Strategic Research Requirement

The Second Giant Leap for Mankind

Maintaining America's Strength by Planting More Than a Flag on the Moon

by

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Under the Direction of:

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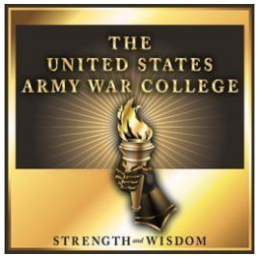

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Abstract

Five hundred years ago the exploration and exploitation of the Americas provided a quintessential opportunity for expansion of wealth and power, today another opportunity is within reach - the Moon. Columbus relentlessly sought the patronage of four monarchies before King Ferdinand and Queen Isabella finally agreed to his gamble to sail across the Atlantic.[1&2] After that venture, the world, and coffers of Spain, were forever changed, while those who lacked the foresight to recognize Columbus' vision played catch up to the Spanish crown for generations.

In the 21st century, the U.S. faces stiff competition from an increasingly multi-polar world in a race for resources, influence, and power.[3] As in the Age of Discovery, this is a marathon to secure new game-changing dividends. The U.S. must have the vision to recognize what space and the Moon can provide. Furthermore, the U.S. must have the will to act to exploit these potential economic, scientific, and military advantages first, lest a resolute competitor beat America to new opportunities.

Earthrise from the Moon as seen by Apollo 11 in July of 1969.

[1] History Channel, *Columbus*, 11 Aug 2023, https://www.history.com/topics/exploration/christopher-columbus
[2] Encyclopedia Britannica, *Columbus*, 5 Mar 2024, https://www.britannica.com/biography/Christopher-Columbus
[3] National Security Strategy, Washington DC, Oct 2022, p. 6.

The Second Giant Leap for Mankind

Maintaining America's Strength by Planting More Than a Flag on the Moon

Shortly after the turn of the millennium, the first man on the Moon lamented he: "fully expected that, by the end of the century, we would have achieved substantially more than we actually did."[4] The giant leap for mankind had come and gone, and though technology rapidly progressed, manned space exploration stagnated. Excuses endure: high costs, competing priorities, wavering interest, and a bevy of hazards. These challenges are daunting, but not insurmountable, and that suggests the Roman adage "fortune favors the bold." Neil Armstrong and the legion of Americans behind him were architypes of boldness, with courage and fortitude that brought the U.S., and civilization, to the pinnacle of discovery with the lunar landing on the 20th of July 1969. Their efforts to win the space race were a waypoint in toppling the Soviet Union, and highlighted the U.S. as a beacon of freedom, goodwill, strength, and advancement.[5]

Today, America and China are inching towards great power conflict. This struggle in many ways resembles the U.S.-Soviet Cold War. Several factors led to the termination of that clash and the collapse of the U.S.S.R., with American footprints on the Moon being a major blow to the Soviets. In the new space race, a lunar base may ensure American success in the evolving competition with China, while similarly avoiding bloodshed. **The U.S. therefore must repeat the Moonshot and establish a permanent lunar presence to expand American influence deeper into space and**

[4] Maria Popova, *Why Science Remains Culturally* Irrelevant, The Atlantic, 27 Aug 2012: https://www.theatlantic.com/health/archive/2012/08/why-science-remains-culturally-irrelevant/261601/

[5] Felix Sutton. *Conquest of the Moon*, (Grosset & Dunlap Publishers, New York, 1969), 50.

sustain the competitive edge over China. This paper will prove this point through an analytical study of historic examples and interviews with prominent space experts. An understanding of the parallels of the exploration of space to the Age of Discovery will be explored to set the stage for the current strategic situation. Subsequent analysis will include the repercussions of a Moon base, drawbacks, and advantages, and proposed solutions to assert America's influence in space and ensure hegemony in technology and terrestrial affairs.

Parallels to the Age of Discovery

Today's civilization stands on the shoulders of giants, and as the Moon beckons, it is vital to look to the examples of past explorer-nations and how they competed to help guide modern decision making. One pivotal Eastern explorer set sail nearly a century before Columbus' Atlantic journey. Zheng He traversed the Pacific and Indian Oceans for the Ming Dynasty in the early 1400s. Legend has it that his flagship was five times larger than the Santa Maria, an extraordinary feat for the age. Zheng He possessed over 60 similarly sized vessels, along with another 400 boats. Chinese scholars profess that a staggering (or perhaps exaggerated) 28,000 sailors, explorers, soldiers, diplomats, merchants, and scientists journeyed with him on each of his seven expeditions. In contrast, Columbus' scurvy-ridden crew was 90 strong, but to their enduring credit, they breached the unknown, open ocean, and forever changed the globe.[6]

[6] China Lousie Levathes, *When China Ruled the Seas: the treasure fleet of the Dragon Throne*, (Oxford University Press, 1994), 21.

Zheng He may not have settled new continents, but he secured China's dominance throughout Southeast Asia and the Indian Ocean. For decades, they traded, collected tribute, and resolved regional disputes from a clear seat of authority.[7] China dominated this region. When the Portuguese rounded South Africa a century later, the locals were reportedly not impressed with the size of Bartolomeu Dias' ships, as they grew up with stories of the fabulous Ming fleets, and still prized the silk goods, traded by their grandparents from the Chinese years prior.[8] Had the Chinese continued their exploration and reached the Americas before the Europeans, imagine how different history would be. After all, a century later, Hernán Cortés and just 100 men with a dozen horses (with the help of local divisions…and some smallpox) conquered the Aztec, a nation of 8 million, for Spain.[9]

