

A woman in a futuristic, white space suit is kneeling on a dark, rocky surface, likely the moon. She is looking down at a glowing, futuristic HUD (Heads-Up Display) overlay on the ground. The HUD features various data visualizations, including a circular progress indicator, a grid pattern, and a glowing blue light. The scene is illuminated by a cool, blue light, creating a high-tech, futuristic atmosphere. The astronaut's suit is detailed with various panels, straps, and a large, illuminated visor. The background is a dark, textured surface, possibly lunar soil or rock.

Policy Recommendations to Accelerate the Establishment of Communities in Space

The June 2020 BE Report | The Beyond Earth Institute

The June 2020 BE Report
Policy Recommendations to
Accelerate the Establishment of
Communities in Space
by Beyond Earth

*“Thinking today about
humanity’s tomorrows”*



I. Executive Summary

Beyond Earth Institute (Beyond Earth) is dedicated to building a policy framework that will accelerate the establishment of permanent human communities in space. To that end, Beyond Earth asked seven subject matter experts how U.S. and international policy should change to promote the commercial development of space and the eventual construction of communities in space. The result of those interviews and subsequent analysis revealed the following concerns:

1. The United States Government must revamp the arms and export control regime, including ITAR and CFIUS, as these regulations in their current form are hurting high-tech U.S. commercial development, failing to achieve their goals, and impeding progress towards permanent human habitation of space.
2. The international aerospace industry should establish voluntary norms of behavior surrounding commercial activities in space. These norms may be administered by trade associations and should be designed to influence any future regulatory, legal, or diplomatic framework covering private sector space activity including the construction of space communities.
3. The United States Government should establish a whole-of-government sectoral trade and exploration agreement with like-minded allies focused on space commercial development and the eventual establishment of permanent human communities in space.¹

II. Introduction

Humanity stands on the cusp of a transformative age. Our economy and society are increasingly unconstrained by the bounds of Earth, creating the prospect for a long-term, permanent human presence in space. This future is in reach of people alive today.

The vast expanse of space promises infinite opportunity, boundless freedom, and unfettered creativity. By cultivating oases of life in the desert of space, humanity could vastly improve both its material well-being and allow us to become better stewards of our unique, ancestral home of Earth. However, without careful planning this great potential may remain unrealized.

Mere technological ability to elevate ourselves above the heavens does not guarantee a future of sustainable, equitable, and economical space activity. Public policy must keep pace. While recent actions by the U.S. government are encouraging, what remains lacking are policies specifically related to enabling a sustainable, permanent presence in space for large numbers of regular people.

It is with this recognition that this survey was conducted. The Beyond Earth Institute reached out to a select group of thought leaders to solicit their ideas about how the current space policy framework might be improved to better facilitate the eventual construction of permanent human communities in space.

This paper represents the distillation of those conversations. It should be noted that these interviewees were known to have a favorable attitude toward space development. The authors have done their best to capture the similarities and divergence of views on the key near term policy issues that space advocates will need to address as they move toward their goal. This paper also derives a list of recommendations for changes to U.S. space policy.

This report is far from comprehensive, but hopefully will start a serious discussion on what national and international policies need to be changed or adopted to advance the establishment of permanent human communities in space.

III. About the Beyond Earth Institute

The Beyond Earth Institute formed in 2019 in response to a deep gap in space policy discourse when it comes to establishing an enduring human presence in space. Beyond Earth is founded on the vision of enabling economically vibrant communities of people living and working beyond Earth, for the benefit of all humanity.

Beyond Earth helps policymakers navigate this new environment. While many organizations—such as academic institutions, trade associations, government agencies, and other non-profit groups—try to address emerging space challenges, few groups focus much attention on the policies and practices for the viability of a long-term human presence in space.

Beyond Earth fills this gap. Our nonpartisan mission focuses on delivering the best current thinking through engagement with stakeholders, government officials, and other leading experts—transforming this process into concrete, viable policies. Beyond Earth's team of experts², with deep, long-term connections within government, private industry, academia, and policymaking, serve to shepherd this role. Beyond Earth is the premier institution with a mission to put forth practical policy solutions for a promising, prosperous future beyond earth.

The purpose of this paper is to explore the legal, regulatory, and policy barriers that may impede, or that could support, proposals to construct human communities beyond Earth. The survey presented in this report is one activity of Beyond Earth, and additional follow-on activities are planned. For more details on the Beyond Earth Institute and its leadership, go to BeyondEarth.org.



IV. Methodology

Between November 2019 and February 2020 Beyond Earth interviewed seven distinguished subject matter experts in the field of space policy: Greg Autry, Michelle Hanlon, Chris Hearsey, Fred Kennedy, Laura Montgomery, Ben Roberts, and Pete Worden. Their biographies are listed in Appendix A. Each expert was asked the same set of open-ended questions:

The interviews were recorded, transcribed, and summarized. The discussion and recommendations described in this paper were distilled from the interview summaries.



