York Times*, April 17, 1961, 5; quoted in Logsdon, *Race to the Moon*, 73.

³ President John Fitzgerald Kennedy, “Inaugural Address,” January 20, 1961, available at <<https://voicesofdemocracy.umd.edu/kennedy-inaugural-address-speech-text/>>.

⁴ John M. Logsdon, *The Decision to Go to the Moon: Project Apollo and the National Interest* (Cambridge, MA: MIT Press, 1970).

⁵ Logsdon, *Race to the Moon*.

⁶ Michael Beschloss, “Kennedy and the Decision to Go to the Moon,” in *Spaceflight and the Myth of Presidential Leadership*, ed. Roger D. Launius and Howard E. McCurdy (Champaign: University of Illinois Press, 1997).

⁷ Many thanks to Steven Heffington for helping me clarify this thought. Heffington, comments to the author, March 26, 2021.

⁸ John M. Logsdon et al., eds., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, vol. 1: *Organizing for Exploration* (Washington, DC: National Aeronautics and Space Administration [NASA], 1995), 422.

⁹ Many thanks to Steven Heffington for helping me clarify these thoughts.

¹⁰ Roger Launius, comments to the author on an early draft of this paper. Launius, email to the author, March 2, 2021.

¹¹ For a discussion of problem statements, see Steven Heffington, Adam Oler, and David Tretler, eds., *A National Security Strategy Primer* (Washington, DC: NDU Press, 2019), 8–9.

¹² The U.S. Space Program during the Cold War is mentioned in Heffington, Oler, and Tretler, *Primer*, 5, 35.

¹³ In his biography of Neil Armstrong, historian James R. Hansen argued that “JFK realized that only swift and dramatic action would restore American respect at home and abroad. To this purpose, Kennedy turned to the potential of the U.S. manned space program. Though Kennedy’s reticent record on space dated back to his days in the U.S. Senate, the President saw in NASA and its astronauts a means to a political end.” See James R. Hansen, *First Man: The Life of Neil A. Armstrong* (New York: Simon & Schuster, 2005), 218.

¹⁴ President Dwight D. Eisenhower, “Address Before the 15th General Assembly of the United Nations,” September 22, 1960, available at <<https://2009-2017.state.gov/p/io/potusunga/207330.htm>>.

¹⁵ Logsdon, *Race to the Moon*, 156.

¹⁶ *Ibid.*, 37–43.

¹⁷ Quoted in Logsdon, *Race to the Moon*, 156; NASA History Office, “Project Apollo: A Retrospective Analysis,” updated April 21, 2014, available at <<https://history.nasa.gov/Apollomon/Apollo.html>>.

¹⁸ Weisner Committee, “Report to the President-Elect of the Ad Hoc Committee on Space,”

NASA History Office, January 10, 1961; see also Logsdon et al., *Exploring the Unknown*, vol. 1, 416. According to Logsdon, Wiesner had worked on science issues in the Eisenhower administration, advised Kennedy during the Presidential campaign, and then became the President's science advisor after the inauguration.

¹⁹ "Ad Hoc Committee on Space," 416.

²⁰ Ibid., 421–422.

²¹ Ibid., 416, 422.

²² Ibid., 422.

²³ John F. Kennedy, "Memorandum for Vice President," April 20, 1961, available at <<https://history.nasa.gov/Apollomon/apollo1.pdf>>.

²⁴ Lyndon B. Johnson, "Memorandum for the President: 'Evaluation of Space Program,'" April 28, 1961, NASA Historical Reference Collection, available at <<https://history.nasa.gov/Apollomon/apollo2.pdf>>. Emphasis added.

²⁵ Johnson, "Evaluation of Space Program."

²⁶ Richard Rumelt, *Good Strategy, Bad Strategy: The Difference and Why It Matters* (New York: Crown Business, 2011), 81–87. See also, for example, John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of American National Security Policy During the Cold War* (Oxford: Oxford University Press, 2005), especially chapters 2 and 3.

²⁷ X [George Kennan], "The Sources of Soviet Conduct," *Foreign Affairs* 25, no. 4 (July 1947), 566–582.

²⁸ Logsdon, *Race to the Moon*, 239.

²⁹ John F. Kennedy, "Special Message to Congress on Urgent National Needs," May 25, 1961, John F. Kennedy Presidential Library and Museum, available at <<https://www.jfklibrary.org/asset-viewer/archives/JFKPOF/034/JFKPOF-034-030>>; see also "John F. Kennedy, Excerpts from 'Urgent National Needs,' Speech to a Joint Session of Congress, May 25, 1961," in Logsdon et al., *Exploring the Unknown*, vol. 1, 453.

