

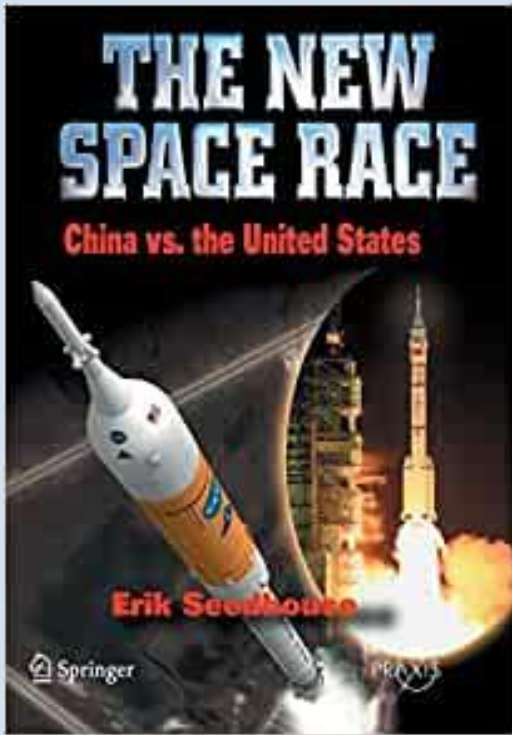
Politics of a Moon Colony

A futuristic moon colony with Earth in the background. The colony consists of numerous tall, dark, cylindrical structures of varying heights, some with intricate details, arranged across the lunar surface. The Earth is a large, detailed sphere in the upper left, showing continents and clouds. The background is a dark, starry space with a faint nebula or galaxy visible on the right. The overall scene is illuminated by a bright light source, likely the Sun, creating strong shadows and highlights on the colony's structures and the lunar surface. Two horizontal teal lines are positioned above the colony, and two horizontal gold lines are positioned below the colony. A thick teal line is positioned below the author names.

By: Julia Replogle and Ruby Smith

Introduction: The Reality of Moon Colonization

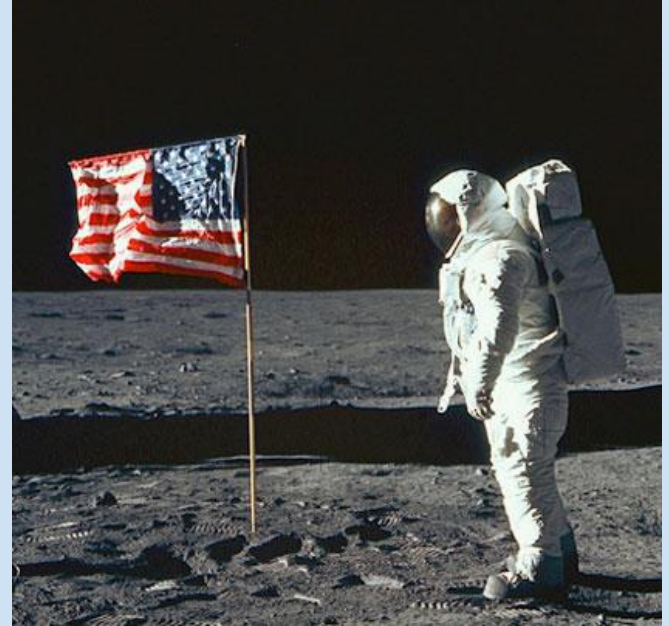
According to the White House Infrastructure and Technology Department, the reality of a moon colony will be a possibility much sooner than we think. Although this is exciting not only as a marker of human achievement, it also could be the start of major change for life as we know it. Going to the moon and building a livable colony could bring a space economy, further knowledge of our solar system and life on Earth, tourism and space activity, endless research opportunities and countless other outcomes we can't even predict. However, competition is already fierce, with Russia and China challenging the United States for leadership, and about 70 other countries working their way into space. Will a moon colony be productive for human life, or cause a more destructive space race than we saw in the late 1960's.



We are already seeing the propaganda...