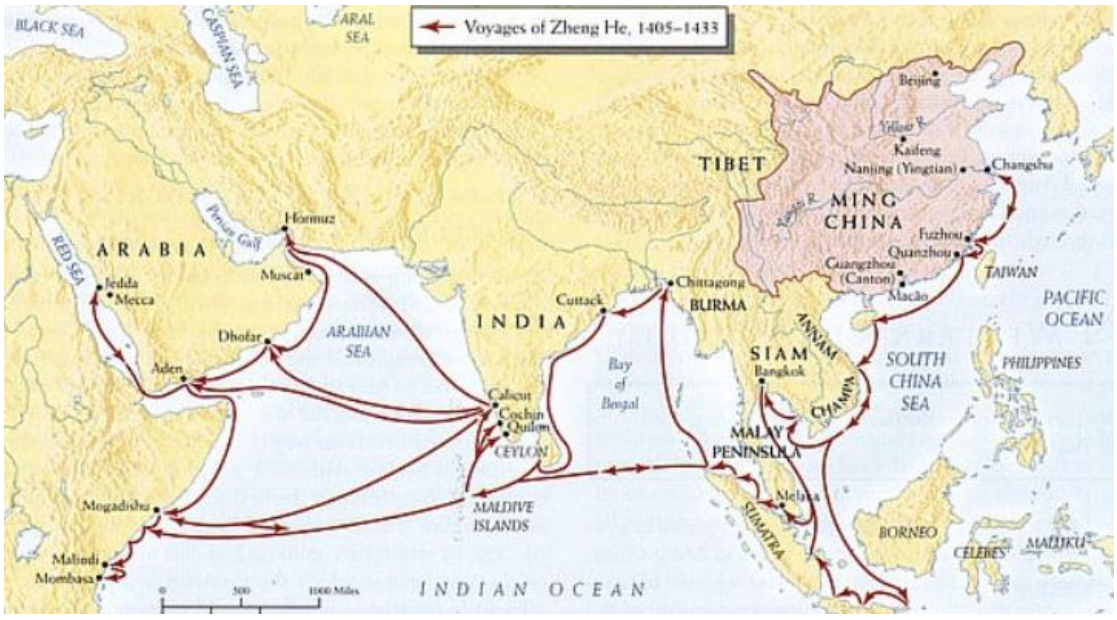

Figure 1: The Treasure Fleet voyages of Zheng He, conducted for the Ming Dynasty from 1405-1433

[7] Levathes, *When China Ruled the Seas*, 140.

[8] Levathes, *When China Ruled the Seas*, 180.

[9] Buddy Levy, *Conquistador: Hernan Cortes, King Montezuma, and the Last Stand of the Aztecs*, (Baantam Books, 2008), 19.

Emperor Zhu Di, the patron of the Treasure Fleets, died in 1424, and with him, so did interest for these excursions. Pressures from Mongolia combined with the opening of the Grand Canal (internally linking China north to south) reduced the necessity for maritime power. Likewise, Confucian dictums and the ruling power's desire to seal off China from outsiders brought a halt to the Ming Navy. Zheng He's massive ships rotted away in port leaving other nations to fill the vacuum in sea power, and benefit from its spoils.[10] Alas for China, the exploration and exploitation of the world was seized by the West.

For millennia, China was wealthy, important, and powerful, but like porcelain, it all cracked when Chinese rulers sequestered their nation from the rest of the world. As the Ming dynasty rested on its laurels at home, Europeans spent the next generations engaging in explosive breakthroughs in technology, finance, military capability, and empire building. This led China down the path to being carved up in the subsequent centuries up by the Russians, Portuguese, British, and Japanese, among others. The Opium Wars of the 19th century, the "Unequal Treaties" and tragedies of WW2 are bitterly remembered by the Chinese as the "century of humiliation".[11] This sweeping turn of events contrasted to the immeasurable affluence Marco Polo observed in the 13th century.[12] Power is not preserved or acquired by those who stop exploring, on the contrary, those who remain static will be dictated to by those bold enough to take risks

[10]Levathes, *When China Ruled the Seas*, 161, 177.
[11] Stephen Platt, *Imperial Twightlight: The Opium War and the end of China's last Golden Age*, (Vintage Books, 2018), 447.
[12] Laurence Bergreen, *Marco Polo: from Venice to Xanadu*, (Vintage Books, 2007), 127.

to expand physically, scientifically, and economically. China realizes that misstep and does not plan to make the same mistake on the next frontier – the Moon.

When China abandoned its Treasure Fleets, they gave up their head start on exploration to the West and missed out on one of the greatest developments of human history, the Columbian Exchange.[13] Colonialism notwithstanding, this massively lucrative, and game-changing opportunity led European powers to new heights of wealth and prestige. The Old World was flooded with cash crops like tobacco and sugar, and foodstuffs like maize and potatoes that induced a population explosion.[14] Additionally, Europe was inundated with American gold, silver, furs, and old-growth timber for expanding navies. Conversely, they introduced horses, cattle, chicken, goats, sheep, apples, bananas, coffee, wheat, and rice that eventually expanded these new colonies. All was secured by Europeans unleashing their excess populations and enslaving others to transform the New World into a Western power base.

To reap the benefits of a New World, it necessitates steadfast commitment. Many American colonies failed outright like England's first venture in the Americas at Roanoke in 1585.[15] But failure did not deter the Europeans. They were in a race for resources, status, and power, and through resolute determination and conquest, cashed in on their investment. Their enthusiasm and competing drives for profit, faith, and expansion, fair or not, made the globe what it is today: a modern world vastly imprinted with Western laws, culture, philosophy, religion, and language. Meanwhile, the China

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[13] Levathes, *When China Ruled the Seas*, 180.
[14] Kenneth Pomeranz, *The World that Trade Created*, (M.E. Sharp, 2006), 135.
[15] National Humanities Center, *American Beginnings: 1492-1690,* Toolbox Library, Jun 2006, https://nationalhumanitiescenter.org/pds/amerbegin/exploration/text6/text6read.htm#:~:text=Roanoke%2C%20Ajacan%2C%20Fort%20Caroline%2C,settlements%3B%20starving%20settlers%20abandoned%20others.

that abandoned Zheng He's fleets was left to the whims of the Spanish-colonial silver market and to barter its wealth away for opium via the British Raj.[16] Zheng He's once great sea power willingly removed itself from discoveries and resources beyond China's borders while European fleets ranged the world. China has suffered from this deliberate decision for generations but will not make the same mistake twice.