³⁰ Logsdon, *Race to the Moon*, 239.

³¹ "Vice President's Ad Hoc Meeting," May 3, 1961, in Logsdon et al., *Exploring the Unknown*, vol. 1, 438.

³² Rumelt, *Good Strategy, Bad Strategy*, 106. Here Rumelt paraphrases Kennedy's May 25, 1961, speech to Congress: "Finally, if we are to win the battle for men's minds, the dramatic achievements in space which occurred in recent weeks should have made clear to us all [as did the Sputnik in 1957] the impact of this new frontier of human adventure." See "John F. Kennedy, Excerpts from 'Urgent National Needs,'" in Logsdon et al., *Exploring the Unknown*, vol. 1, 453.

³³ NASA Space Science Data Coordinated Archive, "Luna 2," available at <<https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1959-014A>>; NASA, "Moon Missions," available at <<https://moon.nasa.gov/exploration/moon-missions/>>.

³⁴ Heffington, Oler, and Tretler, *Primer*, 7–8.

³⁵ Johnson, "Evaluation of Space Program," in Logsdon et al., *Exploring the Unknown*, vol. 1, 428. The difference between the robotic Luna 2 and Gagarin's low Earth orbit Vostok 1 was nearly 10,000 pounds.

³⁶ “Vice President’s Ad Hoc Meeting,” May 3, 1961, in Logsdon et al., *Exploring the Unknown*, vol. 1, 436.

³⁷ See Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race, 1945–1974*, NASA SP-2000-4408 (Washington, DC: NASA, 2000), 402. The Soviet concept for the moon landing included four space launches and assembly of 200 tons of vehicles in low Earth orbit for the moon journey, including a 21-ton lunar lander.

³⁸ Wernher von Braun, “Wernher von Braun to the Vice President of the United States,” April 29, 1961, NASA Historical Reference Collection, available at <<https://history.nasa.gov/Apollomon/apollo3.pdf>>.

³⁹ Ibid.

⁴⁰ Johnson, “Evaluation of Space Program,” 428; Bill Barry and Steve Garber, “A Chronology of Defining Events in NASA History, 1958–1998,” NASA, updated January 3, 2012, available at <<https://history.nasa.gov/40thann/define.htm>>.

⁴¹ Johnson, “Memorandum for the President,” 428.

⁴² Ibid.

⁴³ James E. Webb and Robert S. McNamara, Letter, with Report Attached, from Defense Secretary Robert McNamara and NASA Administrator James E. Webb, to Vice President Lyndon B. Johnson, May 8, 1961, “Recommendations for Our National Space Program: Changes, Policies, Goals, ‘Tab A: The Soviet Program and Capabilities,’” in Logsdon et al., *Exploring the Unknown*, vol. 1, 448–449; for primary source material, see Space Activities: General, vol. 1–3, 1961: April–June, John F. Kennedy Presidential Library and Museum, available at <<https://www.jfklibrary.org/asset-viewer/archives/JFKNSF/307/JFKNSF-307-004>>; Although they had little impact on U.S. direction, both of these assumptions turned out to be false.

⁴⁴ Webb and McNamara, “Recommendations for Our National Space Program,” 445.

⁴⁵ “Federal 1961 Spending by Function,” U.S. Government Spending Web site, available at <https://www.usgovernmentspending.com/fed_spending_1961USbn>; “Vice President’s Ad Hoc Meeting,” May 3, 1961, in Logsdon et al., *Exploring the Unknown*, vol. 1, 434–435.

⁴⁶ Webb and McNamara, “Recommendations for Our National Space Program,” 439.

⁴⁷ Ibid., 439–440.

⁴⁸ Ibid.

⁴⁹ Ibid., 444.

⁵⁰ Ibid.

⁵¹ Ibid., 446.

⁵² Kennedy, “Special Message to Congress.”

⁵³ Ibid.

⁵⁴ Ibid.

⁵⁵ These last two program proposals for more satellite communications and weather capabilities are presented as secondary, but they have arguably had much greater impact on human existence than did the moon landings.

⁵⁶ Kennedy, “Special Message to Congress.”

⁵⁷ See Logsdon, *Race to the Moon*, especially 113–116, for his discussion about the speech to

Congress. Logsdon cites Kennedy speechwriter Ted Sorensen as saying that this was the only time Kennedy made ad libs in "a formal address" (113). Roger Launius suggested in an early draft of this paper that Kennedy's ad libs at this point were because Kennedy "really wanted to make clear that Congress had to agree to this decision." Launius, email to author, March 2, 2021.

⁵⁸ Heffington, Oler, and Tretler, *Primer*, 10–11.