1. What are the current laws, and specific provisions of those laws, that would inhibit/prohibit the development of space communities? This may include regulations, national, and international policies. Feel free to comment on relevant provisions of familiar statutes, including the Outer Space Treaty, the Moon Treaty, property rights, ITAR, CFIUS, and other national security issues, or maritime law.
2. What changes in existing law could be introduced to enable communities in space?
3. What new laws should be considered to counter inhibiting existing law or clarify ambiguous law?
4. What other policies should be considered that would stimulate development of communities in space?

The discussion and policies recommended in this paper are not intended to reflect a consensus or even a broad spectrum of opinion. This is not a statistically significant poll. Rather, Beyond Earth hopes that the ideas proposed by these seven experts form the basis for further discussion among policy makers at all levels of government.



V. Discussion

A. Defining Space Communities

“We will bring every little bit of human society with us into space.” - Chris Hearshey.

One impediment to establishing permanent communities in space could be the term “space settlement” itself. An unexpected outcome of the interviews was the variety of attitudes and interpretations of the terminology of “a permanent human community in space” or a “space settlement.”³ Respondents all stated that a space community must be built with the intention of permanence. That is, just like cities are founded without an end-date, the institution of a space community should not have a ‘design lifetime,’ as if it were a vehicle or a machine.

One respondent stated that space communities must be very physically distant and socially isolated from Earth in order to allow a distinctive culture and economy to emerge. Another questioned the sovereignty of any future community in space. A third respondent stated that a space community, by its very nature, must drag every little piece of society with it to space.

Several interviewees were asked if the International Space Station (ISS) can be considered a community in space. Most disagreed but one respondent answered in the affirmative, stating that because ISS is permanently *occupied* (albeit not intended to be a permanent structure) then it is a space community.



However, the agreement ended there. Some stated that a space community must have the capability to be economically self-sufficient or produce some sort of economic surplus, while others disagreed with this notion. Others stated that one must freely choose to live in a space community, as opposed to being assigned there (as if for a job or a government assignment).

There does seem to be a need to resolve to a generally agreed upon definition of what a community in space is, even if it is by a different name. Thus, for the purposes of this paper, space communities (or space settlements) are defined as permanent, multi-purpose facilities in space where groups of people will live, work, play, and could feasibly raise children over successive generations.



