



Cislunar Space Development Strategy





Our Vision for Cislunar Space

The National Space Society (NSS) looks forward to the development of cislunar space to improve the lives of everyone on Earth. Economic development in cislunar space, which ranges from the top of the Earth's atmosphere to lunar orbit and the Moon's surface, is the next logical step in our expansion into space. Developing this region promises to create a massive new economic market, and the scientific returns will allow us to better understand our place in the universe while at the same time helping us to save our planet. Human activity in the cislunar region will inspire new generations to focus on a bright future of limitless potential. Over the next ten years we will return to the Moon to stay, learn to utilize lunar resources to further the exploration and development of space, and take the first steps toward a thriving commercial economy in cislunar space. We believe this can be done cooperatively and inclusively while encouraging competition and free markets. We further believe this development can be done sustainably, conserving significant resources for future participants while protecting important space heritage sites, such as the Apollo landing zones, on the Moon.

Cislunar Space – Today

The launch and operation of thousands of orbiting satellites adds incredible value to our everyday lives, yet most people have little awareness of how deeply space impacts them. Mobile phone service, television broadcasts, and broadband data for businesses, governments, educational institutions, and national security all depend on satellites. Agriculture, oceanic navigation, weather prediction, resource conservation and management, the monitoring of rail and highway freight, detailed atmospheric analysis, global temperature tracking, and measurements of oceanic conditions all depend on orbital assets. Even something as basic as a banking transaction can depend on satellites, and, of course, GPS services are entirely space-based.

There is also increasing interest in returning to the Moon to stay with initiatives such as the U.S.-led Artemis program. Current efforts emphasize science and exploration, but the long-term utilization of lunar resources to build lunar settlements and continue onward to Mars is also urgently important. Present lunar activities are being driven primarily by the U.S., the European Union, China, Russia, and India, though there are dozens of newer spacefaring nations joining the effort through collaborative initiatives such as the Artemis Accords, which focus on the peaceful and potentially profitable efforts of all signatory nations. According to the Space Foundation's Space Report from the second quarter of 2023, global cislunar space activities resulted in approximately \$546 billion of economic activity in 2022, an increase of approximately nine percent over 2021. The cislunar space economy is expected to surpass \$1 trillion by 2040 as the dramatic growth of orbital assets and services continues to expand and competition increases. Examples include global low-latency broadband connectivity like SpaceX's Starlink, global mobile communications to existing smartphones through companies like Omnispace and AST, manufacturing in low-Earth orbit commercial stations, and more accurate local weather predictions.

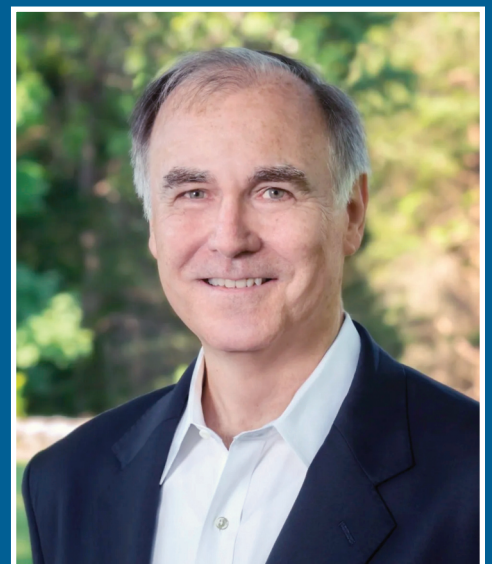


With a radius of about 1,080 miles (1,740 kilometers), the Moon is less than a third of the width of Earth and an average of 238,855 miles (384,400 kilometers) away.

Born in the year of Sputnik, I have seen Earth orbit developed to host critical satellite services for a global market projected to soon represent a trillion-dollar industry. With that great foundation, our next stepping stone into the cosmos is to develop and settle cislunar space. It is time we look outward, learn new ways to work together, and find new ways to build space infrastructure sustainably. The frontier will be fraught with dangers, and the adventure arduous, but limitless opportunity and prosperity for all is worth the sweat and sacrifice for better worlds tomorrow.

