US Space Race and the Political Dynamics

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Abstract

The space race, a pivotal chapter in the Cold War rivalry between the United States and the Soviet Union, began in the mid-twentieth century with the launch of man-made satellites. Driven by the quest for scientific supremacy and national security, this competition led to remarkable achievements in space exploration, including missions to Mars, Venus, and the Moon, and the establishment of NASA. China's entry into the space race, influenced by the US- Soviet rivalry, began in the 1960s with Soviet aid, despite political upheaval and a focus on missile testing. Recent advancements include the Tiangong space stations and plans for a third space station. The balance of power theory underscores the geopolitical dynamics of space exploration, where nations strive for equilibrium. The current US-China space race, marked by the Wolf Amendment restricting NASA's cooperation with China, reflects Cold War -era competition but differs in collaboration strategies. Both nations have ambitious lunar programs: the US's Artemis and China's Lunar Exploration Program (CLEP). Economically, the space race has driven investments in science, technology, and job creation, boosting national prosperity. The US leads with substantial investment and a robust commercial space industry, while China has increased spending but lags. The growing space economy, supported by technological innovations and private sector investments, continues to shape political and economic landscapes, fostering international ties and advancing human capabilities in space exploration.

Keywords: Space Race, Space Economy, Balance of Power Theory

Introduction

The Space Race, a pivotal chapter in 20th-century history, epitomized the intense Cold War rivalry between the United States and the Soviet Union. This competition, sparked on August 2, 1955, when the United States announced its plan to launch artificial satellites, was driven by both nations' ambitions to leverage space for strategic and scientific dominance (Astronomy Staff, 2023). This quest for superiority was not merely about technological prowess; it was a critical element of political hegemony and national security, rooted in the aftermath of World War II and the utilization of German missile technology.

The Space Race catalyzed unprecedented advancements in space exploration, from lunar missions to the launch of artificial satellites and interplanetary probes. Notable milestones include the United States' successful launch of Explorer I in 1958 and the establishment of NASA, under President Dwight D. Eisenhower, to spearhead space exploration initiatives (Astronomy Staff, 2023). Concurrently, security-focused programs like the military-led space endeavors and the classified Corona reconnaissance mission underscored the dual-use nature of space technology.

China's entry into the space arena, influenced by the U.S.-Soviet competition, began in the late 1950s with aspirations of developing space missile capabilities (Berg, 2023). Initially benefiting from Soviet technology, China pursued an independent path in the 1960s, marked by the launch of its first rockets. Despite political upheaval, China has progressively advanced its space program, achieving milestones such as the deployment of the Tiangong space station and planning a permanent lunar base by 2050 (Petersen, 2018).

The evolving dynamics of space exploration reflect the broader geopolitical landscape, particularly the current rivalry between the United States and China. Legislative measures like the Wolf Amendment highlight the cautious and competitive stance of the U.S. towards China's space ambitions (Young, 2019). Both nations are now engaged in ambitious lunar exploration programs, with the U.S.'s Artemis Program and China's Lunar Exploration Program aiming for sustained human presence on the moon.

The balance of power theory, integral to understanding international relations, underscores the strategic interplay in the space race. This theory posits that maintaining equilibrium among states prevents dominance by any single power, fostering global stability and security (Donnelly, 2005). The space race, both historical and contemporary, exemplifies this theory, as nations strive to achieve technological and strategic parity.

To summarize, the space race, from its Cold War origins to the present-day U.S.-China

competition, continues to shape the geopolitical and technological landscape. This research explores the historical trajectory, strategic motivations, and economic implications of the space race, providing a comprehensive understanding of its impact on global power dynamics and scientific progress.

Literature Reviews

The Space Race Among the United States, the Soviet Union, and China

The United States and the Soviet Union: The History of the Space Race Historical Context of the US-USSR Space Race

The mid-twentieth century witnessed an intense rivalry between the United States and the Soviet Union, which extended beyond political and military confrontations to the realm of space exploration. This period, known as the space race, began on October 4, 1955, when the US announced its intention to launch artificial satellites. This announcement intensified the existing competition between the two superpowers, who were already engaged in a nuclear arms race post-World War II.

Both nations leveraged technology and expertise from German missile specialists, emphasizing the belief that technological superiority in space would translate into political dominance and enhanced national security. The space race led to significant achievements, including lunar missions, human spaceflights, and the development of artificial satellites [Astronomy Staff, 2023].