V. Discussion (Cont.)

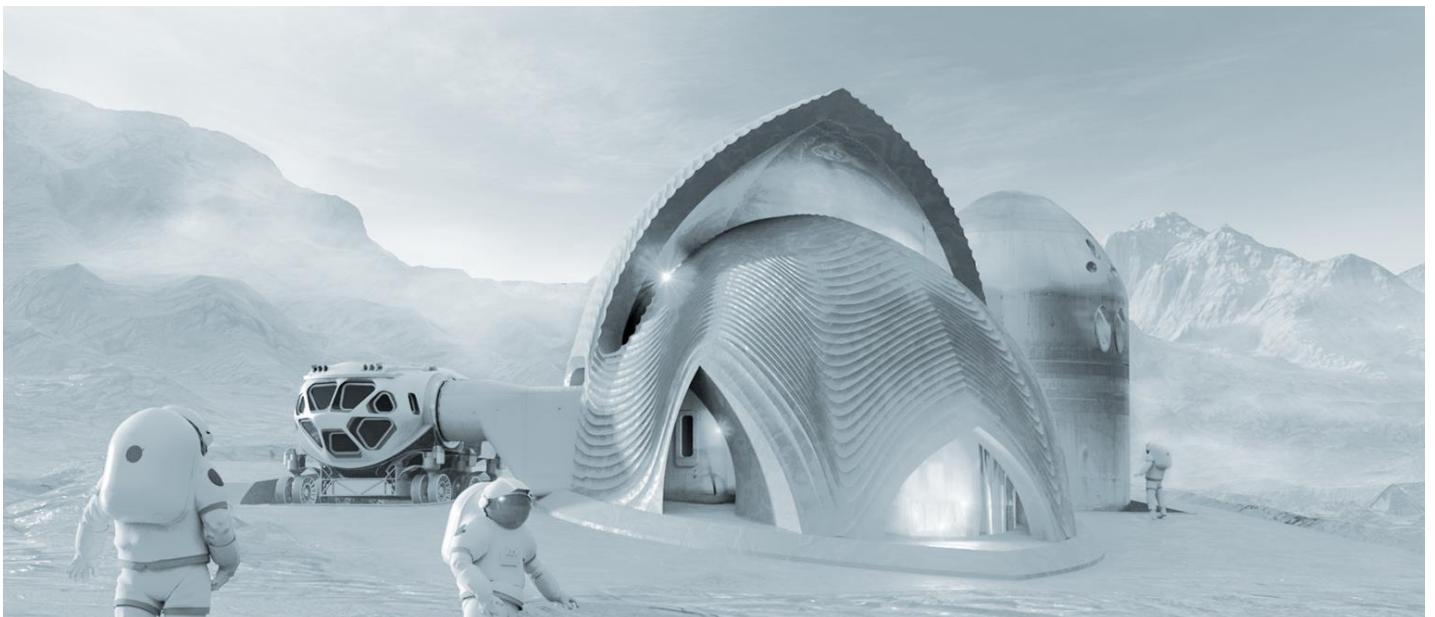
B. Property Rights in Space

“In the beginning, we’re not going to be able to call it property.” - Michelle Hanlon.

The legal right to own the space one occupies—be it land or a structure—is well-established law on Earth. Indeed, property rights are the basis for the creation of much wealth and subsequent prosperity. However, property rights in space are not well-defined. Decades-old international treaties and a relative lack of domestic legal precedent create a contradictory policy framework. The resulting legal and policy confusion likely impedes permanent space establishments. Why, for example, would a group expend fantastic resources to establish a space community without clarity about their rights, privileges, and potential prosperity?

While all the respondents recognized that property rights must be addressed, they differed as to the timing of any such action. Some felt action should be taken in the near term, which could spur increased interest in the commercialization and habitation of space. Others felt there was plenty of time to address the issue once a serious proposal for the use of space territories comes to the fore.

Due to the numerous issues embedded in “property rights,” this discussion will be separated into the different components that respondents believe deserve attention. While a comprehensive discussion is outside the scope of this paper, the following sub-issues were identified by the respondents as potential areas for further development.



V/B. Property Rights in Space (Cont.)

1. “Exclusion Zones”

Respondents vigorously discussed the issue of “Exclusion Zones” (or sometimes called “Safety Zones”) as a means of addressing certain property-like rights in space, even if these are not per se “ownership” rights.

One expert proposed the “exclusion zone” concept as a means to advance the cause of property rights, but not as an amendment to the Outer Space Treaty. Rather, the U.S. government should pass legislation allowing U.S. commercial companies to establish non-interference safety zones around their operations on the lunar surface. This would both protect the safety of these vehicles and establish precedent that could later be leveraged for policy-making.

Furthermore, it was suggested an international scientific consensus is urgently needed to define specific minimum distances between neighboring spacecraft: when Apollo 12 landed on the Moon, its rocket plume damaged the nearby Surveyor lander. The respondent believed that assessing the risks of pitting and other interference from nearby space activity is a technical question, not a political one. The respondent strongly believes that progress on this issue must continue irrespective of a political agreement.



Multiple respondents were in favor of the safety zone⁴ concept as a critical step on the way to defining property rights in space.



Another respondent considered the scope of any exclusion zone as hugely important. This person pointed out that, in the event of a major failure debris will widely scatter, and there is a strong need to keep people safe. Also, if an entity proscribes a law or regulation that goes in contradiction to safety and survival, people will ignore that rule to survive. These zones could be in two dimensions, in the case of a planetary outpost, or in three-dimensions, in the case of a structure not attached to a planetary surface.



V/B. Property Rights in Space (Cont.)

2. International Treaties and Domestic Policies

Another respondent argued that the prohibition on national appropriation of celestial territory (Article II of the Outer Space Treaty) does not prevent nongovernmental, private ownership of property in space. This person suggested countries can reinforce this position by passing domestic laws where they would recognize the property rights or claims of land by anyone of any nationality, so long as certain criteria have been met. In this way domestic legal precedent can be used to advantage people of all nations, as long as their actions meet certain criteria, without the complication and delay of negotiating or re-negotiating an international treaty. Laws similar to adverse possession, or squatters rights, could be developed as well.

This respondent suggested that rather than spending time and money on international space policy, the U.S. government should fund more technology development to facilitate the establishment of communities in space. This in turn will accelerate the establishment of these communities and create a de facto 'ground truth' that can be used to negotiate treaties and policies governing space communities after they are established. The reasoning behind such an approach is a conviction that international treaties and policy actions move too slowly and may actually delay space communities rather than promote them. In this person's opinion it's better for the government to help solve the technical problems first and then address any policy problems that may arise later.



One respondent agreed with the tactic of the U.S. unilaterally allowing permanent commercial activities in space (despite the unclear international treaty framework) as a way to create precedent for later policy action and potential changes to international treaties.