Hoyt Davidson

Cislunar Space Development Lead
NSS Executive Vice President
Founder and Managing Partner of Near Earth, LLC





Cislunar Space – Tomorrow

Current uses of cislunar space are primarily limited to Earth orbit and are almost entirely for the benefit of governments, militaries, businesses, and individuals concerned with activities on Earth. These applications of space are driven by well established economic and governmental forces and need little support from the NSS. Instead, we focus on the next phase of space development—cislunar space between Earth and the Moon, including lunar orbit and the surface of the Moon. Other areas of importance include the relatively stable orbits associated with the five Earth-Moon Lagrange points.

We have long advocated for the creation and deployment of new types of space systems and infrastructure in these regions for a variety of new applications and purposes, including:

- Space solar power (see our space solar power strategy) to help solve the world's growing energy needs while addressing climate dangers.
- Refueling and repairing existing satellites in Earth orbit to extend their useful lives, repositioning them to new or more viable orbits via space tugs, and end-of-life de-orbiting or active remediation services to reduce space debris.
- Assembling large structures and systems in space such as space solar power facilities, mega-sized telescopes for astronomy, remote sensing or communications arrays, space manufacturing facilities, satellite servicing or assembly facilities, space data centers, and new space stations for research or tourism.
- Robotic or human-tended orbital manufacturing facilities to produce valuable products that are best (or exclusively) manufactured in space because of the presence of microgravity, a hard vacuum, the abundance of cheap solar power, or because they are dangerous to us or our environment if produced on Earth. Examples include artificially-grown human organs, stem cell applications, certain pharmaceuticals, protein crystals, large semiconductor wafers, high-quality fiber optics, and new varieties of crops with superior resistance to environmental factors.

- Research and development facilities that will help us to better understand the long-term effects of fractional gravity on the human body from zero-g to one-g, including new rotating artificial gravity space stations in orbit as well as facilities on the lunar surface.
- Fuel depots, space commodities reserves, and a new commodities exchange market for the storage and sale of important commodities in space to support and accelerate the development of cislunar markets and additional infrastructure. These commodities would be stored at various useful locations such as Earth orbit, the Earth-Moon Lagrange points, lunar orbit, the lunar south pole, and other strategic lunar locations, and would include volatiles like water and oxygen, as well as glass and metals.

- Resource extraction and processing facilities on the Moon for lunar regolith and ice, and potentially in Earth or lunar orbit, to process materials from captured and relocated asteroids. These materials could be used in situ to support space stations, outposts, and settlements, or used to support ISAM activities or fuel depots and commodity reserves (see above). In the longer term, resources obtained from the Moon and asteroids could fuel exploratory voyages to Mars and beyond.
- Space adventure and tourism facilities so that people from an ever-increasing variety of nations and backgrounds will have a chance to experience space relatively affordably.



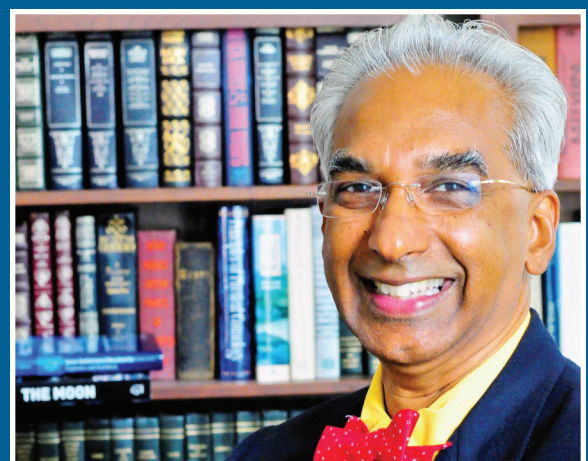
The development and deployment of large-scale cislunar projects like zero-carbon-footprint green energy from orbiting space solar power complexes will benefit everyone on Earth.

Credit: Aldo Spadoni

The NSS Cislunar Development Strategy offers a thoughtful and sturdy framework that will allow humanity to survive and thrive on the Moon. The strategy paves the way for a collective, glorious future for all humanity on Earth, on the Moon, and beyond.

