

A close-up, low-angle shot of an astronaut in a white, futuristic space suit. The astronaut is looking down and slightly to the left. The suit has a complex, multi-layered design with various panels and textures. A glowing blue HUD (Heads-Up Display) is overlaid on the lower left portion of the image, featuring a circular interface with various data points and a central hexagonal grid pattern. The background is dark and out of focus, suggesting a space environment. The overall lighting is cool and blue-toned.

# Defining the Goal: What is a Community Beyond Earth?

The October 2020 BE Report | The Beyond Earth Institute



## EXECUTIVE SUMMARY

The Beyond Earth Institute (Beyond Earth) provides actionable research and analysis to policymakers that aims to move humanity closer to the day when we have communities beyond Earth. Based on experience and recent conversations with other space policy experts, Beyond Earth identified several philosophical and rhetorical debates which might pose significant barriers to engaging in this work.

One such debate is the definition of a group of people living permanently off the planet, and the terminology to use for such a group. At various times, and in various publications, terms such as “settlement,” “city,” “colony,” and “outpost” have been used. Attempts to reach consensus on a fixed term, or even agree what any individual term means, have been fraught with historical and political baggage. Some of this divergent attitude about what constitutes a community in space is clearly expressed in the June 2020 Beyond Earth Report [1].

Words matter. Definitions matter. Clarity matters. Beyond Earth has chosen to use the phrase “communities beyond Earth” in our mission statement, our Beyond Earth Reports, and our policy work. For the sake of clarity in our policy research, analysis, and recommendations, it is critical that Beyond Earth be unambiguous in our definition of a community beyond Earth. Hence, in order to establish a common foundation for the future publications, When Beyond Earth uses the phrase “communities beyond Earth” we mean:

***A community beyond Earth is defined as a group of people building, sustaining, and growing an economically vibrant self-governing society outside the atmosphere of our home planet.***

This definition represents the starting point of Beyond Earth’s work leading to answering an important question: When will the first community beyond Earth be built? While this definition is the work of significant analysis and consideration, it’s possible the drafters have overlooked some critical elements. This definition will possibly change in the future as new information comes to light. We welcome a discussion of potential improvements to the definition, and are actively seeking additional information.

# INTRODUCTION

Humanity's desire to explore beyond the next hill, and to live beyond Earth is not new. In 1869, Edward Everett Hale wrote about humans living as a community on the Brick Moon. Since then many authors, scientists, engineers, and visionaries have expressed various approaches to people living in space. Gerard K. O'Neill directed a working group at NASA Ames Research Center and published a report on how "human colonies in space" should look and how they should operate in free space. National space agencies and private companies are looking to explore and build a more permanent presence on the Moon and Mars.

Thanks to changes in policy advocated by these visionaries, the space industry has recently witnessed a shift of power toward private enterprises. The arrival of these private companies founded by world-famous billionaires, brings with it the goal of "becoming a multi-planet species" as described by Elon Musk, or creating "O'Neill Colonies" off the surface of any planet as championed by Jeff Bezos. Humanity leaving Earth is an idea whose time is almost here.

However, while the locations have been discussed at length, the goals of those missions differ vastly, and no consistency exists surrounding the concept of establishing permanent human presence beyond Earth. Even the terminology is widely and vigorously debated. Space "colonies" or "settlements"

evoke notorious historical parallels to expansionism that oppressed indigenous populations.

Beyond Earth seeks to move beyond the rhetorical discussions and into the underlying concepts and their value to the future of human civilization. In order to do so, we must choose a terminology and provide a clear definition that can move us forward. This is not meant to be the be-all-end-all term of art. It is not meant to undermine anyone else's approach. It is meant to clarify what Beyond Earth believes and on what basis we analyze, assess, and recommend policy.

Hence, Beyond Earth is choosing to use the term "communities beyond Earth" as defined above.

Below we lay out the importance of each element of that definition. The Beyond Earth definition seeks to capture the critical elements of communities beyond Earth. This definition points to a framework to measure the progress that has been achieved, or has yet to be achieved, toward achieving the goal.

It is a difficult task to define the critical elements of a society. Creating a community beyond Earth implies the idea of reproducing Earth-bound society on a smaller scale. Its inherent complexity and diversity cannot be described in a single-sentence definition. However, the act of attempting to define or describe a community in orbit or on a celestial body promotes greater understanding of the subject for policymakers, the general public, and space advocates.