V/B. Property Rights in Space (Conclusion)

3. Do We Need To Settle Property Rights Now?

Several respondents felt that there are more pressing policy issues than property rights. One expert summarized this position by stating that today there are no big policy hurdles preventing, say, a billionaire from setting up an outpost on the Moon to extract materials to sell on the open market. This same respondent conceded that, over the long term, property rights may become necessary if several parties seek control over the same spot of celestial real estate (like, for example, shadowed craters on the Moon's poles). But, for now, space is big, the technical risks are immense, and thus there is probably plenty of room and time for all actors to move forward with little chance for property rights conflicts.

Another respondent essentially agreed with this position, expressing little concern that a lack of clear property rights will impede the establishment of communities in space. This respondent was sanguine primarily because there already exists slow and steady progress towards the creation of international protocols and multilateral agreements (outside of established U.N. treaties) regarding the founding of communities in space. Specifically, the respondent pointed to efforts underway by “non-threatening, neutral” countries like Luxembourg and Bhutan to establish policies governing the activities of commercial, non-governmental actors in space. In the respondent's opinion it is precisely because these policies are being formulated by non-space-faring countries that they will be universally acceptable and enduring.

One respondent viewed the problem less as a technical problem, and more as a policy and economic problem. According to this respondent, the concept of a permanent human presence in space is, at best, unknown by the general public and, at worse, undervalued. Also, to establish a large scale space community requires more economic capital than exists in a single country, which, according to this respondent, is why there will need to be an international aspect to the establishment of space communities.



V/C. Export Controls

“ITAR and export controls have backfired in a horrendous way.” - Fred Kennedy

While most respondents considered property rights essential for the viability of permanent communities in space, several respondents felt that there are more immediate policy issues to address. Examples include export control reform, reform of the International Traffic in Arms Regulation (ITAR), and removing obstacles to international cooperation, investment, and sharing of research.

ITAR has been a sticking point for decades for U.S. space companies wanting to do business globally. Not surprisingly, most respondents cited ITAR as being an impediment to the development of the space economy, and by extension the eventual capabilities that will enable human habitation in space.

ITAR is a Cold War-era American regulation meant to prevent bad actors from having access to sophisticated U.S. technology that may have military applications. This includes spacecraft systems, launch vehicles, and associated equipment. Respondents' attitude toward ITAR ranged from insisting that the regulations be entirely done away with to a thorough overhaul that would leave only the most egregious actors on the list of ITAR nations.



Addressing the ITAR issue is important to promote near-term space commerce. It is also important to the development of large scale habitats over the long term. A high level of international cooperation not impeded by outdated national security policies will be unquestionably necessary for space communities to take shape.

None of the subject matter experts interviewed for this study were in favor of retaining ITAR in its current form. Several respondents said ITAR should be “scrapped.” One respondent said it had “backfired in a big way” by encouraging other nations to develop their own launch vehicle technology rather than license it from U.S. companies. In this way ITAR has failed in its primary mission of maintaining U.S. control over sensitive technologies and has dealt a second blow to the U.S. innovators and manufacturers by robbing them of a potential source of licensing revenue.

Most military and economic experts agree ITAR in its current form does not work, or at least does not work well. Sensitive launch vehicle and missile technology is no longer controlled solely by predictable actors like the U.S., Russia, or China. Rogue states like North Korea and Iran have very sophisticated missile and satellite launch programs and have demonstrated an ability to independently acquire or, in some cases, indigenously develop other advanced military technologies.



V/C. Export Controls (Conclusion)

No respondent advocated for the complete dismantling of arms control regulations. Rather, respondents believed the U.S. should do everything possible to find a new way to prevent bad actors from obtaining additional military capabilities without impeding U.S. innovation and international trade.

To this end, several respondents suggested modifications to ITAR. Instead of a blanket restriction on trade in sensitive military technologies with all non-U.S. entities, the U.S. government should allow cooperation with friendly like-minded nations, or what one respondent called “ideological allies.” U.S. companies and organizations should be allowed to research, develop, and freely sell or license space technologies with countries such as Canada, the United Kingdom, Australia, New Zealand, Japan and many other countries that are no threat to the United States, have a demonstrated track record of protecting technologies (i.e. won’t transfer or sell them to bad actors that might then threaten the world), and represent rich market opportunities for U.S. organizations.



Breaking down barriers between allies and increasing international cooperation between responsible state actors will improve U.S. national security as well as facilitate progress towards the eventual establishment of communities in space. The Cold War is long over and it’s time for the U.S. government to acknowledge ITAR is outdated and harming the U.S. competitive edge in aerospace technologies. A new arms control framework that facilitates closer integration with like-minded allies is needed to both improve U.S. national security, economic strength and bring humanity closer to our long-term future in space.