Madhu Thangavelu

NSS VP of NSS-India Relationships
Co-Author of *The Moon: Resources, Future Development, and Settlement*



The Cislunar Challenge

This cislunar vision will not be easily achieved and will be take generations of hard work. However, it will be built upon known technologies while continuing to benefit from advances in reusable rockets, robotics, artificial intelligence, augmented reality, telepresence, additive manufacturing, genetic engineering, advanced in-space propulsion systems, and more. Underpinning our progress toward this cislunar vision are financial resources, new business models, and political will. In the absence of existing markets beyond Earth orbit (LEO and GEO), Earth's major governments will need to support and subsidize early developments such as initial anchor tenants in space, for example. This is strongly related to past government support for the development of new markets and regions on Earth, including exploration, shipping, railroads, and civil aviation. The key will be finding a healthy balance of government support and commercial investment so that the former can be minimized, and eventually ended. This would result in a self-sustaining economic model with government participation levels resembling more traditional Earth-based models with regard to public benefits, economic stimulus, and regulation.

Another challenge is the fostering of broad, inclusive, and peaceful participation among all nations and people with a healthy level of free and fair economic competition while avoiding armed conflict. When new regions and markets have been developed in the past, they were generally controlled by a single nation. While the U.S. hopes to maintain a leadership position in cislunar space, no one nation will control it, as specified in the Outer Space Treaty. We must innovate new cooperative and multi-national governance models to not only share the financial burdens and rewards of developing cislunar space, but also to establish the standards, procedures, and regulations for sustainable and peaceful coexistence and mutual benefit. More specifically, we need to quickly develop fair and transparent procedures to reduce the risk of a "land rush" associated with the peaks of eternal light and nearby permanently shadowed regions at the lunar poles along with other limited lunar resources. We must advocate for policies that conserve and set aside

substantial resources in such places as the lunar surface so that nations and other entities not yet prepared to fully participate in cislunar development can benefit over time. Lastly, we must protect lunar space heritage sites, such as the Apollo landing sites and similar areas, regardless of what lunar governance framework is adopted, and be consistent with the principles laid out in the Artemis Accords.

NSS Support for Cislunar Development

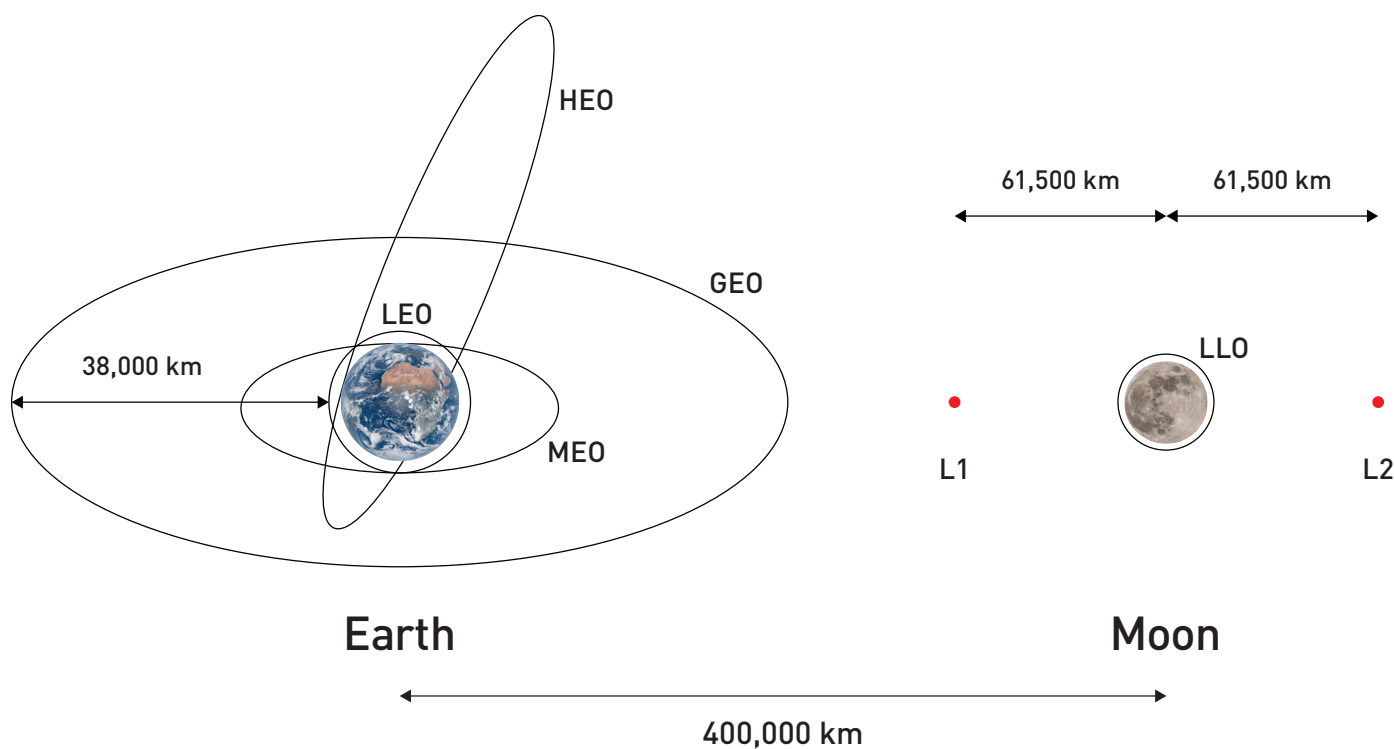
The NSS works tirelessly to support cislunar development. While this is a long-term goal, there are critical steps to be taken in the next five to 10 years.