Repercussions of a Moon Base

An "Apollo Exchange" of sorts took place after the landings on the Moon. While there are obvious differences between the colonization of the Americas and briefly visiting the Sea of Tranquility (no one is taking horses to the Moon), there are certainly analogous economic windfalls, technological advancements, and prestige garnered in both endeavors. Future lunar voyages can duplicate and expand these benefits. Coincidentally, these principals are the motives NASA draws on when explaining the reasons to return to the Moon.[17] According to NASA, the major aims for going back to the Moon, and later Mars, are the trifecta of science, national posture, and inspiration that will solidify American hegemony (Figure 2).

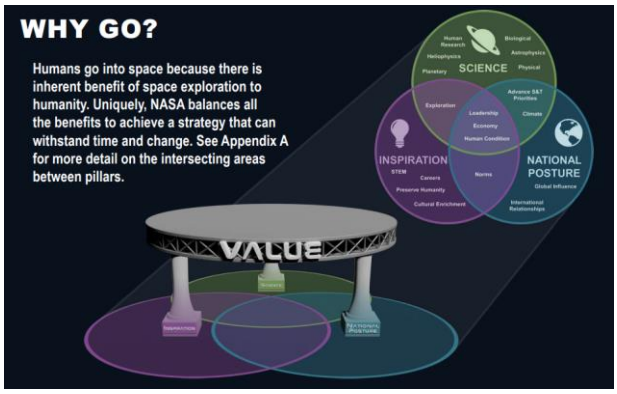

Figure 2: Reasoning to return to the Moon (*NASA's Moon to Mars Strategy*)

[16] Platt, *Imperial Twightlight*, 193.
[17] *NASA's Moon to Mars Strategy and Objectives Development*, NASA Apr 2023.

"Returning to the Moon will offer the chance to develop and test new technologies and will reinvigorate NASA" notes former Chief Scientist of Air Force Space Command, and 30-year NASA veteran, Dr. Merri Sanchez.[18] Examples of such technologies include Artificial Intelligence, drones, robotics, alternative energy, and quantum computing, to name a few. An all-out effort to establish a presence on the Moon will be the driver for these pioneering advancements, as they are applied and refined to make it happen. The labor to inaugurate an outpost on the new frontier will be an immense undertaking that relentlessly draws on all pillars of national power and will require diplomatic, informational, military, and economic efforts to work in concert. The dividend however, once this challenge is conquered, will be a magnificent triumph for humanity…and whoever gets there first.

China currently has the ability and drive to establish a lunar base – within a few years. In interviewing one of the first Space Force astronauts, Col Nick Hague, in the Fall of 2023, he claimed that China is definitely capable of outpacing America back to the Moon. Particularly if NASA does not maintain its schedule of returning in 2026 with the Artemis program (which recently slipped from 2025).[19] He noted that the Chinese have definitively demonstrated the depth of resources and technical capacity to establish a significant presence on the lunar surface – which they intend to do prior to 2030.[20] Dr. Sanchez seconded the notion, indicating that China is capable of a human landing on the Moon before the U.S. returns, ominously noting that China has a reputation of never announcing a deadline for a major space achievement without

[18] Interview with former AFSPC Chief Scientist, Dr. Merri Sanchez, Colorado Springs, Nov 2023.
[19] Artemis is the twin sister of Apollo in Greek mythology, and NASA's latest program to return to the Moon.
[20] Interview with astronaut Col Nick Hague, the Pentagon, Sep 2023.

meeting it.[21] Currently, the last fully successful U.S. lunar lander mission was in 1972 with Apollo 17. While a failed attempt took place in January 2024,[22] and a partially successful landing took place in February 2024.[23] On the other hand, China's Chang'e missions (Figure 3) have successfully landed on the Moon three times since 2013. Additionally, China also conducted orbital and rover operations on Mars in 2021.[24] To discount China would be a mistake.