Specific to the prospects for human expansion into space, a reformed ITAR policy would support the international engagement on space community construction in three ways: 1) stimulate unfettered global growth of the space economy, which will more readily be able to support and justify space communities, 2) technical transparency would greatly improve cross border joint project development activities, improve efficiency and reduce costs for establishing space communities, and 3) enable key space industrialists (e.g. Musk, Bezos, and Branson) to build additional wealth that they can invest in building communities beyond Earth as we know they are eager to do.



V/D. The Outer Space Treaty

“Who in our country decides what activity requires federal oversight? Congress. So, if Congress hasn’t said you need a license to brush your teeth on the Moon, then you don’t need a license to brush your teeth on the Moon.” - Laura Montgomery.

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies is often referred to as the Outer Space Treaty (OST). OST went into effect in 1967 and over 100 countries have ratified the treaty, including all major space-faring powers like the United States, Russia, China, and India.

space—citizens in space—perhaps by requiring domestic legislation. Others disagree, stating that Article VI does not require such extensive action from state-parties whose citizens wish to establish communities in space.

While all respondents agreed that the OST requires clarification with regards to space communities, none advocated that the United States withdraw from the treaty or that the treaty be scrapped. Most agreed that the problems presented by the Outer Space Treaty do not present an immediate impediment to bringing human life to space, and that these challenges can be addressed over the next several years or decades via steady discussions with international partners either within or outside of the U.N. framework.

There are differing interpretations of the extent to which the OST permits nations to establish permanent human communities in space. Some point to Article II of the treaty— which clearly prohibits nations from claiming territory in space—as also prohibiting non-governmental, commercial entities from owning property in space. Others point out that Article VI requires states-parties to the treaty to affirmatively authorize and continuously supervise activities of their citizens in

One respondent argued that the OST will need to be revised and renegotiated to give nations authority and sovereignty over the actions of their citizens in space. This needs to be done not for the purposes of national appropriation (i.e. growing the size of nations physical territory) but rather to better police and regulate their own domestic actors. The current vague policy framework will likely lead to undesirable outcomes where, on the one hand a country is responsible for the actions of its citizens in space but on the other hand lacks the jurisprudence to enforce claims or police the

V/D. The Outer Space Treaty (Cont.)

actions of the citizens in a particular region of space. Trying to achieve this end with solely commercial or civil contracts would be insufficient as it is unclear where such contractual disputes would be evaluated: the U.N. has neither the resources nor capability to act as a civil claims court for possible conflicts between communities in space.

The same respondent recommended that the OST be revised to allow commercial operators the ability to sell and transfer property in space. Transfer and sale of property is a long-term driver of economic growth and prosperity. Therefore, revising the OST is necessary in order to both keep the peace *and* to provide for future prosperity.

emerge as well—many with intentions of building communities in space. Even now, bilateral and multilateral commercial agreements are being negotiated that interpret OST in specific ways. A good example is the International Space Resources Governance Working Group of the Hague⁵ that is developing an international framework on space resource activities. Such agreements are forming a set of common practices that may make it easier to craft future agreements, as well as setting the rules and guidelines for future space settlement.

In a related opinion, one expert believes that now is not the time to call for revisions to the Outer Space Treaty because “we lack information needed to make smart regulatory decisions.” That is, until humans are

On the matter of establishing human communities in space, the OST is unclear and would require considerable revision to clarify. One respondent, citing the glacial speed of making any changes to the U.N. treaty, recommends bypassing the OST for major commercial and community-building agreement. Instead, international ‘protocols’ may be drafted that interpret the OST and are agreed upon by two or more countries. A neutral country can lead the negotiation and formulation of the protocols. Luxembourg has established itself as a safe haven for commercial space companies, and other neutral countries are expected to

actually living and working in space in large numbers for extended periods of time we don’t know what impact, if any, our actions may have on each other and on the environment and how regulations passed now may affect those activities in the future. Instead, this respondent believes commercial space operators should agree amongst themselves to a specific code of operations and allow a non-governmental organization (or similar structure) to mediate disputes and set standards. The respondent pointed to the Motion Picture Association of America and other trade



V/D. The Outer Space Treaty (Conclusion)

associations as a model the space industry might use to achieve this goal. This strategy will allow time for humanity to safely expand activities in space and gain experience with actual operations before making more permanent treaty or regulatory decisions.

Article VI of the Outer Space Treaty says, “The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.” One respondent stated that this wording empowers a nation that has ratified the treaty to determine the extent of the authorization and supervision of its citizens’ activity in space. In the United States that means Congress.

and future commercial activities in space, including the establishment of space communities. To rectify this, the respondent suggests that the President should issue an Executive Order stating that until Congress passes a law defining what commercial activities in space and on celestial bodies require authorization and continuing supervision, the Executive Branch will not regulate such activities. This in turn will assist federal agencies in properly applying their regulatory authorities.