Space agriculture is an important aspect of settlement, and research aboard the ISS is proceeding today.

Credit: NSS/Sam Clark

Map of Cislunar Space



LEO = Low Earth Orbit | MEO = Medium Earth Orbit | HEO = High Earth Orbit
 GEO = Geosynchronous Orbit | LLO = Low Lunar Orbit

Credit: NASA

We are witnessing the dawn of a new space age that will finally make traveling into space an affordable and profitable exercise—not just in monetary terms, but also in the full realization of the human spirit. Countless entities both inside national governments and in boardrooms—and with the advent of new technologies, even in university labs and residential garages—are taking aim at space, each according to their strengths and abilities. We will soon see a zone of convergence in which these parties will both compete and cooperate to regularize a human presence in space, with benefits for all of us. These benefits range from better agricultural practices that will feed additional billions, to limitless clean energy, to the expansion of human communities beyond Earth.

Buzz Aldrin

NSS Board of Governors | From his introduction to the book, *Space 2.0: How Private Spaceflight, A Resurgent NASA, and International Partners are Creating a New Space Age* by Rod Pyle



MOVING FORWARD

Current NSS Cislunar Space Development Goals

Business

Support cislunar market development and entrepreneurship.

Through its political advocacy, the NSS has been a reliable champion for government policies aiming to increase private sector space participation and reduce or streamline harmful regulations. The NSS also uses its various media resources to visualize, describe, and support the creation of cislunar markets and to encourage entrepreneurs working to develop such markets. We also run the annual Martine Rothblatt Space Settlement in Our Lifetime Business Plan Competition, which encourages young entrepreneurs to develop businesses that support Dr. Rothblatt's vision of space settlement, including cislunar space development. The prize is awarded at the NSS's annual International Space Development Conference® (ISDC®).

Legislative

Strengthen the U.S.'s approach to cislunar development by moving NASA from a central-planning, government dominated space program to a new paradigm based on public-private partnerships that will lead to new industries in space.

Past efforts have included support for NASA's first public private partnerships (PPPs) and a greater reliance on Other Transactions Authority (OTAs), like Space Act Agreements. These efforts have helped the U.S. to recover its lead in launch and human spaceflight and continue to leverage the innovative power of entrepreneurship and competition to better utilize scarce government funding for space development. Currently, through the Alliance for Space Development (ASD), the NSS has worked with other 501(c)(3) groups to permanently enhance NASA's charter to include the enabling of space development and settlement. On the international stage, we are advocating for the inclusion of space development, particularly cislunar space, as an 18th UN Sustainable Development Goal.