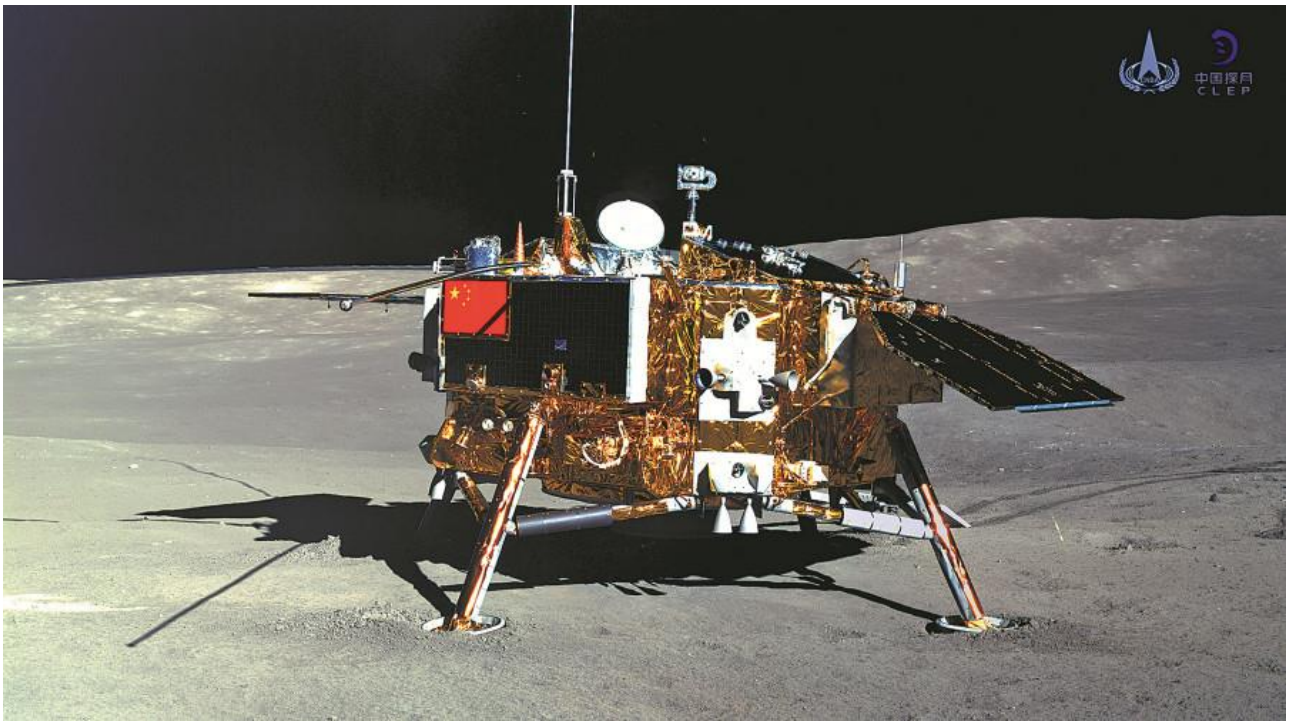

Figure 3: Chinese Lunar Exploration Program - Chang'e 5 lander on the Moon in December 2020

The U.S. is in a race to the Moon, whether we realize it or not. While the U.S. and our allies have decades of achievements and experience, China has benefited from

[21] Interview with Dr. Sanchez, Nov 2023.
[22] The Guardian, *What happened to the Peregrine lander?,* 9 Jan 2024, https://www.theguardian.com/science/2024/jan/09/what-happened-to-the-peregrine-lander-and-what-does-it-mean-for-moon-missions.
[23] Jonathan Amos, The BBC, *Intuitive Machines: Odysseus Moon lander 'tipped over on touchdown',* 23 Feb 2024, https://www.bbc.com/news/science-environment-68388695.
[24] NASA Space Science Data Coordinated Archive, *Tianwen-1,* https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=2020-049A.

that blazed trail, and surged investment into science and space. Meanwhile America is profoundly distracted and polarized on multiple issues, even with a loud minority insisting the world is flat! Other space competitors are present, but the next closest nation, Russia, is constrained from its war in Ukraine (though Russia can provide expertise to China). On the other hand, the U.S. has a variety of allies, with 36 countries having signed the Artemis Accords – a NASA sponsored treaty committing nations to common principles for exploration of the Moon and beyond.[25] The U.S. has the advantage with willing partners, but China's recent investments and gains in technology are disconcerting.

Space faring nations can gain additional advantages by leveraging strategic locations, akin to critical ports, chokepoints, and islands in the Age of Discovery. Similar points will be just as significant in the race for the Moon. Correspondingly, whoever can plant their flag (or park a satellite) first will be at a great advantage. This is analogous to how colonial powers first settled prime real estate at natural harbors with rivers (Boston, New York, etc.). Likewise, the first to occupy areas outside Geosynchronous Orbit will have squatter's rights establishing the precedents for operating in this legally murky territory and are more likely to bend the norms to their favor. Knowing this, in November of 2022, President Biden issued the National Cislunar Science and Technology Strategy (NCSTS), outlining the American goal of being the leader in the peaceful, and sustainable exploration between the Earth and Moon.[26]

[25] *The Artemis Accords*, 13 Oct 2020
[26] National Science and Technology Council, *National Cislunar Science and Technology Strategy*, Nov 2022 https://www.whitehouse.gov/wp-content/uploads/2022/11/11-2022-NSTC-National-Cislunar-ST-Strategy.pdf

Cislunar space refers to the region from the Earth to the Moon's orbit, and therein exist strategic locales called Lagrange points (Figure 4). These positions are where the pull of gravity from celestial bodies is balanced. This makes them optimal places for spacecraft as, depending on which location, they provide either stable locations for Space Situational Awareness (SSA), or can maintain an ideal orbit near the Moon.[27] The occupation of Lagrange points is a necessity for sustained lunar activity, to ensure communications, positioning, observation, and space stations like NASA's planned Gateway outpost around L1 or the Chinese Comsat at L2. [28] & [29]