The same respondent proposes a similar clarifying action regarding Article IX of the Outer Space Treaty, which requires States Parties to the Treaty to, “...conduct exploration of [celestial bodies] so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter...” The

Since Congress has not passed a law requiring U.S. government approval for permanent habitats in space, then, it’s argued, one is not needed. The respondent goes on to state that the lack of a law does not mean that the Executive Branch is responsible for If Congress has not passed a law requiring authorization and continuing supervision then the Executive Branch cannot unilaterally require it of commercial companies either. And yet this respondent is concerned that this is exactly what is happening which in turn may threaten current and future

respondent expresses concern that commercial companies operating in space are being forced to comply with NASA policies regarding preventing contamination in space. But NASA’s planetary protection policies are not mandatory laws and the Executive Branch cannot compel commercial companies from applying them to their activities in space. Therefore, the President should issue another Executive Order stating this to help Executive Branch agencies better understand the extent to which Article IX applies to the regulation of commercial activities in space.



V. Discussion (Conclusion)

D. The Outer Space Treaty (Conclusion)

It is important to acknowledge that after surveys for this study were completed, the White House issued an Executive Order⁶ of April 6, 2020 that clarifies the U.S. position on the Outer Space Treaty and the Moon Treaty as it relates to recovery and use of space resources. The Executive Order states in part:

“Americans should have the right to engage in commercial exploration, recovery, and use of resources in outer space, consistent with applicable law. Outer space is a legally and physically unique domain of human activity, and the United States does not view it as a global commons. Accordingly, it shall be the policy of the United States to encourage international support for the public and private recovery and use of resources in outer space, consistent with applicable law.”

There may be an implication in this Executive Order that permanent and semi-permanent in-space infrastructure and on-site facilities needed to access space resources could include space habitats for human populations that exist to serve a range of public and commercial activities that may or may not include support for mining operations. Arguably, the Executive Order recognizes space communities engaged “*in commercial exploration, recovery, and use of resources.*” Beyond Earth plans additional research into this question.



V:E. Additional Ways to Enable Space Communities

“NASA should go back to its roots by developing useful and cutting-edge technology.” - Pete Worden.

Besides the policies already discussed, respondents suggested additional ways the U.S. government can accelerate the establishment of communities in space. Although these were discussed briefly, and not all respondents were universally in favor of all of these ideas, they are still worth capturing. Specifically, the U.S. government should consider taking steps to:



- ▶ Centralize all space regulatory requirements into one agency creating a true ‘one-stop shop’ for companies seeking U.S. government permission to operate in space.
- ▶ More rapidly establish a robust, international space traffic management and space traffic control regime. Excessive and growing amounts of space debris is a strong deterrent to organizations hoping to establish permanent human communities in space, especially in congested orbits closer to Earth.
- ▶ Require companies selling transportation to spaceflight participants to provide basic human rights in their contracts e.g. a right to oxygen, a right to minimum amount of habitable volume, etc.
- ▶ Develop a separate informed consent regime for non-government personnel assigned to work locations in space. The current informed consent regime, while it does cover employees, is probably inadequate for people who are required to live in space for a long period of time as a condition of their employment.
- ▶ Investigate how the tax code may be used to stimulate U.S. business activity in space that leads to the eventual establishment of permanent communities in space.
- ▶ Investigate how NASA may recruit “industry ambassadors” on a rotating basis similar to what DARPA does: C-level executives from non-aerospace high-tech fields to help build high-level links and inject thinking/expertise in various fields that could help with long duration spaceflight, and ultimately community-building in space (e.g. clean tech, next-gen small nuclear power, solar, biotech etc.).
- ▶ The U.S. government should recognize that the current cost-plus contracting arrangements with legacy prime contractors saps American excitement and goodwill towards the U.S. space program. To achieve our goals in space, relevant agencies should partner more aggressively with the new generation of space companies.



VI. Policy Recommendations

Establishing permanent human communities in space will be expensive and risky. But the benefits to humankind could be endless. Therefore, the United States and the international community should leverage the full array of its collective resources to accelerate progress towards permanent human communities in space including private sector investment and international cooperation.

There were significant divergences of views on many issues from the interviewees making it difficult to arrive at a comprehensive set of policy recommendations.

Nevertheless, to the best of our ability, the authors of this paper have assimilated the perspective of the respondents and arrived at a list of three critical recommendations that will pave the way toward human civilizations beyond Earth. These recommendations are not meant to be comprehensive. However, these are considered critical near-term actions we can take. ▶

VI. Policy Recommendations

Recommendation #1 - Reform export control and related laws to allow for greater cooperation, particularly on a commercial level, between countries and companies.

The Beyond Earth survey respondents were clear that the greatest impediment to greater U.S. business activity in space—and greater cooperation between nations—is the outdated regulatory and arms control regime. If the United States is going to be a leader in humanity's quest for the stars, the International Traffic in Arms Regulation and the Council for Investment in the United States (CFIUS) urgently need to be revised to account for twenty-first century realities.