Legislative

Help create space development-enabling regulations and supportive legislation for cislunar space development, both nationally and internationally.

Through its Policy Committee, the NSS supports and affects domestic policy efforts and recently managed to extend the learning period on commercial spaceflight before the setting of U.S. regulatory standards. We also worked with our partners at the ASD to develop a new Space Industrialization Act that outlines key policies necessary to create a flourishing cislunar economy. Through its International Committee, the NSS supports international efforts, including recent interpretations of the Outer Space Treaty (OST) to allow for the ownership of space resources extracted by governments or private parties. We are currently working to define "shared benefits" under the OST in a way that will support robust development of cislunar space rather than discouraging future investments and efforts. The NSS also supports reserves of cislunar resources for the benefit of future international participants and generations, and the protection of lunar space heritage sites from harmful interference.

Workforce Development

Promote workforce development through NSS education initiatives that develop interests and skills relevant to a future career in space from grade school through college.

The NSS runs two highly successful space development-focused competitions that have a total global student participation of more than 25,000 annually. A \$1 million grant from the Club for the Future has allowed us to increase workforce development activities significantly. Examples include the Space Settlement Design Competitions, the Expanding Frontiers Astropreneurship Program, and the Young Professionals virtual community program.

Thought Leadership

Promote effective governance for cislunar activities to improve the chances for success in cislunar economic development.

NSS members have long been engaged in multiple groups and initiatives focused on the development of cislunar governance models. Examples include the Moon Village Association, the Lunar Development Cooperative, and the Hague Space Resources Governance Working Group. The NSS has also been a vocal supporter of the Artemis Accords as an important first step in setting internationally accepted standards and norms for behavior in cislunar space, and has played a critical role in encouraging some of the current member nations to sign on to the accords.

Thought Leadership

Creation and maintenance of a roadmap for cislunar development consistent with the long-standing *National Space Society Roadmap to Space Settlement*, now in its third edition.

Every five years, the NSS publishes a revised and updated version of the *National Space Society Roadmap to Space Settlement*. This living document lays out the steps that must be accomplished to develop and create sustainable communities in space. Notably, the *Roadmap* contains sections that specifically address cislunar space. In addition to being an educational resource for the general public and broader space community, the *Roadmap to Space Settlement* helps entrepreneurs decide on their area of market focus, the external developments that will be needed to support and grow their businesses, and the potential risks of such developments. It further serves as a tool for government officials and private investors.

Thought Leadership

Conduct successful in-person conferences to support cislunar development.

Each year, the NSS provides a forum for leading academic researchers and entrepreneurs at its International Space Development Conference (ISDC) to share and showcase new and important research and developments. The NSS also hosts an invitation-only Space Settlement Summit (SSS) focused on high-level topics involving space settlement, including critical cislunar development topics like ISAM, space resource utilization, and steps toward the creation of space settlements.



Thought Leadership

Educate the space-interested public about cislunar development.

The NSS utilizes its quarterly print and digital publication, *Ad Astra* magazine, its weekly newsletter, *Downlink*, its affiliated podcasts, virtual forums, websites, press releases, and social media platforms to provide the space community and general public insights on new innovations supporting the development of cislunar space. It also publishes the online and publicly-available *Space Settlement Journal*.

Thought Leadership

Recognize outstanding achievements in cislunar development.

The NSS gives out annual and bi-annual awards for leading contributions to space development. These include The Robert A. Heinlein Memorial Award for lifetime contributions to the creation of a free spacefaring civilization, the Wernher von Braun Memorial Award for the greatest space team effort of that year, and the Space Pioneer Awards in recognition of significant accomplishments in opening the space frontier. Past recipients have included many world-famous leaders and visionaries in the space sector.



To accelerate the development of cislunar space, the NSS plans to continue the activities above, and to set the following major new goals:

New NSS Cislunar Space Development Goals

Legislative

Create a legal foundation for space development allowing for the mining, utilization, and sale of space derived resources (dual strategy goal – also supports the Space Settlements Strategy).