In 1958, under the guidance of rocket scientist Wernher von Braun, the US launched its first satellite, Explorer I. This milestone was soon followed by the establishment of the National Aeronautics and Space Administration (NASA) by President Dwight D. Eisenhower, aimed at spearheading space exploration. Concurrently, Eisenhower initiated two space programs focused on national security: one led by the US Air Force for military applications of space and another, the Corona project, for intelligence gathering on the Soviet Union using orbital spacecraft [Astronomy Staff, 2023].

China's Entry into Space Exploration

China's foray into space exploration began in the late 1950s, driven by the advancements and competition observed between the US and USSR. Initially, China benefited from a cooperation agreement with the Soviet Union, acquiring Soviet R-2 rocket technology. However, this partnership dissolved in the 1960s, prompting China to develop its own space capabilities, launching its first rockets in 1960 [Petersen, 2018].

Throughout the 1960s and beyond, China faced internal political turmoil and focused

primarily on missile technology due to its potential military applications. Despite these challenges, China continued to advance its space program, culminating in the launch of its first astronauts from the Jiuquan spaceport in 2003. Today, China aims to send humans to the Moon and maintain a sustained presence in space with initiatives like the Tiangong space stations and plans for a third space station in the early 2020s [David Leonard, 2021]

The chronicle of China's pursuit of space exploration

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The Balance of Power Theory

The idea of balance of power, which is fundamental to structural realism, suggests that a power structure in equilibrium decreases the probability of dominance by a state with more power. Donnelly (2005) posits that this theory consists of two primary elements: the participation of numerous countries with different levels of power working to preserve balance, and the need for a counterforce to prevent one country from becoming too dominant. This state of balance promotes tranquility and prevents any one country from compromising the autonomy of smaller states. [Donnelly, Jack. 2005].

The conflict between the United States and China in the realm of space exploration.

The current competition between the United States and China in space exploration reflects the rivalry of the Cold War period, although there are notable distinctions in terms of international collaboration and geopolitical tactics. The Wolf Amendment, enacted by the US Congress in 2011, forbids NASA from participating in direct bilateral cooperation with Chinese companies without explicit authorization (Young, 2019). The legislative obstacle highlights the competitive and cautious approach that the US has taken towards China's space aspirations.

Both countries possess ambitious moon exploration initiatives. The Artemis Program, introduced in 2020 by the United States, has the objective of sending people back to the moon to conduct scientific studies and collect essential data for future trips to Mars. China's Lunar Exploration Program (CLEP) has been operational since 2004. Its objective is to create a lunar base and research station by 2050, focusing on the moon's south pole due to its prospective water ice resources.

The United States has an extensive history of engaging in international and commercial collaboration in space, as shown by its many agreements with other countries and organizations. In contrast, China's space collaborations are limited in number and often include nations with less developed space capabilities, such as Iran, Pakistan, Thailand, and Turkey (Ben-Itzhak, 2023).

This disparity underscores the distinct strategic methodologies that each country uses in order to accomplish its objectives in space exploration.

Economic Impacts from Space

The space race has significantly influenced economic growth globally. Investments in science and technology during this period led to job creation in technology and manufacturing, boosting national prosperity (Carlson, 2019). NASA’s activities alone supported a substantial number of jobs across the United States and generated significant tax revenues (National Aeronautics and Space Administration, 2022; Dreier, 2022). China’s increased investment in space technology, though less than that of the United States, reflects a growing global interest in space exploration (Ben-Itzhak, 2023). The U.S. space economy reached a gross output in 2021, supporting over private industry jobs. The space race has also driven innovation, leading to advancements in various fields and stimulating growth in other sectors of the economy (Morin and Tepper, 2023). The space economy's value in 2021, with the United States leading in investments in the commercial space industry (Brukardt, 2022; Grieco, 2022). Private space travel is on the rise, with approximately invested in space startups since 2014, nearly half of which went to U.S. companies (Fleck, 2022). This underscores the economic potential of the space industry and its significance for future economic growth.

Discussion

Space Race History

The US and USSR were two nation-states that competed in the twentieth-century space race. The supremacy of space flight technology aimed for both. On August 2, 1955, the US announced its

plan to launch artificial satellites, which ignited the competition.