Recommendation #2 - Industry should work to establish norms of behavior related to human spaceflight and commercial operations in space.

The consensus of the BE respondents is that the industry should work together (or with a non-governmental organization) to develop best practices, learn from experience, and pre-empt the need for additional regulations by establishing their own voluntary norms that may then lead to more permanent national regulations or even international law.

Recommendation #3 - The U.S. should establish a whole-of-government sectoral trade and exploration agreement with like-minded allies focused on space commercial development and the eventual establishment of permanent human communities in space.

This paper's final recommendation is that working within the context of the Outer Space Treaty and in accordance with international law, there is a tremendous opportunity for nations with bold visions for space to join in bilateral and multilateral accords to spur more rapid development of the space economy and achieve a permanent, widespread human presence in space.

VII. Conclusion

While space advocates may prefer a grand policy directive to construct the first permanent human community in space, we must soberly acknowledge that such a pronouncement would be premature. We are simply not there yet. However, as this paper demonstrates, there are clear policy strategies that can be pursued that would have a direct impact on the viability of human presence beyond Earth.

While the recommendations in this first of Beyond Earth's policy papers are not comprehensive, we believe they lay the foundation for policies that will support a future for millions of humans living and working in space. The authors hope this paper will encourage space policy makers to take a broader view, and where possible, take actions that favor the development of communities in space.

Footnotes

1. The recently announced Artemis Accords, led by NASA, may signal a beginning to this effort.
2. See Appendix B for bios on the Beyond Earth Institute leadership.
3. In the course of the interviews it was discovered that the word “settlement” may be triggering for some groups.
4. NASA will incorporate a safety zone concept into the Artemis Accords policy: <https://www.nasa.gov/specials/artemis-accords/index.html>
5. International Institute of Air and Space Law - The Hague International Space Resources Governance Working Group <https://www.universiteitleiden.nl/en/law/institute-of-public-law/institute-of-air-space-law/the-hague-space-resources-governance-working-group>
6. See text of April 6, 2020 WH Executive Order: <https://www.whitehouse.gov/presidential-actions/executive-order-encouraging-international-support-recovery-use-space-resources/>



Appendix A: Subject Matter Interviewees Biographies



Greg Autry

National Space Society (NSS) Board of Directors - NSS Vice President for Space Development

Greg Autry is an educator, writer, technology entrepreneur and advocate for space settlement. As an Assistant Professor of Clinical Entrepreneurship with the Lloyd Greif Center for Entrepreneurial Studies in the Marshall School of Business at the University of Southern California he researches and publishes on space commerce, entrepreneurship, technology innovation and trade policy. He teaches courses in entrepreneurship, small business management and technology commercialization. He has been conducting research in the New Space / commercial space industry since 2003. Dr. Autry writes and comments regularly on space topics and serves on the editorial board of the *New Space Journal*. He served on the NASA Agency Review Team and as interim White House Liaison to NASA during the Presidential transition. He is also a member of the Commercial Space Transportation Advisory Committee (COMSTAC) at the FAA.

Dr. Autry holds a BA in history from Cal Poly Pomona as well as an MBA and a PhD (public policy and econ) from the Merage School of Business at UC Irvine. Dr. Autry is the co-author of the book *Death by China* and a producer on the documentary film, *Death by China*, (directed by P. Navarro and narrated by Martin Sheen).



Michelle Hanlon

Michelle Hanlon is Chair of the NSS International Committee and a member of the NSS Policy Committee. Michelle is an Associate Director of the National Center for Air and Space Law and an instructor of aviation and space law at the University of Mississippi School of Law. Michelle received her B.A. in Political Science from Yale College and her J.D. magna cum laude from the Georgetown University Law Center. She earned her LL.M in Air and Space Law from McGill University where the focus of her research was commercial space and the intersection of commerce and public law. Prior to focusing on space law, Michelle was engaged in a private business law practice. Her legal career commenced with the restructuring of sovereign debt for a number of South and Latin American countries and evolved into the negotiation and implementation of cross-border technology mergers and acquisitions. Her subsequent solo practice advised entrepreneurs across four continents on all aspects of bringing their innovative ideas to market: from basic corporate formation to financings and buyouts. Michelle is a Co-Founder and the President of For All Moonkind, Inc., a nonprofit corporation that is the only organization in the world focused on protecting human cultural heritage in outer space. For All Moonkind has been recognized by the United Nations as a Permanent Observer to the United Nations Committee on the Peaceful Uses of Outer Space.