⁵⁹ Terry L. Deibel, *Foreign Affairs Strategy: Logic for American Statecraft* (New York: Cambridge University Press, 2007), 125–128.

⁶⁰ Kennedy, "Inaugural Address."

⁶¹ Kennedy, "Special Message to Congress."

⁶² Johnson, "Evaluation of Space Program," 427–428.

⁶³ Webb and McNamara, "Recommendations for Our National Space Program," 441.

⁶⁴ Mark J. Perry, "Dynamic Chart: World's Ten Largest Economies, 1961 to 2017," American Enterprise Institute, November 5, 2018, available at <<https://www.aei.org/carpe-diem/dynamic-graph-of-the-day-top-ten-countries-by-gdp-1961-to-2017/>>.

⁶⁵ Johnson, "Evaluation of Space Program," 427–428.

⁶⁶ "Ad Hoc Committee on Space," 421.

⁶⁷ *Ibid.*, 416–417.

⁶⁸ *Ibid.*

⁶⁹ Many thanks to Steven Heffington for helping me clarify these thoughts.

⁷⁰ Deibel, *Foreign Affairs Strategy*, 125–128.

⁷¹ Heffington, Oler, and Tretler, *Primer*, 37.

⁷² Kennedy, "Memorandum for Vice President," 424.

⁷³ Johnson, "Evaluation of Space Program," 427–429.

⁷⁴ From Steven Heffington: "The race to the moon became a line of effort in the greater strategy. That line of effort integrated very well with other lines of effort (orchestration) because it produced very valuable means for them. Thus, this is a double means-producing strategy. The United States had to develop means to succeed in the space race line of effort, but in doing so was creating means of other lines of effort as a secondary effect."

⁷⁵ Heffington, Oler, and Tretler, *Primer*, 38–39.

⁷⁶ *Ibid.*

⁷⁷ Steve Heffington wrote to the author in an early discussion about shaping strategies, "I would argue that it is not the seriousness, but the immediacy of the threat that determines if shaping is a viable approach. A peripheral threat coming to fruition tomorrow is no better target for shaping than is an existential one. Shaping generally takes time. If you have that time, shaping is a great strategic tool. If you don't then it is not." Heffington, March 26, 2021.

⁷⁸ Johnson, "Evaluation of Space Program," 427.

⁷⁹ Elizabeth Hanes, "From Sputnik to Spacewalking: 7 Soviet Space Firsts," *History*, available at <<https://www.history.com/news/from-sputnik-to-spacewalking-7-soviet-space-firsts>>.

⁸⁰ Barry and Garber, "Defining Events in NASA History."

⁸¹ Frank Newport, "Landing a Man on the Moon: The Public's View," Gallup, July 20, 1999, available at <<https://news.gallup.com/poll/3712/landing-man-moon-publics-view.aspx>>.

⁸² Thanks to Steven Heffington for clarifying this idea.

⁸³ Logsdon, *Race to the Moon*, 127–130.

⁸⁴ The selection criteria for what eventually became the Houston site can be found in “Appendix A, Manned Spacecraft Center, Site Selection Procedure,” abstracted from James E. Webb, “Memorandum for the President,” NASA, September 14, 1961, available at <<https://www.hq.nasa.gov/office/pao/History/SP-4205/app-a.html>>.

⁸⁵ John W. Finney, “Houston Is Picked for Space Center,” *New York Times*, September 20, 1961, 6.

⁸⁶ Logsdon, *Race to the Moon*, 127–130. Quote from Kennedy is on 130.

⁸⁷ Heffington, Oler, and Tretler, *Primer*, 40.

⁸⁸ *Ibid.*, 41.

⁸⁹ *Ibid.*

⁹⁰ *Ibid.*

⁹¹ *Ibid.*, 19.

⁹² Joseph S. Nye, Jr., *The Future of Power* (New York: PublicAffairs, 2011), 6–8.

⁹³ Heffington, Oler, and Tretler, *Primer*, 19.

⁹⁴ Ross Harrison, *Strategic Thinking in 3D: A Guide for National Security, Foreign Policy, and Business Professionals* (Washington, DC: Potomac Books, 2013), 36.

⁹⁵ *Ibid.*, 38.

⁹⁶ These two statistics taken from U.S. Congress, Joint Economic Committee, *USSR: Measures of Economic Growth and Development, 1950–80* (Washington, DC: U.S. Government Printing Office, December 8, 1982), 3, 20, available at <[https://www.jec.senate.gov/reports/97th%20Congress/USSR%20-%20Measures%20of%20Economic%20Growth%20and%20Development%201950-1980%20\(1152\).pdf](https://www.jec.senate.gov/reports/97th%20Congress/USSR%20-%20Measures%20of%20Economic%20Growth%20and%20Development%201950-1980%20(1152).pdf)>.