The U.S. Mentality

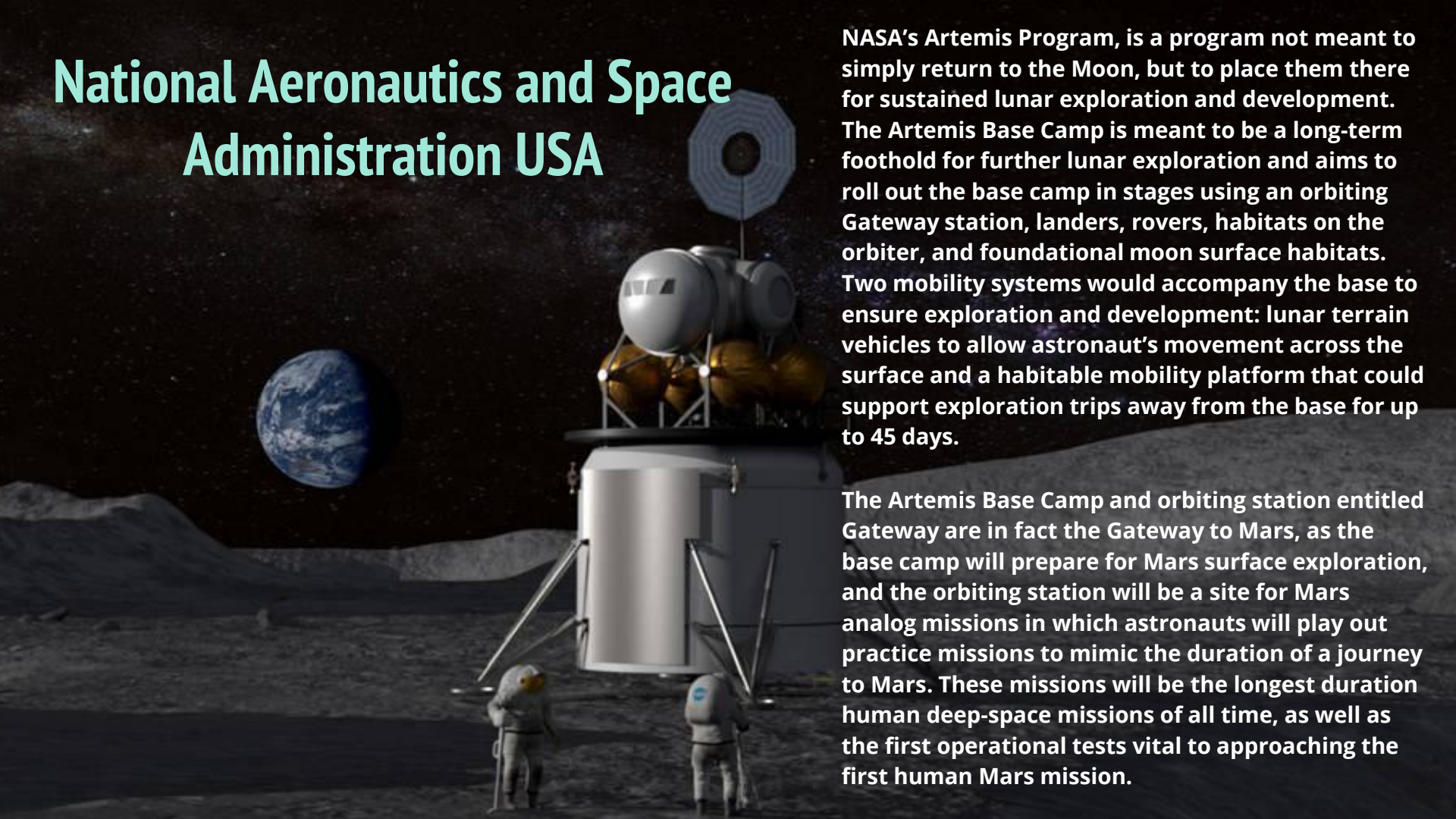
“The first man on the moon held an American flag. In the not-too-distant future, astronauts on the moon may be holding fuel pumps. The future for American commercial space activity is bright.” - *Wilbur Ross is the U.S. Secretary of Commerce*



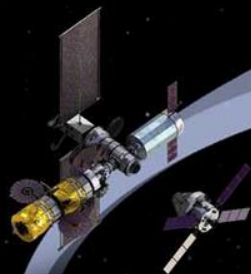
National Aeronautics and Space Administration USA

NASA's Artemis Program, is a program not meant to simply return to the Moon, but to place them there for sustained lunar exploration and development. The Artemis Base Camp is meant to be a long-term foothold for further lunar exploration and aims to roll out the base camp in stages using an orbiting Gateway station, landers, rovers, habitats on the orbiter, and foundational moon surface habitats. Two mobility systems would accompany the base to ensure exploration and development: lunar terrain vehicles to allow astronaut's movement across the surface and a habitable mobility platform that could support exploration trips away from the base for up to 45 days.