Appendix A: Subject Matter Interviewees Biographies



Chris Hearsey

Christopher Hearsey has over ten years' experience in the aerospace community. In that time, Chris has built and managed his firm OSA Consulting, LLC and previously served as the Director of DC Operations and Legislative Affairs for Bigelow Aerospace. Chris also has served as Special Assistant to the Director of the Office of Space & Advanced Technology at the US Department of State and has managed political campaigns at the state and federal level, including a run for Congress in Maryland in 2018. Since Fall 2019, Chris Hearsey has served as Chief Space Liaison Officer for Space Hero.



Fred Kennedy III

Vice President, Future Missions, Astra Space

Fred leads Future Missions. Prior to Astra, Fred stood up the Department of Defense's Space Development Agency as its inaugural Director, led DARPA's Tactical Technology Office, and served as a Senior Advisor for Space at the White House. Fred served in the Air Force for 25 years before retiring as Colonel. He holds a B.S. and M.S. from MIT in Aerospace Engineering and Ph.D. in Electronic Engineering and Physical Sciences from the University of Surrey.



Laura Montgomery

Laura Montgomery teaches space law at Catholic University Columbus School of Law. In her private practice through Ground Based Space Matters she specializes in regulatory space law, with an emphasis on commercial space transportation and the Outer Space Treaties. She provides expert opinion on the Commercial Space Launch Act, its implementing regulations governing the launch of launch vehicles, the reentry of reentry vehicles, the operation of launch and reentry sites, and the financial responsibility and liability requirements of those regulations. She has testified to the space subcommittees of both the House and Senate, including, most recently in the summer of 2019. Laura Montgomery spent over two decades with the Federal Aviation Administration.

She has published articles on the Outer Space Treaty, human space flight, and launch safety. She also writes science fiction, some of which is bourgeois, legal science fiction. The *Waking Late* books are space opera. You may find more about her fiction at <https://lauramontgomery.com/>.



Appendix A: Subject Matter Interviewees Biographies



Ben Roberts

Vice President, Government Affairs, Moon Express

Ben Roberts is currently Vice President of Government Affairs for Moon Express, a company developing a family of vehicles capable of delivering payloads to the surface of the Moon and beyond. From March 2015 until March 2017, he was the White House Office of Science and Technology Policy's (OSTP) Assistant Director for Civil and Commercial Space. He came to OSTP from the Office of Management and Budget (OMB), where he served as a program examiner in the Commerce and Science/Space Branches, and as a Special Assistant in the OMB Director's Office. Prior to joining the Executive Office of the President, Ben worked as a Deputy Attorney General for the State of Hawaii and as a strategy and operations consultant for Deloitte Consulting in northern California. He holds a B.A. in Economics from Carleton College, a J.D. from the University of Michigan Law School, and a M.P.P. in Science and Technology Policy from the Harvard Kennedy School of Government.



Pete Worden

Chairman at Breakthrough Prize Foundation and former Director of NASA's Ames Research Center

Simon Peter "Pete" Worden, (Brig. Gen., USAF, Ret., PhD) (born 1949, in Michigan, USA) is the Chairman of the Breakthrough Prize Foundation and Executive Director of the foundation's 'Breakthrough Initiatives'. He holds a Bachelor of Science degree in Physics and Astronomy from the University of Michigan and a PhD in Astronomy for the University of Arizona. Prior to joining the Breakthrough Prize Foundation, Dr. Worden was Director of NASA's Ames Research Center at Moffett Field, California, USA until his retirement on March 31, 2015. He has held several positions in the United States Air Force and was research professor of astronomy at the University of Arizona, Tucson, USA. He is a recognized expert on space and science issues – both civil and military, and has been a leader in building partnerships between governments and the private sector internationally.



Appendix B. Authors



Tony DeTora is VP, Government Relations at Lynk Global, Inc., a satellite telecommunications company bringing mobile phone connectivity to unmodified mobile phones worldwide. Formerly Senior Professional Staff for the Committee on Science and Technology, U.S. House of Representatives.



Sean W. Hadley, Esq., is Associate Faculty at Rutgers University and Legislative Policy Advisor for the New Jersey Education Association. He teaches graduate studies in public policy and specializes in federal and state legislation.



Tom Marotta is the co-author of the award-winning book *The High Frontier: An Easier Way*, a former Foreign Service Officer, and an analyst in the Office of Commercial Space Transportation at the Federal Aviation Administration (FAA). The views presented in this paper are not the views of the United States Government.



Aaron Oesterle is DC Representative at the National Space Society and the Waypaver Foundation. He is also former Vice President of PoliSpace, a Washington, DC independent space policy consultancy.



Steven Wolfe is the Deputy Executive Director of SpaceCom and the Global Spaceport Alliance, and serves on the Board of the Global Entrepreneur Network - Space. Formerly worked for the U.S. House of Representatives where he served as executive director of the Congressional Space Caucus.