⁹⁷ Heffington, Oler, and Tretler, *Primer*, 20.

⁹⁸ Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 194.

⁹⁹ Larry Abramson, “Sputnik Left Legacy for U.S. Science Education,” National Public Radio, September 30, 2007, available at <<https://www.npr.org/templates/story/story.php?storyId=14829195>>. See also, for example, Barbara Barksdale Clowse, *Brainpower for the Cold War: The Sputnik Crisis and National Defense Education Act of 1958* (New York: Praeger, 1981); Wayne J. Urban, *More Than Science and Sputnik: The National Defense Education Act of 1958* (Tuscaloosa: University of Alabama Press, 2010), especially introduction, 1–9.

¹⁰⁰ Webb and McNamara, “Recommendations for Our National Space Program,” 445.

¹⁰¹ Quoted in Stephen B. Johnson, *The Secret of Apollo: Systems Management in American and European Space Programs* (Baltimore: Johns Hopkins University Press, 2002), 135.

¹⁰² *Ibid.*, 136.

¹⁰³ *Ibid.*, 137–141.

¹⁰⁴ Michael Collins, *Liftoff: The Story of America’s Adventure in Space* (New York: Grove Press, 1988), 137.

¹⁰⁵ Michael Collins, *Carrying the Fire: An Astronaut’s Journeys* (New York: Cooper Square Press, 2001 ed.), 273. Emphasis in the original.

¹⁰⁶ Stephen B. Johnson, "Samuel Phillips and the Taming of Apollo," *Technology and Culture* 42, no. 4 (October 2001), 685–709.

¹⁰⁷ Albert F. Siepert to James E. Webb, "Length of Tours of Certain Military Detailees," February 8, 1963, in Logsdon et al., *Exploring the Unknown*, vol. 1, 672–673; see also, for example, Johnson, *The Secret of Apollo*, especially chapter 5.

¹⁰⁸ Thomas O'Toole, "Launch Chief Is the 'Law': Rocco Petrone's Image in Space Agency Is Like Vince Lombardi's in Sports," *Washington Post*, July 17, 1969, A7.

¹⁰⁹ Heffington, Oler, and Tretler, *Primer*, 20.

¹¹⁰ Aerospace Industries Association of America (AIAA), *The Aerospace Year Book 1962* (Washington, DC: American Aviation Publications, 1962), 18, available at <<https://www.aia-aerospace.org/wp-content/uploads/2016/06/THE-1962-AEROSPACE-YEAR-BOOK.pdf>>.

¹¹¹ *Ibid.*, 211. Wyman-Gordon still exists today, as a subsidiary of Precision Castparts Corporation. See Wyman-Gordon Web site, available at <http://www.pccforgedproducts.com/brands/wyman_gordon/>.

¹¹² See Owal A. Cook, "Foreword," *Aerospace Year Book 1962*.

¹¹³ AIAA, *Aerospace Year Book 1962*, 68–70.

¹¹⁴ U.S. Department of Labor, "History of Changes to the Minimum Wage Law," available at <<https://www.dol.gov/agencies/whd/minimum-wage/history>>.

¹¹⁵ AIAA, *Aerospace Year Book 1962*, 223–227.

¹¹⁶ *Ibid.*, 226–228.

¹¹⁷ *Ibid.*, 228–230.

¹¹⁸ Roger E. Bilstein, *Stages to Saturn: A Technological History of the Apollo/Saturn Launch Vehicles*, NASA SP-4206 (Washington, DC: NASA, 1996), available at <<https://history.nasa.gov/SP-4206/ch4.htm>>.

¹¹⁹ Siddiqi, *Challenge to Apollo*, 550–551; Webb, quoted in Siddiqi, *Challenge to Apollo*, 551. See also Mark Garcia, ed., "50 Years Ago: Soviet's Moon Rocket's Rollout to Pad Affects Apollo Plans," available at <<https://www.nasa.gov/feature/50-years-ago-soviet-s-moon-rocket-s-rollout-to-pad-affects-apollo-plans>>.

¹²⁰ Thuy Mai, ed., "July 1961—Mercury Space Flight Network (MSFN) Completed," available at <https://www.nasa.gov/directorates/heo/scan/images/history/July1961_2.html>.

¹²¹ Heffington, Oler, and Tretler, *Primer*, 20.