The Artemis Base Camp and orbiting station entitled Gateway are in fact the Gateway to Mars, as the base camp will prepare for Mars surface exploration, and the orbiting station will be a site for Mars analog missions in which astronauts will play out practice missions to mimic the duration of a journey to Mars. These missions will be the longest duration human deep-space missions of all time, as well as the first operational tests vital to approaching the first human Mars mission.

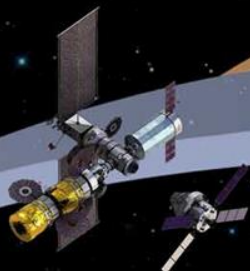


ARTEMIS PREPARES FOR MARS

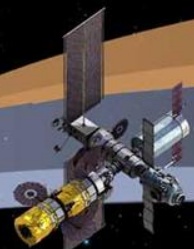


Testing landing and ascent capabilities

Lunar Terrain Vehicle



Expanding the range of surface exploration and ISRU demonstrations



Gateway augmented with international habitat for increased capabilities



Foundation Surface Habitat and Habitable Mobility Platform delivered to complete Artemis Base Camp



Expanded habitation capability added to Gateway to enable Mars mission dress rehearsal at the Moon



Mars mission dress rehearsal with longer in-space and surface durations




Foundational Surface Habitat

Habitable Mobility Platform

SUSTAINABLE LUNAR ORBIT STAGING CAPABILITY AND SURFACE EXPLORATION

MULTIPLE SCIENCE AND CARGO PAYLOADS | INTERNATIONAL PARTNERSHIP OPPORTUNITIES | TECHNOLOGY AND OPERATIONS DEMONSTRATIONS FOR MARS



ESA's concept development of the "Moon Village" does not refer to an earthly housing and shopping development, but a "community created when groups join forces without first sorting out every detail, instead simply coming together with a view to sharing interests and capabilities," (ESA). The association proclaims equal opportunity for robotic and astronaut activities, multi-party and nation unity, scientific and non-scientific pursuits, and the ability for nations to leave behind any differences on Earth. Its planning has also been propelled by the Moon Village Association, a non-governmental organization striving to start international discussions and formulation of plans to foster establishment of the Moon Village.

European Space Agency

Likewise to NASA's base, ESA is thinking about Shackleton Crater on the South Pole to be its location. Construction base would begin with landers setting up inflatable modules to serve as workspaces, labs, and residential areas, and eventually have private industry robots build a 3D printed protective shell made from regolith around the structures to protect from extreme temperatures and micrometeorite strikes.

Japanese Aerospace Exploration Agency



JAXA's plan to establish a lunar base is to build remotely from earth using autonomous robots on the Moon. The project has been researched for years by JAXA collaborating with the construction company Kajima Corp., and three Japanese Universities and has recently conducted an experiment of automated construction at an experiment site in central Japan. The 7-ton backhoe was able to do procedures of driving specified distances and repeating routine operations, while other operations that required more fine handling were performed by a human remotely. The autonomous building of a lunar base would require 4 steps: site preparation work for the human habitation module, excavation to meet the required depth, module installation, and then shielding it with surface material (regolith) to protect from radiation and possible meteoroids. Along with the lunar habitat, JAXA has announced a collaboration with Toyota to create a moon rover to transport humans that could launch in 2029.

The Roscosmos State Corporation for Space Activities



NASA and the Russian Space Agency have signed an agreement to work together on venturing into deep-space with the first goal of being a deep space gateway Russia plans to develop the "Federation" spacecraft in 2022 and have it fly its first mission to the International Space Station in 2023. Deep space flights will follow in the mid-2020's, and a sample return mission of lunar soil with the Luna Grunt Probe in 2027. In 2029, crew flights to lunar orbit will begin along with flight testing of a lunar lander and an inflatable lunar base module, and crew landing will take place in 2030. Unlike US and European commercial plans, leader of the Russian State Space Agency Dmitry Rogozin has said he does not believe there is much potential for industrial utilization on the Moon but has spoken of a potential lunar station in defense against comets and asteroids (although its details have not been clarified).



CSNA's Chinese Lunar Exploration Program, or the Chang'e Project, incorporates lunar orbiters, rovers, sample return spacecraft and plans to build a lunar research station near the south pole of the Moon. China's future lunar missions include four new Chang'e missions including two sample return missions, a survey missions, and a technological test mission. Chang'e 5 is planned to launch in December of 2020, with the goal of landing in the Mons Rumker region of the Oceanus Procellarum and return 2kg of lunar regolith from as deep as 2 meters, and have four modules designed to collect, transfer, and send the sample back to Earth. The Chang'e 6 lander will launch in 2023 or 2024 and is designed to return samples from the lunar south pole. Chang'e 7's launch date is TBD, yet is planned to make detailed surveys of the Moon's south polar region, covering the terrain, locations of water, geological compositions, and environment. Its primary objective is to detect water ice in permanently shadowed regions and locate their origins. Finally, Chang'e 8's launch date is also TBD, yet is designed to test technologies essential to the construction of the lunar research lab, also conducting surveys and scientific experiments.