The NSS works with the ASD to support legislative and administrative actions, including those of NASA, that support this goal. The NSS will also continue to create policy papers on this topic, and develop support for property rights in space via *Ad Astra* magazine, the ISDC conference, and opinion articles in wider space and popular media through partnerships such as our output arrangement with Space.com.

Legislative

Support international cooperation for lunar exploration and development via the Artemis Accords.

To be accomplished via U.S. and international advocacy and the engagement of NSS International Chapters.

Education

Promote workforce development by filling the STEM pipeline with students enthusiastic to work on cislunar development projects (dual strategy goal – also supports the Space Settlements Development Strategy).

The NSS continues to be the world leader in space settlement contests and is working toward being the world leader in online lunar development and settlement education via various initiatives including the Rothblatt Space Settlement in Our Lifetime business plan contest.

Thought Leadership

Develop and advocate for benefit sharing that enables cislunar development, especially lunar and asteroid mining.

The NSS pursues thought leadership through articles in *Ad Astra* magazine, videos, the creation of inspiring new artwork, opinion articles, ISDC speaker panels, popular lectures, publishing books through the NSS Books imprint, and workshops focusing on these topics.

Science / Technology

Facilitate space community standards to enhance the efficiency of user-friendly communications.

The NSS is working to create a lexicon of common vocabulary of space terms to support cislunar space development.

Key Efforts External to the NSS

Alliance for Space Development (ASD)

Non-profits, including the NSS, formed the multi-member non-profit Alliance for Space Development to support space development and settlement.

Space Frontier Foundation (SFF)

The Space Frontier Foundation works with the ASD and NSS to support cislunar space development.

Students for the Exploration and Development of Space (SEDS)

The Students for the Exploration and Development of Space works closely with the NSS to further our common vision.

United States Space Force (USSF)

The USSF has an interest in topics such as cislunar in-space fuel depots that are potentially multi-use between the military, NASA, and commercial firms. All parties have an interest in peaceful cislunar development.

For All Moonkind

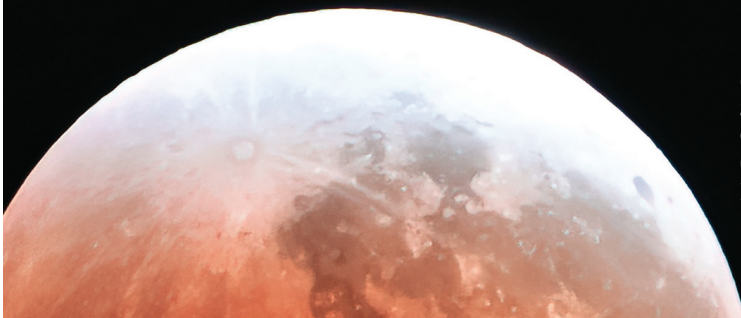
Focused on the protection of humanity's space heritage.

SpaceX, Blue Origin, iSpace, & Many Others

Commercial firms are the prime movers of space technology today.

National Aeronautics & Space Administration (NASA)

Some of NASA's current initiatives, notably the Artemis program, Commercial Lunar Payload Services (CLPS), and Commercial LEO Destinations, work to enable cislunar development (Note: this is not yet an explicit goal at NASA, something the NSS is working hard to resolve).



Examples of Initiatives for 2031: Five-Year Goals

1

Fill the STEM Pipeline

STEM-oriented articles in the NSS's popular magazine *Ad Astra* (available to all members and to the general public through retail channels), and the publication of additional books, graphic novels, and/or an online series of video clips focused on cislunar development as informed by the NSS *Space Settlement Roadmap* and targeted at educating children and young adults.

2

Remain a Thought Leader for Cislunar Space Development

Sponsor and contribute to at least one "deep dive" report annually on a cislunar development topic (potentially with an ASD partner via think tanks such as TechFreedom).