¹²² For more on the evolution of attitudes to the space program, see William Sims Bainbridge, "The Impact of Space Exploration on Public Opinions, Attitudes, and Beliefs," in *Historical Studies in the Societal Impact of Spaceflight*, NASA SP-2015-4803, ed. Steven J. Dick (Washington, DC: NASA, 2015), 12. In 2018, a Pew Research poll found that "most Americans believe[d] the United States should be at the forefront of global leadership in space exploration." In fact, 72 percent said "it is essential for the U.S. to continue to be a world leader in space exploration." See Pew Research Center, "Majority of Americans Believe It Is Essential That the U.S. Remain a Global Leader in Space," June 6, 2018, available at <<https://www.pewresearch.org/science/2018/06/06/majority-of-americans-believe-it-is-essential-that-the-u-s-remain-a-global-leader-in-space/>>.

¹²³ Bainbridge, "The Impact of Space Exploration," 13.

¹²⁴ Henry Petroski, *To Engineer Is Human: The Role of Failure in Successful Design* (New York: St. Martin's Press, 1985), 9, 84.

¹²⁵ Gene Kranz, *Failure Is Not an Option: Mission Control from Mercury to Apollo 13 and Beyond* (New York: Simon & Schuster, 2000), 177, 307.

¹²⁶ Launius, email to the author, March 2, 2021.

¹²⁷ Steven Heffington argues, "Kennedy was making choices about conversion. . . . Huge chunk[s] of money (elements) [were] converted to institutions and infrastructure, human capital [was] converted to focus on [the] space race. . . . We took a lot of elements and converted them either into more valuable elements or institutions and actors . . . [representing] the conversion of latent to realized or actual power/capability." Heffington to the author, comments, March 26, 2021.

¹²⁸ Heffington, Oler, and Tretler, *Primer*, 19.

¹²⁹ *Ibid.*, 22.

¹³⁰ *Ibid.*, 23–24.

¹³¹ John F. Kennedy, "Ich bin ein Berliner" speech, June 26, 1963, West Berlin, American Rhetoric Online Speech Bank, available at <<https://www.americanrhetoric.com/speeches/jfkberliner.html>>.

¹³² Loyd S. Swenson, Jr., James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury*, NASA SP-4201 (Washington, DC: NASA, 1966), 309.

¹³³ *National Aeronautics and Space Act of 1958*, Pub. L. 85-568, 72 Stat. 426-438 (July 29, 1958), as amended, August 25, 2008, 11, available at <<https://history.nasa.gov/spaceact-legishistory.pdf>>.

¹³⁴ *Ibid.*, 11n22.

¹³⁵ Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), 206.

¹³⁶ Swenson, Grimwood, and Alexander, *This New Ocean*, 217.

¹³⁷ McDougall, *The Heavens and the Earth*, 206–208.

¹³⁸ For links to these documents and more, see United Nations, "United Nations Office for Outer Space Affairs," available at <<https://www.unoosa.org/oosa/index.html>>.

¹³⁹ John W. Finney, "Space Pact Nearer for U.S. and Russia," *New York Times*, October 30, 1962, 1.

¹⁴⁰ Kennedy, quoted in Logsdon, *Race to the Moon*, 180.

¹⁴¹ Thomas J. Hamilton, "Kennedy Asks Joint Moon Flight by U.S. and Soviet as Peace Step; Urges New Accords in U.N. Speech," *New York Times*, September 21, 1963, 1; Carroll Kilpatrick, "Kennedy Offers Soviet 5 Proposals for Joint Exploration of Space," *Washington Post*, March 18, 1962, 1; Lawrence E. Davies, "Kennedy Again Asks Soviet Cooperation in Space," *New York Times*, May 9, 1962, 11.

¹⁴² Quoted in Logsdon, *Race to the Moon*, 175.

¹⁴³ *Ibid.*

¹⁴⁴ Drew Pearson, "JFK Vetoed Experts on Space Bid," *Washington Post*, September 26, 1963, F11.

¹⁴⁵ *Ibid.*

¹⁴⁶ *Ibid.*

¹⁴⁷ Siddiqi, *Challenge to Apollo*, 661.

¹⁴⁸ Khrushchev, quoted in Logsdon, *Race to the Moon*, 187.

¹⁴⁹ For more on the details of these initiatives, see Logsdon, *Race to the Moon*, especially chapters 10 and 11.

¹⁵⁰ Sunny Tsiao, "Read You Loud and Clear!" *The Story of NASA's Spaceflight Tracking and Data Network*, NASA 2007-4233 (Washington, DC: NASA, 2008), 42.

¹⁵¹ Douglas J. Mudgway, *Uplink-Downlink: A History of the Deep Space Network 1957-1997*, NASA SP-2001-4227 (Washington, DC: NASA, 2001), 25.

¹⁵² Heffington, Oler, and Tretler, *Primer*, 25-28.

