

Date: August 12, 2020
To: James Quirk, GOVT 322
From: Katherine Boyko
Re: Why should the U.S. engage in space colonization?

Benefits of Space Colonization

Space colonization alleviates the problem of resource scarcity on Earth. Celestial bodies, such as Ceres, the largest known asteroid, contain vast supplies of minerals. Additionally, as satellites and rovers have proven, settlements in space could provide access to invaluable new knowledge. Pew Research Center study showed that a statistically large percentage of Americans support space colonization for these two reasons.

Current Efforts for Colonization

Saudi Arabia recently announced the “Mars 2117” mission and, alongside Japan, launched the “Hope” rover in an effort to prepare for future colonization efforts. India and China also made notable efforts toward eventual colonization of celestial bodies, particularly Mars. In a pursuit of a similar mission, on July 30th, NASA launched “Perseverance” rover to Mars.

Regulatory Concerns Surrounding Colonization

The UN’s “Outer Space Treaty” provides a framework on international space law. In theory, its provisions guard against space dominance. It also hinders Elon Musk’s efforts of establishing an independent colony on Mars. Many academics, however, are skeptical about whether respecting the Outer Space Treaty will be Donald Trump’s top priority, especially after he established a new military branch, Space Force, to prove his dedication to U.S. involvement within the space domain.

How Can the Space Force Substantiate NASA’s Efforts?

Currently, NASA is experiencing an organizational decline. Space Force, on the other hand, is a new department that can act as a solution to future acquisition of resources in space as well as a military force necessary to ensure the free access to the space domain. USSF can also substantiate NASA’s goals by supporting its missions with personnel and technologies.

Recommendations and Reservation for the Future

United States has a history of refusing to ratify and adhere to international treaties. Notably, it neither signed nor ratified the “Moon Treaty” that establish space as a peaceful domain. Potential cooperation between NASA and the new military branch substantiates the academics’ concerns that the U.S. may choose to militarize space. However, many semi-autocratic nations are already making efforts at space colonization. To secure a free access to space and ensure adherence to international treaties, space needs a police force. Therefore, the U.S. should combine Space Force’s efforts with those of NASA and engage in space colonization alongside other nations. This will slow NASA’s organizational decline, allow the U.S. to reap benefits of space colonization for all humankind, and prevent semi-autocratic governments from making space anything but a free-access domain.

Why should the U.S. engage in space colonization?

Each year, more and more nations are transitioning from agricultural to industrial societies, subsequently improving their living standards and increasing competition for Earth's limited resources. To alleviate this pressing environmental concern, nations should pursue space colonization. U.S., especially, should engage in it to ensure that space remains a free-access domain.

Benefits of Space Colonization

Space colonization could potentially alleviate the problem of resource scarcity. For example, Princeton physicist Gerard O'Neil strongly suggests that asteroids and lunar mines could even provide abundant materials to sustain future space colonies, besides enriching Earth¹. Ceres, the largest known asteroid, has enough materials to construct orbital space settlements with a total living area exceeding the land areas of Earth a hundred times². 3554 Amun, a small asteroid in comparison, has a potential \$20 trillion worth of metals³. Mining could also act as a new industry that would wash over our solar system and work to supplement continued development on Earth⁴.

Additionally, starting with the U.S. and the USSR, nations worldwide have launched robotic emissaries to the Moon, Mars, Venus, and Titan to expand knowledge⁵. Permanent settlements on celestial bodies would provide an even greater understanding of space. In theory, space colonization may even answer the question of whether there is intelligent life beyond Earth.

Academics aren't alone in supporting space colonization. According to Pew Research Center, 47% of American believe that conducting basic scientific research to increase knowledge and understanding of space should be a top priority and 34% of Americans support the idea that searching for raw materials and natural resources that could be used on Earth should be a top priority⁶. Interestingly enough, then, the academics and ordinary citizens alike support space colonization.

Current Efforts for Colonization

Multiple nations already commenced missions supporting space colonization. For example, Sheikh Mohammed bin Rashid al Maktoum, Saudi Arabia's vice president and prime minister,

¹ Richard D. Johnson and Charles Holbrow, "NSS Space Settlement Nexus," National Space Society, accessed August 11, 2020, <https://space.nss.org/space-settlement-national-space-society/>

² Ibid.

³ Ibid.