## RATIONALE OF DEFINING A SPACE COMMUNITY

As mentioned in the introduction, there is no universally accepted definition of what a community beyond Earth would be. Policy experts, space enthusiasts, science-fiction writers, astronauts: everyone has their own vision – and their own definition – of what a community beyond Earth should be like. This lack of a common language hinders the development of these communities, and delays bringing them into reality. If there is no general agreement on the definition, then there can be no agreement on the technology, products, laws, policies etc. that should be developed to meet the goal.

Future research and public outreach efforts planned by Beyond Earth will rely on a well-reasoned, consistent definition of space communities. But more generally, any outreach program must speak a common language in order to educate and bring attention to a topic.

The importance of defining Beyond Earth's vision of a community beyond Earth will also support

the logic behind our future Beyond Earth reports. Defining the core foundation on which Beyond Earth is working helps clarify the ultimate goal, and the purpose of policies meant to be a catalyst to creating communities beyond Earth. Having a precise definition facilitates discussion and understanding of the concepts, while reducing or, hopefully, eliminating misunderstandings or misinterpretations.

Finally, it is important to note that many people in the aerospace industry and the space advocacy community conflate the practice of establishing a community beyond Earth with a physical structure – a habitat which is able to host people for a definite amount of time. This approach overlooks the fact that a community is a social structure, while a habitat is a physical structure. Hence, this paper will focus on defining criteria that must be met before the people living in a habitat beyond Earth can be considered a community.

## EXISTING MISSIONS AND DEFINITIONS AND TERMINOLOGY

Of course, visionary space organizations have sought to define what a community beyond Earth would be. National space agencies and private companies are currently working on making a permanent human presence beyond Earth a reality. Due to significant differences in destinations, purposes, and approaches, disparities in these visions exist even when they use the same language. It's no surprise that a variety of definitions have naturally emerged.

### Legislation/Bills

#### **The US Space Settlement Act of 1988**

In 1988, the Space Settlement Act entered the US laws and proposed a clear definition of a space settlement: "...any community of humans living

beyond Earth's atmosphere which exists with a substantial degree of independence of resupply from Earth." [2]

#### **The NASA Transition Act of 2016** (passed Senate)

With President Obama's time in office coming to a close, a bipartisan group of Senators sought to establish continuity in America's national space goals. The bill also provided additional long-term goals for NASA's human spaceflight and exploration programs: "to expand permanent human presence beyond low-Earth orbit..." enabling "the extension of human presence throughout the solar system..." which should include "human habitation on another celestial body and a thriving space economy in the 21st Century." [3]

## **The U.S. Space Exploration, Development and Settlement Act of 2016**

(introduced)

In 2016, Congressman Dana Rohrabacher introduced the Space Exploration, Development and Settlement Act which defined space communities as: "... any community of humans living beyond Earth's atmosphere that is able to economically sustain its population through a neutral or positive balance of trade of goods and services, and is able to expand its habitable real estate as need and desire of the community may warrant and international law permits".[4]

## **National Space Agency**

### **The European Space Agency – 2016**

The European Space Agency's General Director, Jan Woerner, offered in 2016 the following definition of a Moon Village:

"By 'Moon Village' we do not mean a development planned around houses, some shops and a community center. Rather, the term 'village' in this context refers to this: 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."[5]

## **Private Companies**

### **SpaceX - 2016**

"At this point I am certain there is a way. I'm certain success is one of the possible outcomes for establishing a self sustaining Mars colony, in fact a growing Mars colony. I'm certain that it's possible. " - Elon Musk, IAC, September 2016

On September 29, 2017 Elon Musk – CEO of SpaceX – provided an update on his plans to establish a long-term Mars settlement in order for humans to become a multi-planet species. While the initial outpost would start with only a dozen of persons, Musk expressed his hopes to create a self-sustaining and independent settlement that would be able to host one million people by 2050[6].