¹⁵³ Central Intelligence Agency (CIA), National Intelligence Estimate 11-5-58, "Soviet Capabilities in Guided Missiles and Space Vehicles," August 19, 1958, quoted in Siddiqi, *Challenge to Apollo*, 205.

¹⁵⁴ CIA, National Intelligence Estimate 11-5-61, "Soviet Technical Capabilities in Guided Missiles and Space Vehicles," April 25, 1961, quoted in Siddiqi, *Challenge to Apollo*, 374.

¹⁵⁵ Dwayne A. Day, "From the Shadows to the Stars: James Webb's Use of Intelligence Data in the Race to the Moon," *Air Power History* 51, no. 4 (Winter 2004), 32-33.

¹⁵⁶ CIA, National Intelligence Estimate 11-1-62, "The Soviet Space Program," December 5, 1962, quoted in Logsdon, *Race to the Moon*, 178.

¹⁵⁷ Thanks to Roger Launius for suggesting a little more depth on what the CIA was telling Kennedy. Roger Launius, comments to the author on an early draft of this paper. Launius, email to the author, March 2, 2021. For more information, see Dwayne A. Day and Asif Siddiqi, "The Moon in the Crosshairs: CIA Intelligence on the Soviet Manned Lunar Programme," *Spaceflight* 45 (November 2003), 466-475, and *Spaceflight* 46 (March 2004), 112-125.

¹⁵⁸ "John F. Kennedy Moon Speech—Rice Stadium," September 12, 1962, available at <<https://er.jsc.nasa.gov/seh/ricetalk.htm>>.

¹⁵⁹ For more information, including text of the speech and video clips, see "John F. Kennedy Moon Speech."

¹⁶⁰ John Glenn with Nick Taylor, *John Glenn: A Memoir* (New York: Bantam, 1999), 283.

¹⁶¹ "John Glenn Published Speech to Congress After Friendship 7 Flight," *Congressional Record* 108, no. 27, February 26, 1962, reprinted by Ohio Memory Collection, available at <<https://ohiomemory.org/digital/collection/p267401coll36/id/11634>>.

¹⁶² Hansen, *First Man*, 226-227.

¹⁶³ *Ibid.*

¹⁶⁴ Collins, *Carrying the Fire*, 278-280.

¹⁶⁵ *Ibid.*, 280; Siddiqi, *Challenge to Apollo*, 609.

¹⁶⁶ Collins, *Carrying the Fire*, 280

¹⁶⁷ *Ibid.*, 278.

¹⁶⁸ *Ibid.*, 280.

¹⁶⁹ Hansen, *First Man*, 576.

¹⁷⁰ *Ibid.*

¹⁷¹ *Ibid.*, 577. Collins served as Assistant Secretary of State for Public Affairs for just over a year beginning in 1970 and then as director of the National Air and Space Museum for the next several years.

¹⁷² *Ibid.*, 582.

¹⁷³ Heffington, Oler, and Tretler, *Primer*, 28-29. That is not to say using the military instrument of power equals use of the Armed Forces, because the two are not synonymous.

¹⁷⁴ "Military Advisors in Vietnam: 1963," John F. Kennedy Presidential Library and Museum,

available at <<https://www.jfklibrary.org/learn/education/teachers/curricular-resources/high-school-curricular-resources/military-advisors-in-vietnam-1963>>.

¹⁷⁵ Many thanks to Steven Heffington for helping me clarify these thoughts. Heffington, Oler, and Tretler, *Primer*, 29.

¹⁷⁶ See, for example, Barton C. Hacker and James M. Grimwood, *On the Shoulders of Titans: A History of Project Gemini*, NASA SP-4203 (Washington, DC: NASA, 1977), appendix G, “Department of Defense Support,” 595–596.

¹⁷⁷ Heffington, Oler, and Tretler, *Primer*, 30–31.

¹⁷⁸ Beschloss, “Kennedy and the Decision,” 57.

¹⁷⁹ Reem Heakal, “The Investor’s Guide to Global Trade,” *Investopedia*, February 18, 2021, available at <<https://www.investopedia.com/insights/what-is-international-trade>>.

¹⁸⁰ Heffington, Oler, and Tretler, *Primer*, 31. Thanks to Steven Heffington for clarifying this thought.

¹⁸¹ “Tracking and Data Acquisition,” in Linda Neuman Ezell, *NASA Historical Data Book*, vol. 3: *Programs and Projects 1969–1978*, NASA SP-4012 (Washington, DC: NASA, 1999), available at <<https://history.nasa.gov/SP-4012/vol3/ch6.htm>>.