China National Space Agency

United Nations Outer Space Treaty of 1967

- Formally known as Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.
- This treaty has established the basis of international space law, prohibiting the placement of nuclear weapons in space, limiting the use of the Moon and other celestial bodies to be used for peaceful purposes only, free exploration and use of space for all nations, and that no nation may appropriate outer space by claim of sovereignty. Nations are also responsible for their own activities and any damage they may cause by launching objects from their territory into space.
- It was first opened for signature by the Russian Federation, United Kingdom, and the United States of America in January of 1967, and entered into force in October of 1967. As of 2019, 109 countries are parties to the treaty, yet 23 have signed but not ratified.



Private Works

There is another option to colonizing in outer space. The first colonization effort on another planet by the human race may be undertaken by a private company. One of the most important elements of space law is to do with territory and land ownership.

“Under the Treaty, private entities cannot own land on the moon. However that hasn’t stopped commercial businesses already looking at resource extraction from other planets, and mining asteroids. While asteroids couldn’t be owned by countries, they could be owned by private corporations.” says government space law.

SPACEX

JAXA

PLANETARY
SOCIETY

IAI

Orbital ATK

XCOR
AEROSPACE

AEROJET
ROCKETDYNE

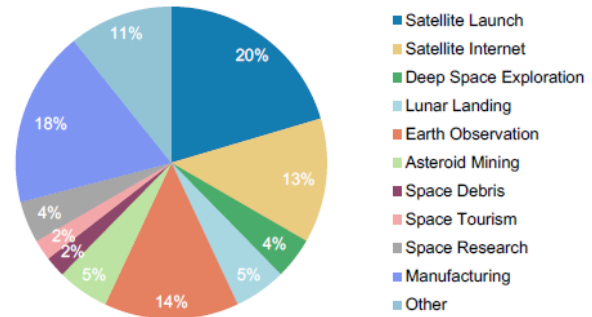
BOEING

LOCKHEED MARTIN

SPACE
.....

XPRIZE

Exhibit 3: Private Space Economy Breakdown (% of Total)



Source: Morgan Stanley Research
Universe includes 93 companies, 90 of which are discrete (SpaceX and Blue Origin appear in multiple sub-industries)

SpaceX

The background of the slide features a vibrant sunset sky with a bright orange and yellow sun partially obscured by a dark horizon. A long, glowing white and orange arc, representing a rocket's launch trail, curves across the upper portion of the image. The SpaceX logo is positioned in the top left corner.

A new partnership between NASA and the aerospace company SpaceX has tasked SpaceX with sending cargo and supplies to a space station that NASA wants to build in the Moon's orbit called the Gateway, and will be a big piece of NASA's Artemis program. Just like the ISS, the Gateway is going to need supplies for science experiments, and SpaceX is the first company that have been charged with making it happen as they have already been supplying cargo to the ISS for almost a decade. The company is developing a new cargo vehicle called the Dragon XL that can carry more than 5 metric tons of cargo to the Gateway lunar orbit. During each trip, Dragon XL will stay docked to the Gateway for up to 12 months at a time, and will carry sample collection materials and other essentials the Gateway crew needs during their lunar surface expeditions. Still, plans for returning to the Moon continue to be uncertain and questioned as NASA's 2024 deadline does not seem realistic.

Donald Trump's Space Force

On December 20th of 2019, The Space Force was established as an independent branch of the US Armed forces within the department of the US Air Force and is headed by the Secretary of the Air Force. It will take responsibility for all major space acquisitions programs and manage a distinct and separate budget from the Air Force. The U.S. Space Force's mission is to "organize, train, and equip space forces in order to protect U.S. and allied interests in space and provide space capabilities to the joint force," (USSF). Specifically, they are responsible for space domain awareness (military, civil, and commercial), space support to nuclear command, control, space support to satellite operations, communications and nuclear detonation detection, and missile warning and space support to missile defense operations. Its function, as stated in the U.S. Space Force Act is to provide freedom of operation for the U.S. in, from, and to space, and to provide prompt and sustained space operations. Finally, its duties are to protect the interests of the U.S. in space, deter aggression in, from, and to space, and to conduct space operations. Although most believe the Space Force to be Donald Trump's invention, the concept has been floating around since the mid 1990's and was even suggested by Defense Secretary Donald Rumsfeld in 2001, before the calamity of 9/11.