The space race started with the two nations competing with nuclear weapons after World War II. Both sides benefited from German missile specialists and technology from their missile programs. It was believed that the technical advantages necessary for such dominance were required for political supremacy and national security. The space competition made intriguing initiatives to send spacecraft to Mars, Venus, and the moon, as well as artificial satellites, and human space flights in lunar missions and low-Earth orbit, conceivable.

The competition for space between the Soviet Union (USSR) and the United States (US) was a singular historical moment that resulted in many important advancements in technology, space exploration, and research. The United States Army was guided by rocket scientist Wernher von Braun in the creation of Explorer I, the nation's first satellite, which was launched in 1958. In that year, a public proclamation signed by the National Aeronautics and Space Administration (NASA) was founded by President Dwight D. Eisenhower, a space exploration-focused federal agency.
Eisenhower created two space programs with a national security emphasis at the same time as NASA. The first focused on exploiting space for military objectives and was headed by the US Air Force. The second, code-named Corona, would employ circling spacecraft to collect information on the Soviet Union and its allies. It would be led by the Air Force, the CIA, and a recently established National Reconnaissance Office, which was not publicised until the early 1990s. (Astronomy Staff, 2023).

History of China Space Race

During the mid-1900s, China saw the Soviet Union and the United States begin their intense competition to be the first nations to set foot on the moon. China and other countries across the world were understandably alarmed when both the US and the USSR demonstrated advancements in space missile technology.

China began investigating a trip to space in the late 1950s in response to these concerns, intending to send its tactical nuclear weapons and launch them into space. China and the Soviet Union had a beneficial cooperation pact that allowed China to first obtain Soviet R-2 rocket technology. However, the accord collapsed in the 1960s, and China began blazing its own trail into space, launching its first rockets in September of that year [Carolyn Collins Petersen. 2018].

In the latter part of the 1960s, China began testing human space flights. It was not, however, a rapid process. There was widespread political unrest in the country, especially after Chairman Mao Zedong's passing. Furthermore, as their space exploration efforts were still primarily a reaction

to potential battles on Earth and in space, the testing of missiles was the main technical emphasis.

China's space program aims to eventually send humans to the Moon and beyond these days. Aside from these missions, China has built and launched Tiangong 1 and Tiangong 2 space stations into orbit. While the second station, Tiangong 2, has deorbited, Tiangong 1 has not. is continuing in use and is home to a number of scientific experiments. Early in the 2020s, is when the third Chinese space station is expected to launch. If everything goes as planned, a cargo ship will maintain the new space station, which will launch personnel into orbit for prolonged stays in research stations.

The CNSA runs several satellite launch sites all around Asia. In the city of Jiuquan in the Gobi Desert sits the nation's first spaceport. Satellites and other items are launched into low- and medium-orbits using Jiuquan. In 2003, Jiuquan served as the launchpad for the first Chinese astronauts.

The Taiyuan Satellite Launch Centre is primarily responsible for managing weather and earth science satellites. Furthermore, it can deploy intercontinental ballistic missiles and defense missions. In addition to Beijing and Xi'an space mission control centers, the CNSA maintains a fleet of monitoring ships deployed worldwide. Antennae in Beijing, Shanghai, Kunming, and other locations are part of the CNSA's extensive deep-space tracking network [David Leonard. 2021][Carolyn Collins Petersen. 2018]. The Taiyuan Satellite Launch Centre is primarily responsible for managing weather and earth science satellites. Furthermore, it can deploy intercontinental ballistic missiles and defense missions. In addition to Beijing and Xi'an space mission control centers, the CNSA maintains a fleet of monitoring ships deployed worldwide. Antennae in Beijing, Shanghai, Kunming, and other locations are part of the CNSA's extensive deep-space tracking network. (Petersen, 2018).

Balance of Power Theory

The balance of power theory is the basis of structural realism theory. State of anarchy. A balanced power structure reduces the likelihood of being overthrown by a more powerful group. Less powerful countries, in general, have fewer choices or pursuits. By virtue of the great nations' influence, only a superpower could afford such losses. Instead, it reserves its funds for bolstering national security and forging new partnerships with its allies. Equilibrium of power theory describes how power is fairly distributed across nations or groups of states that disagree over international organizations. Every nation or group of nations will make every effort to maintain or increase its wealth, influence, and reputation. safeguarding one's own safety for the benefit of one's own national

group or national interests. There are two basic components to power theory

To begin with, a large number of nations must be involved. Nations have different powers. Everyone is still looking for methods to bolster their positions until they start to tip the scales. Equilibrium is likely to be attained in the international community when states or groups of nations band together such that no one nation or group of nations has the dominant power. each time a state gains more authority than the others. Opposing nations or groups will keep the state in balance. As long as each group's national strength is equal, a balance of power will exist. After that, there will be peace on Earth. Additionally, the independence of small nations can be guaranteed so that the major powers won't easily undermine it.