¹⁸² Tsiao, “*Read You Loud and Clear!*” 40. There was so much drama at one tracking station during the moon landing that a movie was made about events at the Parkes Observatory in Australia. See *The Dish*, directed by Rob Sitch (Sydney: Roadshow Entertainment, 2000). To this day, images of these tracking stations even appear on postage stamps of the small countries that hosted them.

¹⁸³ Quoted in Logsdon, *Race to the Moon*, 188. Emphasis in the original.

¹⁸⁴ Heffington, Oler, and Tretler, *Primer*, 20.

¹⁸⁵ *Ibid.*, 21.

¹⁸⁶ *Ibid.*, 21–22.

¹⁸⁷ *Ibid.*, 41.

¹⁸⁸ James R. Hansen, *Enchanted Rendezvous: John C. Houbolt and the Genesis of the Lunar-Orbit Rendezvous Concept*, Monographs in Aerospace History Series No. 4 (Washington, DC: NASA, 1999), 6.

¹⁸⁹ *Ibid.*, 1.

¹⁹⁰ “The Challenge,” in Courtney G. Brooks, James M. Grimwood, and Loyd S. Swenson, *Chariots for Apollo: A History of Manned Lunar Spacecraft to 1969* (Washington, DC: NASA, SP-4205, 1979), available at <<https://www.hq.nasa.gov/office/pao/History/SP-4205/ch1-9.html>>.

¹⁹¹ *Ibid.*

¹⁹² Siddiqi, *Challenge to Apollo*, 171.

¹⁹³ *Ibid.*, 205–212.

¹⁹⁴ *Ibid.*, 332.

¹⁹⁵ *Ibid.*, 255.

¹⁹⁶ *Ibid.*, 287–290.

¹⁹⁷ *Ibid.*, 384, 404–408.

¹⁹⁸ *Ibid.*, 513–517.

¹⁹⁹ Heffington, Oler, and Tretler, *Primer*, 34–35.

²⁰⁰ *Ibid.*, 44.

²⁰¹ Kennedy, "Special Message to Congress," May 25, 1961.

²⁰² "Apollo Program Budget Appropriations," compiled from *The Apollo Spacecraft: A Chronology*, vols. 1–4, NASA SP-4009 (Washington, DC: NASA, 1962–1974), available at <https://history.nasa.gov/SP-4029/Apollo_18-16_Apollo_Program_Budget_Appropriations.htm>. This number is for direct program costs, while other appraisals have the number much higher by including the costs of the Gemini program, during which NASA gained much information about how to get to the moon, and other indirect costs, such as ground facilities and robotic lunar lander pathfinder missions, raising the costs by at least 50 percent. See, for example, The Planetary Society, "How Much Did the Apollo Program Cost?" available at <<https://www.planetary.org/get-involved/be-a-space-advocate/become-an-expert/cost-of-apollo-program.html>>.

²⁰³ In 2020 dollars, \$195 billion is almost \$1.3 trillion. See *Fiscal Year 2016 Historical Tables: Budget of the U.S. Government* (Washington, DC: Office of Management and Budget, n.d.), table 1.1, available at <<https://www.govinfo.gov/content/pkg/BUDGET-2016-TAB/pdf/BUDGET-2016-TAB.pdf>>.

²⁰⁴ Kennedy, quoted in Beschloss, "Kennedy and the Decision," 51. Ricky Bobby, played by Will Ferrell, is the titular character in the film *Talladega Nights: The Ballad of Ricky Bobby*, directed by Adam McKay (Culver City, CA: Columbia Pictures, 2006).

²⁰⁵ Kennedy, "Special Message to Congress," May 25, 1961.

²⁰⁶ Quoted in "The Challenge," in Brooks, Grimwood, and Swenson, *Chariots for Apollo*.

²⁰⁷ Philip Abelson, quoted in Logsdon, *Race to the Moon*, 199.

²⁰⁸ Amitai Etzioni, *The Moon-Doggle: Domestic and International Implications of the Space Race* (Garden City, NY: Doubleday, 1964).

²⁰⁹ Victor Cohn, "Cut in Space Program Urged," *Washington Post*, December 29, 1969, A1.

²¹⁰ Heffington, Oler, and Tretler, *Primer*, 43–45.

²¹¹ Thanks to Adam Oler for pointing this out as a risk from the strategy.

²¹² Thanks to Roger Launius for suggesting this risk. (Roger Launius, comments to the author on an early draft of this paper. Launius, email to the author, March 2, 2021.) For more on Wiesner's opposition to Lunar Orbit Rendezvous, see Logsdon, *Race to the Moon*, 144–148.

²¹³ Quoted in Mary C. White, "Detailed Biographies of Apollo I Crew—Gus Grissom," available at <<https://history.nasa.gov/Apollo204/zorn/grissom.htm>>; cited in John Barbour, *Footprints on the Moon* (New York: Associated Press, 1969), 125.