Trump's Reason For A Moon Colony

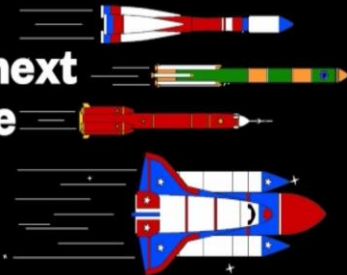
After Obama's administration worked to decrease spending for NASA and space programs, the Trump administration decided to reverse Obama's actions and create a new plan where he promised to get back to the moon by 2024. Trump's administration wants to create a privately funded American space industry. White House data states, "The global space economy is approaching \$350 billion and is expected to become a multi trillion-dollar industry. There are more than 800 operational American satellites in orbit, and by 2024 that number could exceed 15,000." As these companies advance new ideas for space commerce and nontraditional approaches to space travel, they seek the legitimacy and stability that comes with government support and approval. Trump has already signed the Bill in 2017 and allocated \$19.5 billion in spending for the US space agency that year.



A New Space Race/ Weaponizing Space



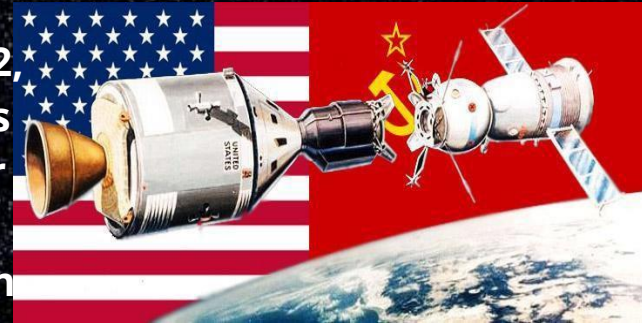
The next
space
race



It was announced in early 2019 that the U.S. would land their next lunar mission by 2024, four years earlier than previously planned, and seemingly to defeat Russia and China, whose Chang'e 4 had just made the first-ever soft landing on the far-side of the Moon in January. Mike Pence stated in the announcement that, "China and Russia are aggressively developing and deploying capabilities — including anti-satellite weapons, airborne lasers, menacing 'on-orbit' capabilities and evasive hypersonic missiles — that have transformed space into a warfighting domain... While our adversaries have *weaponized* space, too often we have *bureaucratized* it. Organizational inefficiencies that plague our space military authorities, warfighting capabilities, acquisition programs and personnel policies stifle our ability to meet the rapidly evolving threats in space."

Weaponization Continued

However many believe that there is no race at all. Although detailing a plan for four more Chang'e missions, China's plans do not actually land humans on the Moon until after 2030. A reasonable comparison, however, to the Cold War space race is military competition. Both Russia and China are developing military capabilities including laser weapons and ground-based anti-satellite missiles. It was found in late 2018 that a never-before-seen Russian missile was in fact a mockup of an anti-satellite weapon that would be ready for warfare by 2022, and expected to target communication and imagery satellites in low Earth orbit. Although China has officially advocated for peaceful use of space, they too have created a ground-base anti-satellite missile to target low Earth orbiters, as well as an expected ground-based laser weapon that can counter low-orbit space-based sensors.



Nasa has been adamant about not sharing anything with CNSA (China's Space Agency) to keep their plans secret. This has gone as far as Chinese students and researchers being excluded from NASA funding.