⁴ Bill Keeter, "Space Colonization," NASA, December 04, 2018, accessed August 11, 2020, https://www.nasa.gov/centers/hq/library/find/bibliographies/space_colonization

⁵ Fred Kennedy, "To Colonize Space Or Not To Colonize: That Is The Question (For All Of Us)," Forbes, December 18, 2019, accessed August 11, 2020, <https://www.forbes.com/sites/fredkennedy/2019/12/18/to-colonize-or-not-to-colonize--that-is-the-question-for-all-of-us/#4a96d9d52367>

⁶ "Majority of Americans Believe Space Exploration Remains Essential," Pew Research Center Science & Society, May 30, 2020, accessed August 11, 2020, <https://www.pewresearch.org/science/2018/06/06/majority-of-americans-believe-it-is-essential-that-the-u-s-remain-a-global-leader-in-space/>

states that Saudi Arabia's new mission to colonize Mars, *Mars 2117*, aims to build a fully self-sustainable city on Mars, housing 600,000 people⁷. To eventually attain this goal, the country recently launched the *Al-Amal* rover with coordinated assistance from Japan⁸. Its mission is to provide a complete picture of the Red Planet's atmosphere for the first time.

The Indian Space Research Organization (ISRO), in coordination with NASA, is also planning to develop similar missions and, in the past, already managed to put a probe in orbit around Mars⁹. China, too, had taken a step toward space colonization when, on July 23, it launched the *Tianwen-1*, a lander, rover, and orbiter, set to reach Mars in February 2021¹⁰. If the landing proves successful, China will be the second nation to put a rover on the Red Planet's surface, right after the U.S.

Despite other nations' efforts, NASA remains steadfast in its pursuit of knowledge through exploratory missions and commences to prepare for possible future colonization of Mars. Historically, NASA sent *InSight*, *MarCO-A*, and *MarCO-B*, all of which successfully landed in November 2018¹¹. On July 30, it launched the *Perseverance* rover, which is part of the larger goal of exploring celestial bodies, including the Moon, to prepare for human settlement on the Red Planet¹².

Regulatory Concerns Surrounding Colonization

To ensure that space colonization benefits all of humankind, its efforts need to be a product of global cooperation. However, the administrations spanning from Ronald Reagan to George W. Bush have blocked negotiations on treaties such as the *Prevention of an Arms Race in Outer Space (PAROS)* that aim to limit the use of modern satellite and weapons technologies in space¹³. Academics backing these administrations argue that U.S. military and technological dominance in space is the only guarantee of peace in space, rather than trust and cooperation. However, this approach poses several regulatory concerns.

⁷ Ann M. Simmons, "The United Arab Emirates Launches a Plan to Colonize Mars by 2117," *Los Angeles Times*, May 31, 2017, accessed August 11, 2020, <https://www.latimes.com/world/la-fg-uae-space-20170531-story.html>

⁸ Stephen Clark, "United Arab Emirates Successfully Sends Its First Mission toward Mars," *Spaceflight Now*, July 19, 2020, accessed August 11, 2020, <https://spaceflightnow.com/2020/07/19/united-arab-emirates-successfully-sends-its-first-mission-toward-mars/>

⁹ Mike Wall, "US, India to Team Up on Mars Exploration," *Space.com*, October 01, 2014, accessed August 11, 2020, <https://www.space.com/27305-nasa-india-mars-exploration.html>

¹⁰ Charlotte Jee, "China's Tianwen-1 Mission Is on Its Way to Mars," *MIT Technology Review*, July 23, 2020, accessed August 11, 2020, <https://www.technologyreview.com/2020/07/23/1005557/chinas-tianwen-1-mission-is-on-its-way-to-mars/>

¹¹ Anatoly Zak, "Robotic Missions to Mars," *Spacecraft: Planetary: Mars Missions*, July 30, 2020, accessed August 11, 2020, http://www.russianspaceweb.com/spacecraft_planetary_mars.html

¹² "Mars 2020 Mission Overview," NASA, accessed August 11, 2020, <https://mars.nasa.gov/mars2020/mission/overview/>

¹³ Mike Moore, "Space, American Exceptionalism, and the Next Cold War," *Center for International Security and Cooperation*, February 12, 2008, accessed August 11, 2020, https://cisac.fsi.stanford.edu/events/space_american_exceptionalism_and_the_next_cold_war

For example, the U.S.'s pursuit of space dominance is contradictory to the *United Nations' Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*. Nicknamed the "Outer Space Treaty," it provides a framework on international space law. Most notably, it states that "outer space shall be free for exploration and use by all States and it will not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."¹⁴ This treaty ensures that space exploration benefits humanity by making space solely a shared domain.