### **Blue Origin - 2019**

In 2019, Jeff Bezos – Blue Origin's founder – outlined his vision for space settlements. Bezos' idea seems very similar to the one of Gerard K. O'Neill back in 1975. Blue Origin aims to go back to the Moon and "this time to stay"[7]. By merging Bezos' speech and the few public details on this subject that are available, his vision of a community beyond Earth can be summarized as a community in space whose purpose is to produce knowledge, services and products that would benefit the Earth and human life.

## **Non-Governmental Organizations**

### **The Moon Village Association - 2017**

The Moon Village Association is a Non-Governmental Organization founded in 2017 and based in Vienna. They see the Moon Village as "a diverse community of projects carried out by stakeholders from different fields (for example, technical, scientific, cultural, economic) working together under the auspices of lean coordination mechanisms and/or common standards (i.e., technical, and ethical), and globally harmonizing existing resources to reach further-term aims. It acts as a catalyst for next alliances between public and private entities, including non-space industries and operators. Additionally, the Moon Village will entities, including non-space industries and operators.

Additionally, the Moon Village will provide a strong inspirational and educational foundation for future generations."[8]

### **The Open Lunar Foundation**

The Open Lunar Foundation is a non-profit organization working towards developing a collaborative and peaceful approach to lunar settlements.[9]

These definitions and approaches are only a sample of the differing interpretations of these terms. They show how broad the goals are and the number of people with means who are actively working towards establishing the first permanent human community beyond Earth.

# DEFINITION OF COMMUNITIES BEYOND EARTH

Beyond Earth defines a community beyond Earth as:

***A “community beyond Earth” is a group of people building, sustaining, and growing an economically vibrant, self-governing society outside the atmosphere of our home planet.***

We will now break down each component of the definition in order to discuss the language and make these choices as clear as possible.

***"A group of people building, sustaining, and growing..."***

The community is defined by the people within it. The people who live within the structures and borders of the physical location will have all manner of relationships and interactions. They will try to attract more people to join them. Building, sustaining, and growing requires a commitment to the community, an intent to create a lasting, permanent community. Some of the signs that people are committed to any community: the creation of families, or families joining the community; individual ownership of residences designed to last for decades; and individual ownership (or control of) land and natural resources.

Obviously, any community will also require physical habitats that house the community and the infrastructure needed to sustain a growing society over time. The technical ability to expand the physical space as needed and desired will require special considerations in these communities. These physical and technological needs are also significant considerations for the ability to grow a society.

***"...an economically vibrant..."***

An economically vibrant community is one in which a diversity of products and services are created, bought, and sold. Vibrant economies grow over time, and the diversity of the goods and services available increases. This diversity enables new economic activity, which can fuel further growth, in a positively reinforcing manner. As this diversity increases, the community becomes attractive to more people who join and bring their expertise and ideas with them. This increases the diversity of goods and services.

It is expected that these communities will trade with other communities, both on Earth and elsewhere in the solar system. This requires reliable transportation and communication networks. History has shown that the most enduring and successful communities had access to and from other communities in order to allow the regular exchange of goods, information, and people. While lower prices can help stimulate activity, reliability of transportation will be the most important dimension. It is assumed that this reliable in-space transportation and communications network eventually extends back to our home planet, allowing the continual transfer of knowledge, products and services with Earth, expanding the terrestrial economy into space.

To put this in proper context, if the only work being done at a facility is government-funded research and development, such as at the Antarctic research stations, then it would not meet this definition. This also applies for most manufacturing or mineral extraction locations - if all a Moon base does is extract lunar ice and export it, it would most likely not meet the definition of a space community. It is expected, however, that communities may very well grow up around such activities.

### "...self-governing society..."

This is the most critical component. A community beyond Earth has an internal governance structure and a system of enforceable laws by which the people agree to abide. Such laws should be consistent with international laws as well as any laws and protocols that may apply to in-space activity. A space community should have a fair and just governance structure that regularly reviews recommendations and grievances and attempts to adjust internal laws to best serve the population and to keep the people safe and healthy.

The final aim of a community beyond Earth is to create a permanent society. People moving beyond Earth will be able to organize themselves in groups, to create a social circle, have a career and a family. These

are indicators of the emergence of a society, they are not defined requirements per se. A society encompasses so much more than these examples, but they are a starting point to evaluate whether or not a community is forming in these habitats.