China vs. U.S. Relations



**Affecting International
— Students**

How Power Will Be Divided on the Moon

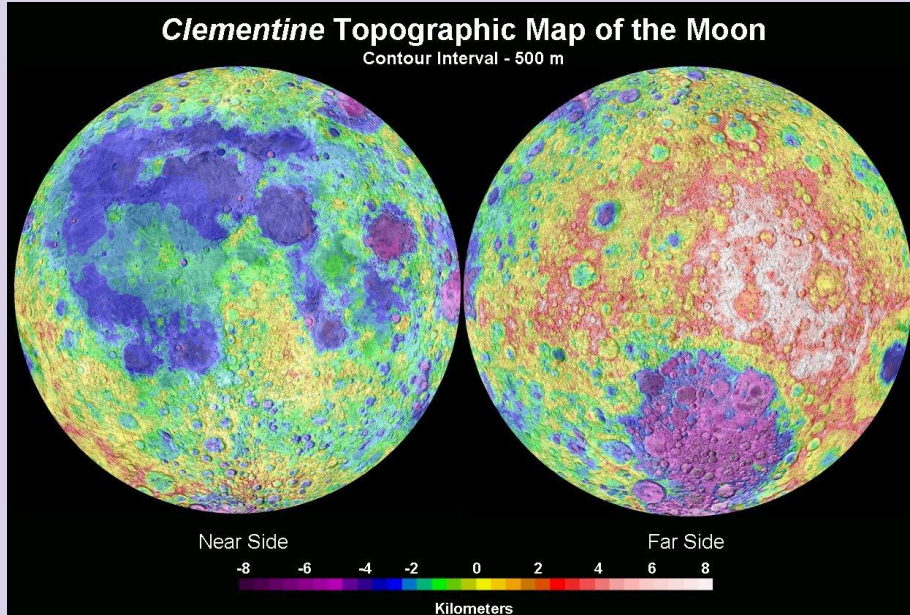
It seems as though national space agencies around the world believe that power on the moon for a moon colony will be granted by a first come basis but that no one country can have complete control over the moon's land. The Outer Space Treaty, which all space faring nations have signed, specifically forbids nation states claiming territory in space. And that includes all their citizens. A new Moon Treaty will need to be passed in order to avoid a power struggle. Since the moon offers many potential valuable resources, it is inevitable that nations and companies will try to assert power over these resources. How can power be divided though if nobody owns anything in space? It is likely that power will be displayed by the amount of land a country has colonized

How Space on the Moon Would Be Divided



If history continues to prevail itself, it is hard to believe that the moon land will be divided amongst countries peacefully. Since currently, there is no private property or property rights on the moon, the first thing that will have to happen is that moon land will be given a value that countries can buy. NASA has “claimed” small area around their lunar landing sites as “No go zones,” so future exploration will not disturb the Historic sites. It is important to be aware that the moon is $\frac{1}{3}$ of the size of Earth and if it has been difficult to keep peace on Earth, it may be even harder on a smaller body.