According to Michael Listner, an attorney and founder of the private firm Space Law & Policy Solutions, this treaty also directly contradicts Elon Musk's colonization plans for Mars¹⁵. Musk is already visualizing ideas as ambitious as sending 1,000 starships over the next ten years to Mars¹⁶. However, if he, as a private citizen, claims a territory on Mars, the United States would also be indirectly making that claim due to U.S. government's continuous jurisdiction that establishes private companies' legal ties to their mother country. Therefore, this action would directly breach the Outer Space Treaty.

While Elon Musk may ultimately forego such action, many academics are nonetheless skeptical about whether respecting the Outer Space Treaty will remain Donald Trump's top priority. Already, he established the National Space Council and a constructive agenda to support private space commerce¹⁷. Byron Callan, a defense stock analyst for Capital Alpha Partners, believes that Lockheed Martin, Northrop Grumman, and Harris Corporation may especially benefit from this¹⁸. Furthermore, in 2019, the White House established the sixth military branch, Space Force (USSF), to prove its dedication to efforts in space and substantiate NASA's current goals and initiatives.

How Can the Space Force Substantiate NASA's Efforts?

Despite NASA's previous and continuous successes and leaps, it is crucial to ask whether it is best for NASA to continuously handle the majority of responsibilities related to space exploration and future efforts at space colonization. Currently, NASA has 19 Administrative Staff Offices, 4 Mission Directorates, 7 Mission Support Directorates, and 18 Centers and Facilities in varying locations¹⁹. It is also handling 12 different missions with an annual budget

¹⁴ "The Outer Space Treaty," The United Nations Office for Outer Space Affairs, accessed August 11, 2020, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

¹⁵ Caroline Haskins, "The Legal Battle to Colonize Mars," The Outline, March 15, 2018, accessed August 11, 2020, <https://theoutline.com/post/3739/mars-colony-settlement-spacex-elon-musk-trump?zd=2&zi=q4fu3ub3>

¹⁶ Morgan McFall-Johnsen, "Elon Musk Says He Plans to Send 1 Million People to Mars by 2050 by Launching 3 Starship Rockets Every Day and Creating 'a Lot of Jobs' on the Red Planet," Business Insider, January 17, 2020, accessed August 11, 2020, <https://www.businessinsider.com/elon-musk-plans-1-million-people-to-mars-by-2050-2020-1>

¹⁷ Caroline Haskins, "The Legal Battle to Colonize Mars," The Outline, March 15, 2018, accessed August 11, 2020, <https://theoutline.com/post/3739/mars-colony-settlement-spacex-elon-musk-trump?zd=2&zi=q4fu3ub3>

¹⁸ Aaron Gregg and Christian Davenport, "Here Are the Companies That Could Profit from Trump's Space Force," The Washington Post, August 14, 2018, accessed August 11, 2020, <https://www.washingtonpost.com/business/2018/08/14/here-are-companies-that-could-profit-trumps-space-force/>

¹⁹ Brian Dunbar, "NASA Organization Structure," NASA, January 08, 2015, accessed August 11, 2020, https://www.nasa.gov/about/org_index.html

of \$22.63 billion, compared to Saudi Arabia's space agency's planned budget of \$1 billion²⁰. Because of the extensive number of supportive agencies, academics suggest that NASA is currently in an organizational deceleration. NASA's existence follows a pattern described by Anthony Downs' classic "life cycle of bureaus." It represents an inexorable tendency of federal agencies to increase bureaucracy and conservative behavior that gradually leads to agencies' falling efficiency²¹.

Space Force could become the solution to NASA's organizational decline. It could also guard against legislative repercussions of private companies' space colonization and attain the vast resources from space for the benefit of humankind. Established in December of 2019 under the Department of Air Force, Space Force is a military branch that organizes, trains, and equips space forces to protect U.S. and allied interests in space and provide space capabilities to the joint force²².