Second, a nation must act as a counterweight if the equilibrium is disrupted by an increase in power on the other side of the scale. A counterbalance on the side of the weaker power is necessary to maintain the global equilibrium. If not, there will be a severe loss of homeostasis experienced by people everywhere. global peace and security (Donnelly, Jack, 2005)

The US-China Space Race Conflict

The Wolf Amendment is a law that was passed by the US Congress in 2011 and is named after US Representative Frank Wolf at the time. It forbids the US National the use of the National Aeronautics and Space Administration (NASA) from using government funds to carry out direct, bilateral collaboration with Chinese organisations and the government that are affiliated with China without specific permission via the Federal Bureau of Investigation and the US Congress. (Makena Young.2019.)

China versus. United States Space Race Project

The US and China have high aspirations for lunar exploration. In 2020, the US unveiled the "Artemis Program," which aims to send humans back to the moon. The two main goals of this mission are to perform commercial research on the lunar surface and to collect important data about the impact of space travel on human health during prolonged stays on the moon [1][3]. The NASA Mars mission depends on this information. China has been actively exploring the moon since 2004 via its Lunar Exploration Program (CLEP), which has now produced five lunar missions. China has declared plans to build an operational lunar base and research station by 2050 in an attempt to support a prolonged human presence there. Their first goal is to go to the south pole of the moon, which is thought to contain ice, a resource vital to human life. The water that has been removed from this ice may be used for many essential purposes, such as fuel generation and life support. Important differences between the United States and China concern the nature and amount of international

cooperation [Svetla Ben-Itzhak. 2023].

For decades, NASA has cultivated international and commercial cooperation in all matters. In addition to developing cutting-edge space technology for human spaceflight, the US government has inked 169 agreements for the exchange of space data with 33 governments, international bodies, businesses, and academic institutions [Svetla Ben-Itzhak. 2023]

China has spacefaring allies as well. Specifically, Iran, Pakistan, Thailand, and Turkey are members of the Asia-Pacific Space Cooperation Organisation, together with Russia. Chinese partners, however, are fewer in number and possess far less advanced space capabilities [David Leonard. 2021]

Economic Analysis of the Space Race

The space race, which started as a contest between the United States and the Soviet Union during the Cold War, has had major economic impacts. Advances in space technology and exploration have shown human progress and have also driven economic growth.

Firstly, the space race led to big investments in science and technology. The U.S. and other nations involved in the race trained more scientists and engineers, creating jobs in technology and manufacturing. This investment in people and infrastructure ultimately boosted the nation's prosperity (Carlson, 2019).

Furthermore, the space field has provided jobs for thousands of people, including scientists, engineers, technicians, construction workers, and clerical workers, helping local economies. Major facilities like NASA have had a significant impact on local economies, especially where they are located (Bill of Rights Institute, n.d.).

According to the National Aeronautics and Space Administration (2022), NASA supported an estimated 339,000 jobs across the country. Additionally, Dreier (2022) states that for every full-time job at a NASA facility, about 18 additional jobs were created throughout the

U.S. economy. These positions offered higher-than-average wages, showing the specialized skills of the space workforce. Moreover, NASA investments generated around $7.7 billion in federal, state, and local tax revenues. The states most positively affected include California, Texas, Alabama, Florida, and Maryland. Specifically, NASA's Moon-to-Mars campaign alone supports 93,731 jobs and contributes an economic output of $20.1 billion. For every full-time employee on Moon-to-Mars projects at a NASA center, 37 additional jobs are supported in the broader economy.