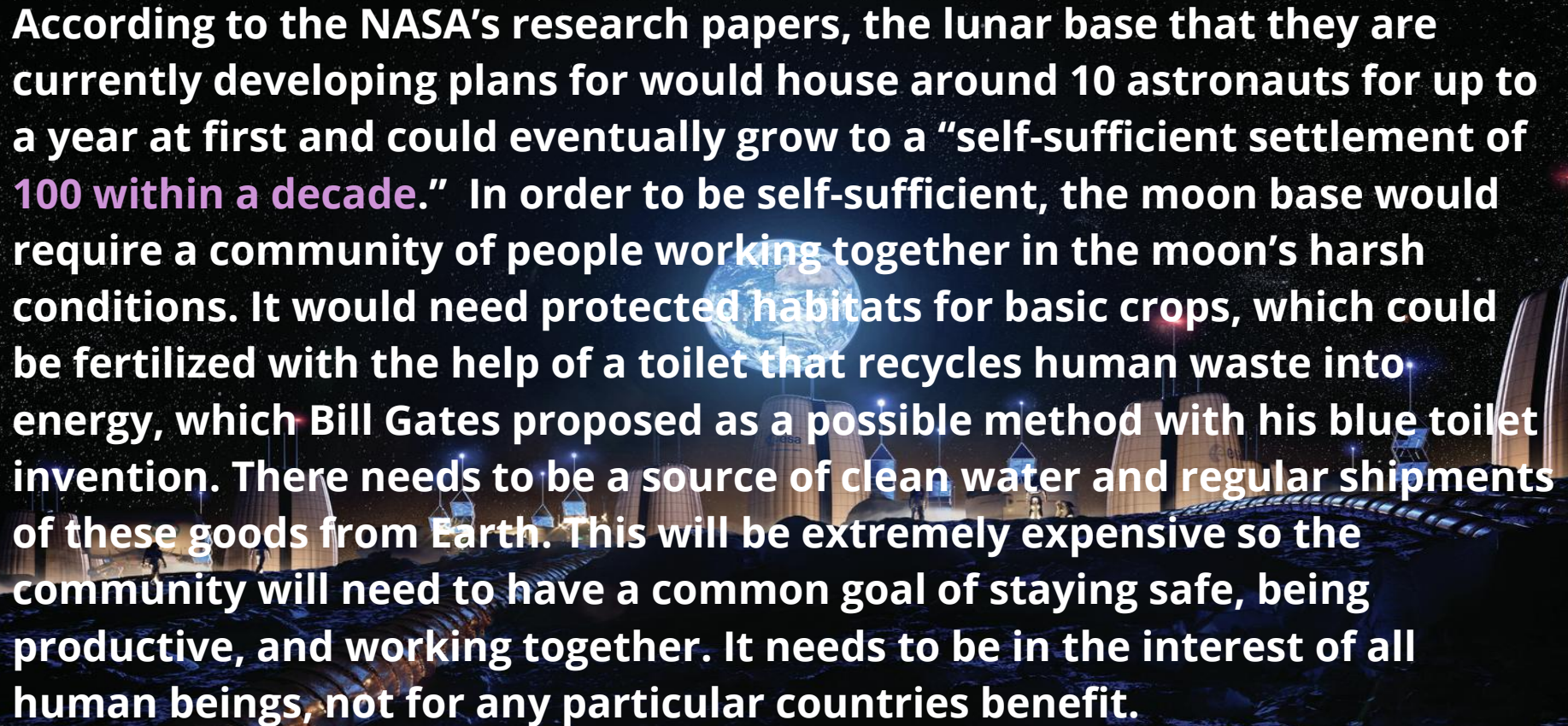
How Will Resources Be Divided



From what scientists have discovered so far, the moon offers resources like precious metals including platinum, regolith minerals, water ice at the poles, carbon monoxide and carbon dioxide, ammonia and/or other nitrogen compounds. These are all valuable for industries, but there is no sign of regulation of these materials. Since no one has ownership over these resources, is it legal to sell and make a profit? These are all questions that have strong political implications and can cause potential conflict.

Moon Village Community Working Together

According to the NASA's research papers, the lunar base that they are currently developing plans for would house around 10 astronauts for up to a year at first and could eventually grow to a "self-sufficient settlement of 100 within a decade." In order to be self-sufficient, the moon base would require a community of people working together in the moon's harsh conditions. It would need protected habitats for basic crops, which could be fertilized with the help of a toilet that recycles human waste into energy, which Bill Gates proposed as a possible method with his blue toilet invention. There needs to be a source of clean water and regular shipments of these goods from Earth. This will be extremely expensive so the community will need to have a common goal of staying safe, being productive, and working together. It needs to be in the interest of all human beings, not for any particular countries benefit.

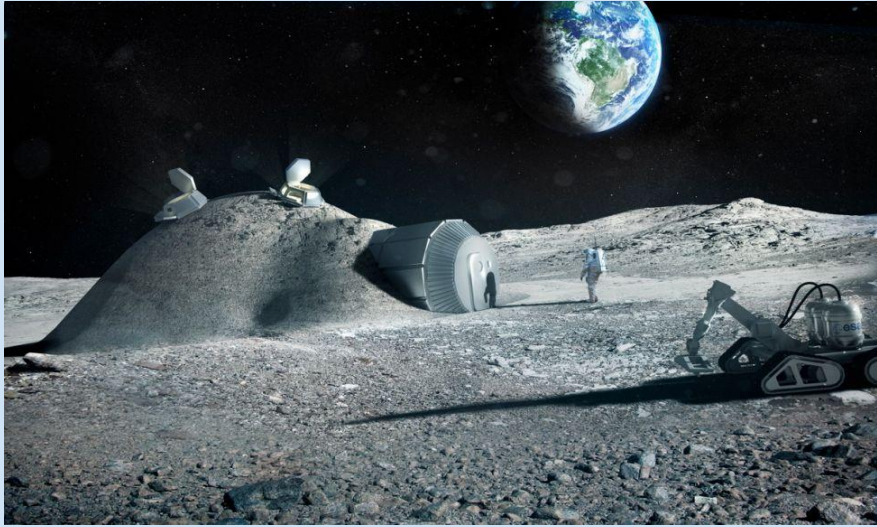
A futuristic lunar base is depicted on the dark, cratered surface of the moon. The base consists of several interconnected, cylindrical habitats with a metallic, reflective exterior. Some habitats have small, glowing windows. In the background, a large, detailed Earth is visible in the dark sky, showing continents and clouds. The scene is illuminated by a soft, blue light, possibly from a nearby lunar habitat or a small satellite. The overall atmosphere is one of a high-tech, isolated settlement in space.

Laws to Govern Moon Life/ Keeping the Peace

Because human character is unpredictable but history has proven we are political by nature, laws will be set in order to give a sense of unity to a moon colony. When Russia launched the world's first satellite in 1957, it revealed a glaring hole in legal policy which is, How should we regulate outer space? And if there is a population living there, how can they interact peacefully?