²¹⁴ Kranz, *Failure Is Not an Option*, 204–207.

²¹⁵ Siddiqi, *Challenge to Apollo*, 590.

²¹⁶ Sorensen, quoted in Logsdon, *Race to the Moon*, 116; see also Beschloss, "Kennedy and the Decision," 61.

²¹⁷ Quoted in Logsdon, *Race to the Moon*, 155–156. These quotes are verbatim from Kennedy and Webb because by that point Kennedy had set up the secret recording machine in the Oval Office.

²¹⁸ Astronaut Mike Collins estimated that, in the 2 years after the fire, the configuration control board considered 1,697 changes, approving 1,341 of them, including, for example, replacing the 100 percent oxygen environment with a 60/40 oxygen/nitrogen environment, which added weight to the spacecraft from the new tanks and hoses. See Collins, *Liftoff*, 137.

²¹⁹ Webb and McNamara, "Recommendations for Our National Space Program," 448–449.

- ²²⁰ Quoted in Logsdon, *Race to the Moon*, 178–179.
- ²²¹ *Ibid.*, 239.
- ²²² Stuart Auerbach, “Soviet Rocket Exploded in Test,” *Washington Post*, November 18, 1969, A1.
- ²²³ Siddiqi, *Challenge to Apollo*, 653–661.
- ²²⁴ John Noble Wilford, “Soviet Apparently Drops Plan to Put Men on Moon,” *New York Times*, October 26, 1969, 1; Harry Schwartz, “Why Cosmonauts Fell Behind in Moon Race,” *New York Times*, July 27, 1969, E7.
- ²²⁵ Heffington, Oler, and Tretler, *Primer*, 45–46. As Steven Heffington pointed out, it is also true that the moon landing was simultaneously building the means needed for other lines of effort in other strategic approaches necessary for success in the overall containment strategy; however, for simplicity, this section on viability merely addresses the viability of the moon landing as a shaping approach to solving the problem.
- ²²⁶ Heffington, Oler, and Tretler, *Primer*, 45.
- ²²⁷ *Ibid.*, 45. Many thanks to Steven Heffington for helping me clarify these thoughts.
- ²²⁸ *Ibid.*, 45–46.
- ²²⁹ *Ibid.*, 46.
- ²³⁰ *Ibid.*
- ²³¹ Kranz, *Failure Is Not an Option*, 122.
- ²³² John M. Logsdon, *After Apollo? Richard Nixon and the American Space Program* (New York: Palgrave MacMillan, 2015), 124.
- ²³³ Joan Hoff, “The Presidency, Congress, and the Deceleration of the U.S. Space Program in the 1970s,” in Launius and McCurdy, *Spaceflight*, 106.
- ²³⁴ “John F. Kennedy Moon Speech.”
- ²³⁵ Thomas O’Toole, “\$25 Billion Later, Value Is Debated,” *Washington Post*, December 20, 1972, A1. For more on the topic of lunar science, see, for example, Donald A. Beattie, *Taking Science to the Moon: Lunar Experiments and the Apollo Program* (Baltimore: Johns Hopkins University Press, 2001).
- ²³⁶ William E. Burrows, “Reaching into Space,” *Wall Street Journal*, July 18, 1969, 1.
- ²³⁷ *Ibid.*
- ²³⁸ *Ibid.*
- ²³⁹ *Ibid.*
- ²⁴⁰ *Ibid.*
- ²⁴¹ “Sharp Nixon Gain Found by Gallup,” *New York Times*, November 23, 1969, 1.
- ²⁴² Beschloss, “Kennedy and the Decision,” 63.
- ²⁴³ Logsdon, *Race to the Moon*, 240.
- ²⁴⁴ Melvin Kranzberg, “Technology and History: ‘Kranzberg’s Laws,’” *Technology and Culture* 27, no. 3 (1986), 544–560.
- ²⁴⁵ James C. Tanner, “Space By-Products: Moon-Shot Technology Spawns Ideas for Home,” *Wall Street Journal*, July 9, 1969, 1.
- ²⁴⁶ Robert C. Jensen, “Millions Around the World Hail Lunar Landing; Follow It on TV,” *Washington Post*, July 21, 1969, A1.
- ²⁴⁷ Paul D. Lowman, Jr., “Our First Lunar Program: What Did We Get from Apollo?” NASA, Oc-

tober 17, 2007, available at <https://www.nasa.gov/centers/goddard/news/series/moon/first_lunar_program.html>.

²⁴⁸ Thanks to Steven Heffington and Robert J. Orr for making sure I did not sell myself short here.

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