The USSF is currently coordinating with the U.S. Air Force to develop a holistic plan to transfer the appropriate forces to the new military branch by leveraging the U.S. Air Force for 75 percent of its enabling functions to reduce costs. The Department of Air Force plans to provide civilian personnel management, I.T. support, and base operating support to secure a fast development of the new military branch²³.

Space Force plans to develop technologies to "defend our way of life on Earth through interests in space."²⁴ NASA, in contrast, aims to advance scientific knowledge and use the environment of space for research.²⁵ Because USSF is still undergoing development, it can be structured to substantiate NASA's goals and support NASA's missions with personnel and technologies while securing the space domain.

The jobs within the Space Force include, most notably, Space Operations Officer, Space Systems Operations, and Intelligence Officer²⁶. Airmen and appropriate Air Force space-related personnel are being transferred to serve in the USSF²⁷. This means that USSF will include people trained for withstanding atmospheric pressures and demanding environments - a characteristic that could be useful for NASA's future space exploration missions.

Recommendations and Reservations for the Future

²⁰ John Sheldon, "Saudi Space Agency Begins To Take Shape, Reported \$1 Billion Budget In First Year," SpaceWatch.Global, April 19, 2019, accessed August 11, 2020, <https://spacewatch.global/2019/04/saudi-space-agency-begins-to-take-shape-reported-1-billion-budget-in-first-year/>

²¹ Howard E. McCurdy, "Organizational Decline: NASA and the Life Cycle of Bureaus," *Public Administration Review*, August 1994, pp. 308

²² "Fact Sheet," United States Space Force, accessed August 11, 2020, <https://www.spaceforce.mil/About-Us/About-Space-Force>

²³ Ibid.

²⁴ "Space Force," U.S. Air Force, accessed August 11, 2020, <https://www.airforce.com/spaceforce>

²⁵ "National Aeronautics and Space Administration," National Partnership for Reinventing Government, accessed August 11, 2020, <https://govinfo.library.unt.edu/npr/library/status/mission/mnasa.htm>

²⁶ "Space Force," U.S. Air Force, accessed August 11, 2020, <https://www.airforce.com/spaceforce>

²⁷ "Fact Sheet," United States Space Force, accessed August 11, 2020, <https://www.spaceforce.mil/About-Us/About-Space-Force>

Because of this, Barbara M. Barrett, the 25th Secretary of the Air Force, which is comprised of also the U.S. Space Force, should work to allocate more money from the overall \$205 billion budget toward Space Force and work to encourage cooperation with Jim Bridenstine, the current NASA Administrator²⁸. The collaboration between NASA and USSF will attain significant advancements within the space domain to secure life on Earth, the free access to the space domain, and a continued search for knowledge. Space Force's Spacelift operations at the East and West Coast launch bases already provide assistance and facilities for the conduct of DOD, NASA, and commercial space launches²⁹. USSF can also work to provide technical personnel and combatants to NASA for its future missions to combat NASA's organizational deceleration.

Academics, however, hold several relevant reservations. Historically, the U.S. failed to adhere to a myriad of international treaties and refused to sign and ratify others, such as the *Moon Treaty*, which expands the provisions of the Outer Space Treaty by providing that the Moon and other celestial bodies should be used exclusively for peaceful purposes³⁰. Thus, the potential cooperation between NASA and USSF brings concerns; the efforts aimed at research and space exploration may transform into strides toward military dominance.

However, the cooperation between these two departments is necessary. China and Saudi Arabia have semi-autocratic governments and a running history of human rights abuses. Without a military police force to prevent them from restricting access to celestial bodies, free access to space would become obsolete. Therefore, the United States should look past its historical isolationist and hostile policies, ensure that Space Force continues its development by expanded its funding, and establish a working relationship between the NASA and Space Force. Such actions will provide the space domain's continued free access for all humankind; it would yield an abundant amount of resources and unparalleled access to new knowledge, resolving the growing concerns about the astronomical rate of consumption of Earth's resources.

²⁸ "BARBARA M. BARRETT," United States Space Force, accessed August 11, 2020, <https://www.spaceforce.mil/Biographies/Article/2039368/barbara-m-barrett>

²⁹ "Fact Sheet," United States Space Force, accessed August 11, 2020, <https://www.spaceforce.mil/About-Us/About-Space-Force>

³⁰ "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies," United Nations Office for Outer Space Affairs, August 11, 2020, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html>

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