### "...outside the atmosphere of our home planet."

A community beyond Earth can be located anywhere beyond Earth's atmosphere. As previously mentioned, some actors are looking into establishing cities on Mars or the Moon, but it is also possible to envision a settlement being built at the L4 and L5 Lagrange Points where no active orbital station-keeping would be required. Eventually, communities in space will fill the solar system and beyond.



## CONCLUSION

Beyond Earth's choice of terminology and definition of a community beyond Earth is intentionally broad enough to capture the range of potential communities while specifying the essence of what will enable permanent human expansion beyond Earth. It also reveals a number of areas requiring further research and study - areas that will be discussed in further papers.

It is recognized that there may be groups of people living in space who do not meet the Beyond Earth definition in full, particularly in terms of economic vibrancy and self governance. With this definition, Beyond Earth is attempting to delineate the off world societies which are of the most interest -

those which will be needed to truly establish and grow permanent human presence off our home planet.

As Buzz Aldrin said: "The challenge ahead is not only daunting; it is monumental and historic. And it is time to roll up our sleeves and get to work." [10] The high frontier beckons us, as it always has, with endless opportunity that humanity hopes to leverage into immeasurable prosperity.

It is, however, only a starting point. The definition may evolve over time and Beyond Earth welcomes feedback. But, for now, this definition provides the framework to define the key metrics by which humanity will gauge its progress on establishing itself as a spacefaring, multiplanetary species.

## NOTES

- [1] The Beyond Earth Institute (2020) Policy Recommendations to Accelerate the Establishment of Communities in Space. Available at: <https://beyondearth.org/wp-content/uploads/2020/06/BE-Paper-Designed-Final.pdf>.
- [2] Brown, G. E. (1988) H.R.4218 - Space Settlement Act of 1988. Available at: <https://www.congress.gov/bill/100th-congress/house-bill/4218/all-info>
- [3] Cruz, T. (2016) S.3346 - National Aeronautics and Space Administration Transition Authorization Act of 2016. Available at: <https://www.congress.gov/bill/114th-congress/senate-bill/3346>.
- [4] Rohrabacher, D. (2016) H.R.4752 - Space Exploration, Development, and Settlement Act of 2016. Available at: <https://www.congress.gov/bill/114th-congress/house-bill/4752>.
- [5] Woerner, J. (2016) Moon Village: A vision for global cooperation and Space 4.0, European Space Agency. Available at: [https://www.esa.int/About\\_Us/Ministerial\\_Council\\_2016/Moon\\_Village#:~:text=Its%20mission%20is%20to%20shape,of%20Europe%20and%20the%20world](https://www.esa.int/About_Us/Ministerial_Council_2016/Moon_Village#:~:text=Its%20mission%20is%20to%20shape,of%20Europe%20and%20the%20world).
- [6] Drake, N. (2017) 'Elon Musk: In Seven Years, SpaceX Could Land Humans on Mars', National Geographic, 29 September. Available at: <https://www.nationalgeographic.com/news/2017/09/elon-musk-spacex-mars-moon-bfr-rocket-s-space-science/>.
- [7] Youn, S. and Theodorou, C. (2019) 'Blue Origin, Jeff Bezos unveils plans for space colonization', ABC News, 10 May. Available at: <https://abcnews.go.com/Business/blue-origin-jeff-bezos-unveils-lunar-lander-mission/story?id=62941981>
- [8] The Moon Village Association (no date) Moon Village Implementation, The Moon Village Association. Available at: <https://moonvillageassociation.org/about/moon-village-implementation/>.
- [9] Open Lunar Foundation (no date) Open Lunar Foundation - Building a Common Foundation. Available at: <https://www.openlunar.org/organisation>.
- [10] Planetary Echoes (2018) Exploring the Implications of Human Settlement in Outer Space. Edited by L. Feireiss and M. Najjar. Spector Books.

## AUTHORS:

**Tom Marotta**, Advisor for Industry Affairs and Outreach at the Office of Commercial Space Transportation, Beyond Earth Co-founder  
**Tony DeTora**, Former Senior Staff to Committee on Science and Technology U.S. House of Representatives, Beyond Earth Co-founder  
**Heloise Vertadier**, PhD Candidate at University of Otago, New Zealand  
**Steve Wolfe**, Deputy Executive Director, SpaceCom, Beyond Earth Co-founder