- Essentially, the moon land should be treated like international waters where no one group has control- Stated in the Outer Space Treaty.
- There will have to be some sort of regulation on harvesting and mining moon material. Possibly a mining license system.
- The population living there should have a common goal of furthering science for the betterment of human life and anyone who goes against this common goal should not be part of the moon colony.
- The Outer Space Treaty also bans nuclear weapons and military so there is no nation dominating space interaction.
- There needs to be protected rights for the population of moon villagers where their research is protected, their belongings are protected, and they can be aided back to Earth if needed.

A Bill of Rights For The Moon Colony



The Future of Going to the Moon... and Staying On the Moon

“One of the things that has been so important in the history of human civilization is freedom and liberty, so what we wanted to do was think about liberty beyond the Earth.” - Charles Cockell, an astrobiologist

On the moon, isolated and with a small population, over time it is likely the group of moon colony inhabitants will adopt their own set of rules to abide by. “A space colony is a tyranny prone environment,” Cockell warns. Since the moon has no atmosphere and is an unforgiving place, people should have the right to proper resources like oxygen, clean water, food, and gear. The same rights of speech, personal practices, assembly, and petition should remain in place. Governments of participating moon traveling countries should adopt a transcript of rules and also continue to evolve the UN Space Treaty because it is likely to need many adjustments over time.



Big questions would need to be answered like would you get to vote for a colony leader? Would you have to obey a speed limit in your Moon rover car? And if you wanted to settle there permanently, would you get property? What would the immigration process look like? An annual International Extraterrestrial Liberty Conference is already trying to solve these and other scenarios.

Language and Language Barriers

One question that has arisen as many countries have planned to establish a lunar base is: Do we need a singular international space language? As the space world is changing rapidly, further exploration of both the Moon and Mars demands international collaboration. Choosing a singular language for operational necessity has also been recommended for aviation, assuring communication. Because most space craft currently leave the Earth on Russian territory, meaning their mission is commanded by a Russian Citizen, ground controls are limited to Russian and English. ISS module operations are written in Russian, thus any astronauts going to the International Space Station have to learn Russian. This has made many believe Russian to be the most sensible option, despite its difficulty. Astronauts in fact often complained of the insufficient language training when preparing for the ISS, and agree that better proficiency of Russian is essential to conducting safe operations.



In the Distant Future of a Moon Colony... A New Moon Race and Culture?

Over the next thousands of years, if a moon colony is established, humans are likely to evolve to better suit the harsh environment of the moon. Humans will best survive on the south pole of the moon due to less direct radiation and less drastic temperature however, the moon still reaches 260 degrees F and -387 degrees at night. The moon also has the gravity of about 17% what it is on the Earth. So if you weigh 200 pounds on Earth, you will weigh 34 pounds on the Moon. This will have extreme effects on humans' bone strength, weight, etc.

These environmental factors plus the idea that the moon population will be isolated from Earth's people means that a new race and culture will develop over hundreds or thousands of years. What will it mean to have a sub-species of human beings? Will they be able to live amongst Earth dwellers? It is a complicated idea. This is why, for now, Space Agencies are proposing smaller colonies of only scientists and companies doing research and mining for materials. But we all want to know what the future could hold.

Other Significant Implications

- **If multiple nations are working together in the moon colony once the leading figures like China, Japan, Russia, and the U.S. can agree on the formalities of a moon economy, a universal moon currency would need to be created to trade, sell, and buy resources.**
- **Will territories be divided by nations? Can multiple private and public space associations work together?**
- **How can governments justify spending the money for moon exploration? Can we get the political parties to agree? Will it cause more problems on Earth?**
- **Is this only an elitist movement? Will the rich get richer from this and only benefit the upper classes?**
- **Can we build hospitals, schools, and other public buildings for the future of moon life?**

Although it is fascinating to think about the future of a moon colony and all the changes it could bring, we of course have to simply get to the moon first and just getting there is already causing disputes amongst the world's top political powers. A second Space Race could be a very scary thing for life on Earth now that nuclear weapons are a reality and many global governments are clashing. If we make it back to the moon and stay there, safety should be the first priority. Business leaders, climate scientists, and futurists of all kinds point towards the colonization of the moon and other planets as a necessity for the human race to survive the next century given dwindling resources, destructive and unpredictable weather patterns, and toxic pollution poisoning our water, not to mention the possibility of nuclear war.

Is it worth it to go beyond Earth, or will we just bring our problems with us to the moon and other planets? Only time will tell how outer space colonies will be governed.

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