3

Thought Leadership via Conferences Development

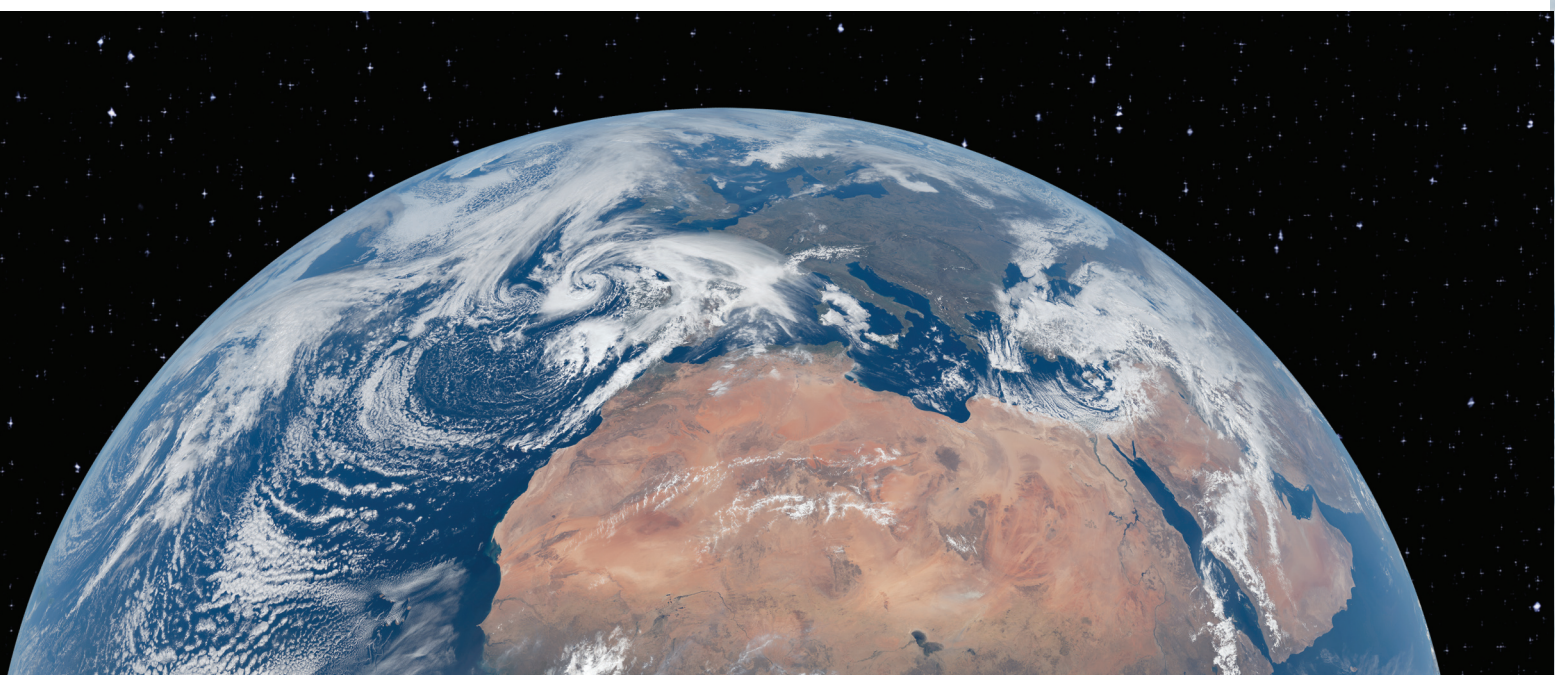
Initiate a session for the ISDC conference focused on cislunar development.

Launch an annual NSS-hosted Cislunar Markets Conference focused on cislunar companies and investors.

4

Recognize Outstanding Achievements in Cislunar Space Initiatives

Add a new annual NSS award for the company or investment group that has most advanced the development of cislunar markets in that year.



Examples of Initiatives for 2036: Ten-Year Goals

1

Support Cislunar Market Development and Entrepreneurship

Develop an assumptions-driven interactive model for dynamic predictions of economics, timing, and market risks for development of new markets in cislunar space.

Achieve establishment, via legislation, of a government-enabled cislunar space commodities reserve and exchange.