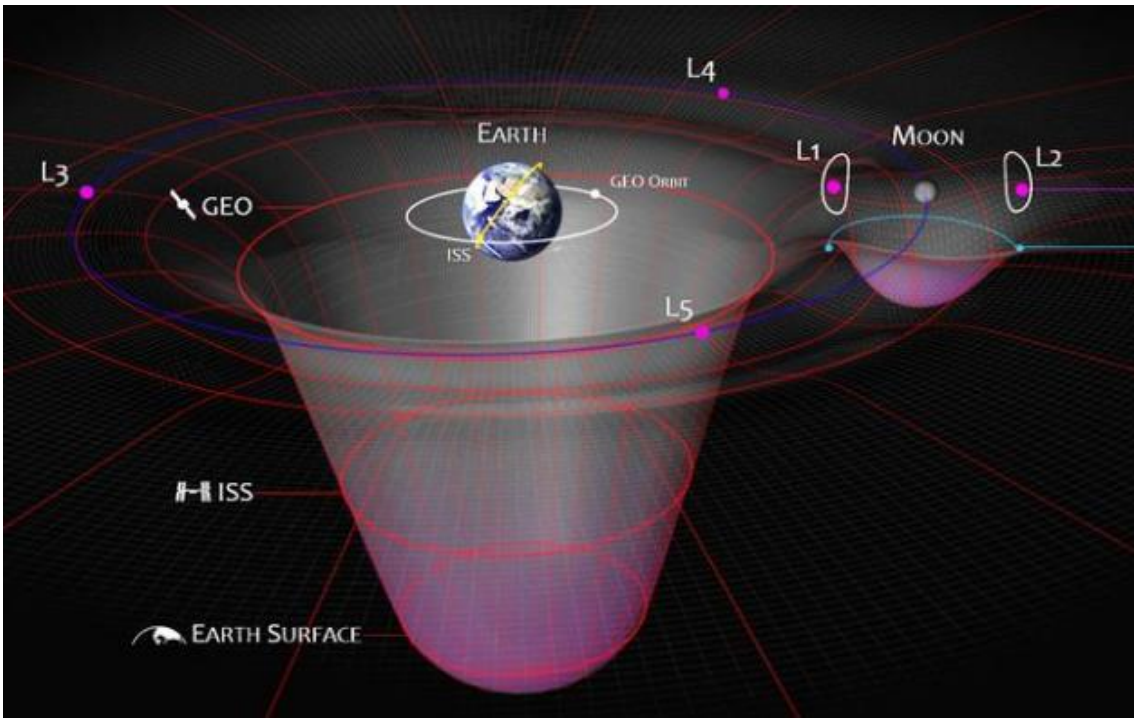

Figure 4: Cislunar space per the NCSTS. The pink "wells" demonstrate the Earth and Moon's gravity, while the 5 "Ls" are Lagrange points where the pull from celestial objects is balanced.

[27] Charles Galbreath, Sec*uring Cislunar Space and the First Island Off the Coast of Earth*, Mitchell Institute Policy Paper, January 2024, 5.
[28] National Aeronautics & Space Administration, NASA Gateway, 16 Nov 2023, https://www.nasa.gov/mission/gateway
[29] Space News, Chang'e-4 Relay Satellite, 14 Jun 2018, https://spacenews.com/change-4-relay-satellite-enters-halo-orbit-around-earth-moon-l2-microsatellite-in-lunar-orbit/

Likewise, certain locations on the Moon are superior to others, particularly at Shackleton Crater (Figure 5) on the South Pole. Here ice lays in the shadowed crater while the rim is nearly perpetually bathed in sunlight. This makes it an ideal spot to harvest lunar ice and solar energy simultaneously. Due to multiple craters in this region, there is limited level surface available for landing, launch or operations. Shackleton Crater therefore is extremely unique and valuable real estate. The potential serviceable geography for a lunar base here amounts to a few square miles, or not much more than the premises of Arlington Cemetery and the Pentagon.[30] The first to gain a foothold and physically claim such idyllic lunar landscapes (or similar Lagrange points) will gain the initiative and the ability to leverage it for further expansion. This should not be a surprise, as it is the same struggle for physical possession fought by pioneering nations of the past.

Figure 5: Shackelton Crater (https://svs.gsfc.nasa.gov/4716/)

[30] Sacehana Sathyan et al, *Potential landing sites characterization on lunar south pole: De-Gerlache to Shackleton ridge region*, Icarus, Apr 2024, https://www.sciencedirect.com/science/article/abs/pii/S0019103524000460

Challenges to Developing a Lunar Settlement

No one has established a lunar base, despite advances in technologies, due to its persistent difficulty, and lack of immediate dividends (to be discussed later). The U.S. Army issued the formerly classified *Project Horizon*, a 121-page advocacy for a lunar outpost, prior to the Apollo program. The 1959 paper outlined the parameters for a new post on the Moon, categorically demonstrating that the idea of a lunar base is not new and is indeed an arduous ambition.[31] Not only is the Moon far away, but it is a harsh environment, lacking the life support we take for granted on Earth. There is no liquid water, though in theory water may be extracted from lunar ice. Food or familiar building materials are also not awaiting intrepid explorers. However, hydroponics and sourcing bricks out of lunar regolith (dust) are viable solutions. The lunar surface is blanketed with dangerous radiation and extreme temperatures ranging from 250°F to -200°F. Additionally, there is the awkwardness in functioning at 1/6 Earth's gravity, and the abrasive, ever-present dust. While all are dangerous complications, the lunar dust may be the least obvious to laymen observers. The dust is a result of the lack of erosive properties, like wind and moving water on the Moon, which means it is the product of eons of meteor strikes resulting in sharp, jagged, clingy, electrostatically charged particles that can hamper equipment, like spacesuits, mechanical gear, and electronics.[32 & 33]

Aside from physical barriers, there are steep funding hurdles required for sustained exploration. At the height of the Apollo program, NASA was charged with

[31] *Project Horizon*, United States Army, 20 Mar 1959.
[32] Interview with Dr. Sanchez, Nov 2023.
[33] Galbreath, Se*curing Cislunar Space and the First Island Off the Coast of Earth*, 7.

responding to Soviet advances in space,[34] and its funding accounted for nearly 4.5% of the annual federal budget. Today it is reduced an order of magnitude to a myopic 0.4% or $25B. In contemporary terms, the peak of NASA's funding would have equated to $300B of 2023's $6T federal budget.[35] Any sustained activity on the Moon will necessitate a significant boost in NASA funding, and likewise heavy commercial partnership. In an era of competing priorities, security, and domestic concerns, plus an ever-growing $34.5T debt,[36] there is seemingly little appetite to fund such a venture. NASA acknowledges these challenges in their 2023 *Moon to Mars Strategy*, but forges ahead with coherent plans to make it happen.[37]

With such an expensive undertaking, perhaps it would be advantageous to partner with China, possibly even leading to a lasting détente? That is an optimistic perspective, but unrealistic at this juncture. And that is not necessarily a bad thing, as competition drives accomplishment, as seen in the first Space Race, and Age of Discovery. Additionally, if China makes overreaching claims on its terrestrial neighbors now (the South China Sea's 9-dashed line), will a spacefaring China be any more accommodating to a U.S. that cedes the Moon? Ultimately, the lines have already been drawn, as both Russia and China have disregarded the West and announced plans to build a joint nuclear power plant on the Moon by 2035.[38] This not only potentially energizes a future autocratic lunar settlement but fuels the race to get there first.