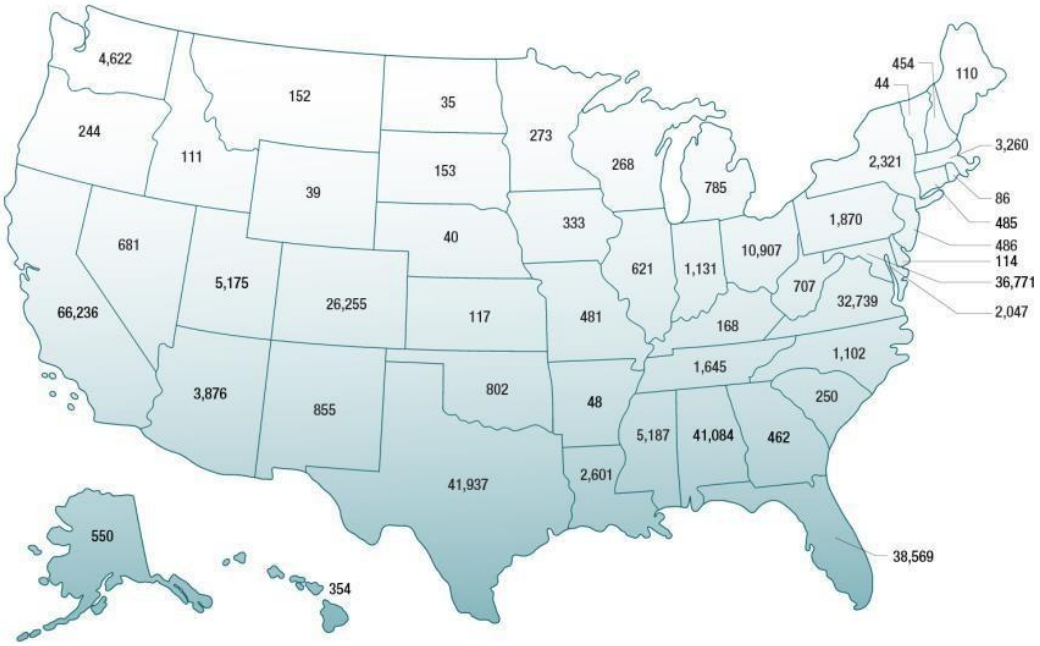

Figure 1: NASA Employment Impact by State (Source: NASA, 2022)

China has significantly increased its investment in space and rocket technology over the past decade, doubling its spending in the last five years. Despite this, with an estimated budget of $16.18 billion in 2021, China still spends less than a third of the U.S. budget on space (Ben- Itzhak, 2023). In contrast, the U.S. space economy in 2021 accounted for $211.6 billion in gross output, $129.9 billion (0.6 percent) of GDP, $51.1 billion in private industry compensation, and over 300,000 private industry jobs (Highfill and Surfield, 2023).

The space race has driven innovation and technological advancements. The development of advanced spacecraft and equipment has led to breakthroughs in various fields, including telecommunications and materials science. These advancements have had wide-reaching effects, stimulating growth in other sectors of the economy (Morin and Tepper, 2023).

Furthermore, the space economy itself has grown significantly over the years. According to the Space Foundation, the space economy was valued at $469 billion in 2021, up 9 percent from 2020 (Brukardt, 2022). This growth is expected to continue as more countries and private companies invest in space exploration and related technologies. Additionally, the U.S. boasts a thriving commercial space industry, with hundreds of startups joining leading firms like Blue Origin and SpaceX, and investors pouring billions of dollars into the U.S. space economy. Meanwhile, China’s private space industry lags behind American companies (Grieco, 2022).

Moreover, the political and economic impact of the space race is undeniable. Winning the space race helped countries like the U.S. build ties with many nations, benefiting them economically and politically (Manjrekar, 2022).

Table 1: Distribution of Investment in private space companies since 2014 (billion U.S. dollars)

Rank	Country	Value
1	United State	46.3
2	China	29.8
3	Singapore	5.2
4	United Kingdom	4.3
5	Indonesia	2.7
6	India	2.3
7	France	1.2
8	Canada	1.1
9	Other	7.1

(Source: Fleck, 2022)

Fleck (2022) demonstrates that private space travel is on the rise, with approximately $265 billion invested in space startups since 2014. According to Space Capital, nearly half of this investment went to U.S. companies, while around 30 percent was directed to Chinese firms. Table 1 shows that the total investment by country, and the U.S., remains the biggest one.

Conclusion

Space security is one important factor that could have an impact on national security. Equivalent to land, sea, and cyberspace. This is due to its borderless nature and the abundance of resources available for any country to exploit. Therefore, it is a destination for powerful countries. Try to find an advantage in the country's development. By nature, more prepared countries will always have an advantage. In the past, America has always held greatness; now, China has developed its economic potential. In terms of technology and space studies, China is unsurprisingly able to develop into an important competitor to America.