2

Promote Effective Governance for Cislunar Activities

Participate as a thought leader and advocate leading to the adoption of a cislunar governance charter or the creation of a cislunar governance entity that includes participation by a majority of spacefaring nations, numerous cislunar space companies, and other institutions and individuals.



Cislunar Development Milestones for 2031: Five-Year Goals

Numbers refer to *NSS Roadmap to Space Settlement*, 3rd edition

Milestone 1

Dramatically Lower Launch Costs to Orbit

Example: The advent of the first fully reusable launch vehicle (the Falcon 9 is not fully reusable).

Milestone 2

Continuous Human Occupancy in Low-Earth Orbit

Example: The exclusively-commercial operation of a LEO space station.

Milestone 3

Development of the Space Tourism Industry

Example: The advent of low-Earth orbit tourism as a self-sustaining business.

Milestone 4

Establishment of In-Space Commerce by Private Companies

Example: First sale of a product from one on-orbit commercial enterprise to another on-orbit commercial or government habitat or enterprise.

Milestone 13

Use of Space Technology and Resources On and For Earth

Example: The first profitable manufacturing of a product in space for sale on Earth.

Milestone 18

Robotic Confirmation of Lunar Resources

Example: The completion of a detailed lunar surface survey via satellites and rovers to support future resource exploitation.



Cislunar Development Milestones for 2036: Ten-Year Goals

Numbers refer to *NSS Roadmap to Space Settlement*, 3rd edition

Milestone 5

Crew Habitats for Use Beyond Low Earth Orbit

Example: Operation of an Earth-Moon Cycler.

Milestone 6

Use of Rotational Artificial Gravity for Habitats and Industry

Example: Operation of a commercial space station with some degree of artificial gravity for research and tourism.

Milestone 7

Legal Protection of Property and Other Rights

Example: Operation of the first production-scale lunar ISRU (in situ resource utilization) facility and commercial exchange of resulting products and resources.

Milestone 14

An Integrated Cislunar Space Transportation and Logistics System

Example: Commercial operation of a fuel depot in cislunar space.

Milestone 15

Robust Space Infrastructure for Human and Robotic Operations

Examples: Commercial operation of a fuel depot in cislunar space and a cislunar space commodities reserve and exchange in operation.

Milestone 19

A Lunar Research and Development Facility

Example: Operation of a permanently crewed, mixed-use facility on the lunar surface, open to governments, commercial enterprises, and educational institutions.

Your participation in these initiatives will help the NSS to bring the benefits of cislunar space development to Earth and to educate the general public, industry, and governments about the benefits of both the robotic and human exploration and development of cislunar space.

For more information, visit [NSS.org](https://www.nss.org)



MOVING FORWARD

How Your Support Can Advance Cislunar Development

\$10,000

1. Funds the research and drafting of a “deep dive” report on an important cislunar development topic.
2. Makes you a Bronze Sponsor of a Cislunar Markets Conference track (e.g., ISAM) bringing together exciting new space companies with leading venture and private equity investors.
3. Supports the cost of creating and administering a first year, new award for cislunar space companies or space investment groups developing the cislunar marketplace.
4. Funds two NSS interns to support cislunar space development legislative initiatives as part of the NSS policy team.
5. Funds a publishable paper on an aspect of cislunar space development.

\$100,000

1. Funds the creation of an assumptions-driven model for cislunar space development.
2. Funds, as leading sponsor, the new Cislunar Markets Conference.
3. Funds a significant research project demonstrating that cislunar economic development will enable lower costs and faster results in establishing a human presence on Mars.

\$1,000,000

1. Funds a long-term global effort to design and implement a new cislunar governance framework and/or entity.
2. Funds a significant research project, likely through a university graduate school, that demonstrates how cislunar economic development will enable lower costs and faster results in the establishment of a human presence on Mars.

I believe that we must work toward additional homes for mankind, because a troubled world needs a refuge from destruction. The vehicles to get there are now being developed. What is needed is a population willing to support going there to stay. This population needs to be educated as to why space settlement is key to the future of civilization. The NSS is doing this education and merits our support.

Edwin Jones

NSS Donor



For more information on becoming a donor, visit <https://nss.org/donate>