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[34] John Uri, *65 Years Ago: NASA Begins Operations*, 2 Oct 2023, https://www.nasa.gov/history/65-years-ago-nasa-begins-operations/#:~:text=On%20Oct.,Soviet%20advances%20in%20space%20exploration

[35] Interview with Space Operations Command, NASA liaison, Tom Plumb, Colorado Springs, Sep 2023.

[36] U.S. Debt Clock, Mar 2024, https://www.usdebtclock.org/

[37] *NASA's Moon to Mars Strategy and Objectives Development*, NASA Apr 2023.

[38] Harry Baker, *Russia and China announce plan to build shared nuclear reactor on the moon by 2035*, 12 Mar 2024, https://www.space.com/russia-china-shared-nuclear-reactor-2035-moon

Naysayers may also protest that since we have already been to the Moon, it is not worth the investment to revisit while Earth is full of problems. Or why not go straight to Mars instead? There, however, is significant risk with these arguments. The Moon is the logical and necessary steppingstone to Mars, and a close trial area for exploration into the beyond. Furthermore, today's technology can enable a number of benefits from exploration compared to the nascent computer age of 1969. For example, the iPhone 6's computing power is 120 million times faster than Apollo-era computers.[39] The ability to discover and exploit resources utilizing 21st century technology will translate into more science and faster breakthroughs on the Moon. Conversely, imagine if the U.S. willingly chose to ignore this potential (analogous to the 1400's Ming dynasty), while China takes full advantage.

Advantages of a Lunar Settlement

America must not discount the potential of the Moon, as science-fiction as it may seem. Numerous benefits can be reaped from exploration and exploitation in space. Despite the initial down payment, developing a sustained lunar presence is worth the cost. NASA's liaison to Space Operations Command, Mr. Plumb, elaborates that the primary gains from a lunar presence as: national prestige, inspiration for STEM (Science, Technology, Engineering, and Mathematics), science, commercialization, and the development of defense capabilities.[40]

[39] Tibi Puiu, *Your smartphone is millions of times more powerful than the Apollo 11 guidance computers*, 11 May 2023, https://www.zmescience.com/feature-post/technology-articles/computer-science/smartphone-power-compared-to-apollo-432/#:~:text=Put%20simply%2C%20the%20iPhone%206's,all%20at%20the%20same%20time

[40] Interview with Mr. Plumb, Nov 2023.

The idea of planting one's flag and developing new lands had been the epitome of national prestige – and there is still new territory – just overhead. If China were to reach the Moon before the U.S. revisits, there is no doubt they would reap extraordinary diplomatic rewards. Such a scenario would fit squarely with the narrative that America is in an unrecoverable decline. A triumphant, and ascendant space-faring Chinese Communist Party would solidify power at home and induce other nations to reconsider their partner of choice. Whereas an American return to the Moon, and lasting presence, would do just the opposite, while securing the U.S. as a center for development for the century.

On development, civilization progresses from the minds of STEM-minded students and the scientific and economic opportunities they create. Just as Apollo inspired a generation, Artemis can do the same and stimulate the American economy for decades to come.[41] A lunar base would allow Earth and space observations, uninhibited by the light pollution, atmosphere, or satellite-size limitations, that could revolutionize our understanding of the universe.[42] Though much exploitation could be conducted remotely, Col Hague underscored the importance of physical presence. His 200+ days in space demonstrated that it serves to anchor our understanding and allows humans to learn at an exponential rate compared to purely robotic exploration.[43] Moreover, humans actively engaged on the Moon will be an inspiration itself to stimulate

[41]American Museum of Natural History, *The Scientific Legacy of the Apollo 11 Mission*, 8 Jul 2019, https://www.amnh.org/explore/news-blogs/news-posts/the-scientific-legacy-of-the-apollo-11-mission
[42] Nicole deRoberts, *How Landing on the Moon Changed Our World*, Columbia Climate School, 17 Jul 2019, https://news.climate.columbia.edu/2019/07/17/apollo-11-moon-landing-science/
[43] Interview Col Hague, Sep 2023.

STEM orientated careers. Additionally countless advances and secondary effects can be anticipated as new challenges are solved and our limits tested.

Civilizations are also motivated by money, and commercialization is crucial as competition in space is exponentially growing. As of 2022, the space economy accounted for $500B, with projections of it doubling to over $1T by 2030 and continuing to soar.[44] By establishing a sustained lunar outpost, the U.S. will secure and escalate the largest share of the sky-rocketing space mercantilism – bringing in billions to the American economy. Finally, technologies developed and enhanced in this endeavor will be dual use for both civil and military purposes, ensuring that America is at the leading edge in defending effects from space (GPS, communications, intelligence, etc.) that make the modern world possible.