As specified by the convention No state has the right to occupy or impose its sovereignty on an area. This ensures that each state enjoys equal freedom to explore and utilize the area. Text from the 1967 Convention on the Principles of State Business in the Exploration and Use of Outer Space, including the Moon. This is the first multilateral agreement to guarantee that all countries profit

equally from the exploration and use of space. Very well organized; however, conflicting objectives in space can affect national security. As a result, they compete with each other to develop technology in space. It entails making the most of space resources. We may observe that nations occupying more space than the rest of the world often exert influence on each other. This influence extends beyond the military's role in upholding sovereignty. create dominance and eliminate threats. However, the use of space technology may have social, political, cultural, and economic consequences.

Failure to maintain the balance of power could potentially impact national security. The balance of power theory analyzes the space race between the United States and China on a global scale. It provides valuable insights into strategic motivations and their potential impact on world politics in areas such as: Competition for hegemony. The analysis, based on the proposed balance of power theory, highlights the importance of maintaining power and expanding it to control other states. The idea of trying to maximize one's own power relative to other states stems from the need to prevent aggression from other states.

To maintain or achieve superiority The space race reflects the competition for global influence between the United States and China. Both countries view space as a battlefield for both countries, as do America and China. Each sees the other. is their main competitor. Both countries established dimensions such as economic, military, and technological superiority, and invested considerable resources to gain an advantage in the space race. This is based on their respective perspectives. The balance of power arises from the differences between Communism and Liberal Democracy. As a result, the two countries have a high level of competition. 2. Military and security importance: Space capabilities are crucial for the military. These capabilities encompass satellite-based communication and the potential for space-based weapons systems. Both the United States and China are developing and deploying advanced space technologies to enhance military capabilities and deter potential adversaries. Therefore, creating an advantage in sending signals from satellites is an important strategy in today's war.

Both sending and dividing the purpose of military reconnaissance is to provide protection from enemies and ensure precision in the execution of tasks. Artificial missile systems can control future ballistic missiles, thereby protecting them. This will allow the defending country to prepare for a response and destroy the missile first. Another thing is that Java has resulted in technological innovations that enhance the power and security of one's own country. As a result, the space race between the United States and China is characterized by fierce competition in development. This competition extends to cutting-edge space technology, exemplified by lunar exploration and China's

large-scale space installation project. Both countries leverage their space programs to drive technological advancement. As both countries strive to stimulate economic growth and maintain a competitive advantage in the global economy, we will observe a shift in "geopolitical competition" from Earth to space. Congress in the US recently passed a rule that forbids NASA from sharing space technology information with China. As a result, China's participation in the International Space Station (ISS) project seems unlikely. This serves as a major catalyst for China to develop its own space program. Especially China's space station project. It effectively merges the Wentian and Mengtian laboratory modules with the Tianhe core module.

We can conclude that China has made great progress in space technology. Whether it's about satellites receiving assistance from the Chinese government, China has made significant strides in space technology. Plans to send Chinese astronauts to their own space station will be built. Plans for missions to explore Mars and the Moon are already underway. This was done in part to counter U.S. protectionism and build the country's image as a technological leader. In order to become a world leader, therefore, the competition between America and China cannot reach a conclusion. And this is still just the beginning of the space race. But what is more important than competing for world leadership? To be a leader in creating peace and seeking greater cooperation between each other. The goal is to dismantle the obstacles posed by political and governmental differences, to maximize benefits for both one's own country and the global community.

To lastly mention about the economic perspectives, the space race, originally a Cold War contest between the United States and the Soviet Union, has had profound economic impacts, driving advancements in technology and fostering economic growth. The significant investments in science and technology led to the creation of numerous jobs and the training of scientists and engineers, ultimately boosting national prosperity. Major space facilities like NASA have stimulated local economies and supported a substantial number of jobs, generating billions in tax revenues. The U.S. space economy remains robust, contributing significantly to GDP and employment, while the commercial space industry continues to thrive with substantial investments. Meanwhile, China's increasing investment in space technology, although substantial, still lags behind the U.S. in terms of budget and private industry development. The space race has spurred innovations that extend beyond space exploration, impacting various sectors such as telecommunications and materials science. As the global space economy grows, with the U.S. leading in private investments, the political and economic benefits of space exploration continue to shape international relations and economic strategies.

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