Resources from the Moon will also be a game changer. Rare Earth Metals are ironically not just of Earth and are among the expected lunar assets that need further prospecting on the Moon. Ice is a known quantity and can be rendered into water and oxygen necessary to sustain life in space, while also converting hydrogen into fuel vital for a lunar economy and sustained space operations. However, a revolutionary opportunity lays with Helium-3, which is extremely rare terrestrially, but abundant in lunar regolith.[45] Extraction of this resource has the potential to make nuclear energy radiation free – conceivably resolving energy deficiencies and carbon emittance issues on Earth. One ton of Helium-3 is worth $4B (a ton of gold is $64M), and over one million tons is estimated to exist on the surface of the Moon, deposited by solar winds

[44] Space Foundation, *Space Report 2023 showing Annual Growth of Global Space Economy,* 25 Jul 2023, https://www.spacefoundation.org/2023/07/25/the-space-report-2023-q2/
[45] Interview Dr. Sanchez, Nov 2023.

over the eons.[46] In practical terms, 25 tons of Helium-3, filling 25% of SpaceX's Starship (which NASA will utilize with Artemis), would be enough to power the U.S. for an entire year.[47] Of note, China has already collected trace samples of lunar Helium-3 and returned them back to Earth.[48]

Helium-3 collection is reason enough for lunar settlement, but there is far more to gain. As an outpost grows, space-efficiencies and lucrative commercial opportunities will surge, and the U.S. must be on the right side of this pending eruption. Manufacturing in low gravity will be a game changer. Bulk products like spacecraft, fuel, water, and food are costly to procure from Earth due to launch costs. Eventual sourcing from the Moon, and the inherent low-gravity transportation networks, will reduce the price of operating in space dramatically and have a cascading effect on the burgeoning space economy. Additionally, "in-space production" taking advantage of low-gravity will provide a multitude of applications for improved fabrication of specialty electronics, alloys, medicine, and more.[49]

There are a variety of motivations and exciting rewards to extend humanity to the Moon. The next question is who possesses the willpower and foresight for prudent investment to make it happen. America has the opportunity to capitalize on its current

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[46] Claire Donnelly, *Who owns the Moon owns the future*, 25 Sep 2023, https://www.wbur.org/onpoint/2023/09/25/moon-planets-space-travel-united-states-race

[47] Mark Whittington, *Solving the climate and energy crises*, The Hill, 28 Feb 2021, https://thehill.com/opinion/technology/540856-solving-the-climate-and-energy-crises-mine-the-moons-helium-3/#:~:text=Roughly%201.1%20million%20metric%20tons,United%20States%20for%20a%20year.

[48] Mark Whittington, *China has returned helium-3 from the Moon*, The Hill, 18 Sep 2022, https://thehill.com/opinion/technology/3647216-china-has-returned-helium-3-from-the-moon-opening-door-to-future-technology/#:~:text=Opinion%3ETechnology-,China%20has%20returned%20helium%2D3%20from%20the%20moon,opening%20door%20to%20future%20technology&text=The%20Chinese%20Chang'e%205,mineral%20from%20the%20lunar%20surface.

[49] Alaina Demopoulos, *Building in zero gravity: the race to create factories in space*, The Guardian, 25 Sep 2023, https://www.theguardian.com/science/2023/sep/25/space-manufacturing-zero-gravity

prowess, and partner with like-minded nations to continue the march of civilization. A permanent station on the Moon therefore will be multi-faceted, and call upon, while also strengthening, America's instruments of power and securing U.S. hegemony.

Proposed Solutions

Nations can accomplish terrific feats or stagnate into obscurity within a generation. Carthage was the master of the Mediterranean until an upstart Rome usurped them within little more than a human lifetime.[50] With that in mind, 75% of the world's population were not alive when the U.S. last landed astronauts on the Moon. Within six decades, America went from the Wright Brothers' first flimsy canvas aircraft, to rocketing off Earth and footprints on another celestial body. Since then, manned space exploration has stagnated. But we should not kid ourselves, development of the Moon will be a generational endeavor and will take patience and steady investment…lots of investment.

In the Age of Discovery, nations had the prospect of direct gains from the New World, utilizing technology and resources (sailing ships) that were readily available and relatively inexpensive compared to spacecraft. An estimate for the cost of Columbus' first voyage accounted for about 1% of Spain's budget, but it took time for significant monetary return.[51] Therefore, the U.S. must have the foresight to prioritize investment in this next frontier, with serious prospect to reap the rewards down the line. To stay competitive in an era of resurgent great powers, the U.S. must accelerate its pace and

[50] Encyclopedia Britannica, *Punic Wars*, 16 Feb 2024, https://www.britannica.com/event/Punic-Wars
[51] Age of Exploration.net, *Cost of Exploration Voyages*, accessed 20 Nov 2023, https://ageofexploration.net/2021/05/12/cost-of-exploration-voyage-like-columbus-or-magellan/.

investment in NASA and the Artemis program to establish a long-term presence on the Moon before China. Recognizing that there will always be competing priorities, the U.S. has four avenues to pursue to distribute costs and risks.

The first avenue is the retirement of the International Space Station (ISS). First launched in 1998, the ISS is a prime example of what America can do with its partners, but now is the ideal time to change course. Especially as Russia, a once-major collaborator, is fighting Ukraine and therefore economically strained and politically hostile. With that in mind the ISS will also reach the end of its usefulness by 2030. While NASA will continue to have a presence in Low Earth Orbit, it is anticipated that these operations will be less expensive, freeing up $4 billion a year in ISS-related expenses, or 17% of NASA's budget – and similar percentages of allied nations' space programs.[52] While not enough savings to service a sustained lunar footprint, it is a good start.

The second major avenue is the power of American industry. The free and capitalistic market of the U.S. has continuously developed entrepreneurs that bring revolutionary ideas to fruition, and result in the betterment of humanity.[53] SpaceX is a superlative of this phenomena, where NASA's prudent investment allowed for radical rocket designs to become the gold standard for space-lift, drastically reducing costs. Such partnership can be a force multiplier in financing the way back to the Moon. As noted by NASA leadership, for any long-term, substantial presence on the Moon,

[52] Interview with Mr. Plumb, Sep 2023.
[53] Richard V. Reeves, *Capitalism used to promise a better future. Can it still do that?*, Brookings, 5 Jun 2019, https://www.brookings.edu/articles/capitalism-used-to-promise-a-better-future-can-it-still-do-that/

commercial success and partnership is necessary.[54] With strategic funding, NASA can seed the path for friendly commercial entities to take the mantle of establishing lunar infrastructure and begin to generate profit – accelerating a space-based economy that will be worth trillions.[55]

Thirdly, from a military perspective, the Space Force should pursue Cislunar SSA, and build the capacity to map, track, and someday enable the freedom of navigation for the eventual "sea-lanes" to the Moon, asteroid belt and beyond. This would be akin to how the U.S. Navy allots for safe ocean traffic, enabling bustling sea-going global commerce. Feasibly a new squadron under Delta 2 can leverage existing and future assets to develop Cislunar SSA (Delta 2 is an O-6 led unit responsible for space domain awareness). In the future, this unit could utilize Lagrange points (Figure 3) with specialty designed SSA satellites, prior to China. The ability to understand the environment and who is moving where, would be a major leap forward in establishing a sustained presence on the Moon.

The final, and key avenue is profitability to drive investment into a lunar settlement. Vast wealth is in space.[56] The "new gold rush" has already began, with commercial companies already raising capital to harvest lunar Helium-3.[57] Another possibility includes retrieving minerals from the Asteroid Belt to the Moon for harvest,

[54] Interview with Mr. Plumb, Sep 2023.
[55] Dr. Joel Mozer et al, *The Future of Space 2060 and Implications for U.S. Strategy* (Air Force Space Command, Office of the Chief Scientist, Sep 2019).
[56] Michael Sheetz, *The space industry is on its way to reach $1 trillion in revenue by 2040*, CNBC, 21 May 2022, https://www.cnbc.com/2022/05/21/space-industry-is-on-its-way-to-1-trillion-in-revenue-by-2040-citi.html
[57] Eric Berger, *Mining helium-3 on the Moon has been talked about forever—now a company will try*, 13 Mar 2024, https://arstechnica.com/space/2024/03/mining-helium-3-on-the-moon-has-been-talked-about-forever-now-a-company-will-try/

with experts estimating a potential wealth of $100B … per person on Earth … await us (though the capture of a large asteroid would no doubt effect pricing, supply and demand).[58] Additionally, the scientific value of such undertakings, as in past expeditions, will lead to secondary developments of merit.

Taking another page out of history, the U.S. can seek funding directly from the American people to both mitigate risk and allocate reward. To reconcile from the Civil War, America linked the East and West with a ribbon of iron. The first Intercontinental Railroad was a dangerous, risky, and expensive gambit into a remote wilderness that lacked infrastructure. To fund this project, which promised enormous economic benefits, the government issued bonds which allowed citizens and corporations to share in the dividends of the Wild West. A similar approach can be taken today for lunar investment, with profit sharing being a driver for advancement.[59]

In summary, there are multiple opportunities that can be stimulated to help establish a lunar base. To do so, the U.S. must shift NASA's focus by retiring the ISS and subsequently unleash the power of American industry into space. The Space Force can also take charge of Cislunar Space awareness for safety and exploration. Finally, it is critical to demonstrate the profitability of the Moon, which will lead to prudent investment into the next frontier. If the U.S. dawdles, America will lose. Space will then become China's asymmetrical advantage, in a resolute historical reversal.

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[58] Business Insider – India, *Asteroids contain metals worth quintillions of dollars — but mining them won't necessarily make your richer than Bezos or Musk*, 30 Jun 2021, https://www.businessinsider.in/science/space/news/asteroids-contain-metals-worth-quintillions-of-dollars-but-mining-them-wont-necessarily-make-your-richer-than-bezos-or-musk/articleshow/83989878.cms

[59] The Union Pacific Railroad's Credit Mobilier funding apparatus of the 1860s was rife with corruption … that portion should be avoided!

Conclusion

Great Power competition is inevitable, as has been proven since antiquity. History also illustrates that it is preferable to be on the winning side. Around the same time as Zheng He, Wan Hu was the subject of a Chinese fable where he attempted to reach the Moon by attaching himself to 47 rockets. After they were lit, a massive explosion enveloped the area, and the Middle Kingdom's first taikonaut (Chinese astronaut) was gone.[60] While this first effort had questionable results, China is aiming not to fail on its next attempt at the Moon - and it will happen in our lifetime. The Chinese will do all they can so as not to be left out of the exploitation of the next frontier, as they were in the Age of Discovery. To stay ahead of this fast-pacing competition and **to maintain and expand American influence**, **the U.S. must win this Sino-American competition by establishing a permanent lunar presence in the next New World.**

As demonstrated by the parallels between the Age of Discovery and today's newfound space race, history shows us that explorer-nations profited by being the first to new shores and reap the benefits of new worlds, while leaving those who stayed behind in their wake. The strategic consequences of not investing in space would be catastrophic as adversaries would gain the upper hand economically, scientifically, and militarily. Though the investment is significant, and challenges steep, it is a necessity to ensure that the U.S. is the preeminent space power and dominant player in the Cislunar economy. The American people, friendly nations and commercial partners could source the capital required and all gain from cooperation. Likewise, the Space Force can aim to assist in freedom of navigation, much like the Navy provides on the high seas. This

[60] NASA.gov, *Rockets as Weapons*, https://www.grc.nasa.gov/www/k-12/rocket/BottleRocket/13thru16.htm

mix of stakeholders can deliver a resilient coalition and has the potential to unify political divisions and increase alliances with a common purpose for the most ambitious goal humanity has ever attempted. To ensure U.S. leadership in technology and terrestrial affairs, it is existential for America to extend its influence to the Moon in order to galvanize the nation and allies, and stay ahead of ascendant adversaries.