



# The 15 Barriers to Space Settlement

These are the major targets for change (obstacles to be overcome) that the National Space Society believes must be accomplished to realize our Vision, and, therefore, constitute our Mission.

## 1. No Long Term Government Funding Mechanism

Especially in the United States, industry is prevented from obtaining investors for future private space transportation systems because the near-term customer, U.S. government agencies, are not allowed to make orders for space launches as airlines can for commercial aircraft. While some progress has been made with DoD's handling of the EELV program, NASA thus far has not been allowed (or encouraged) to follow such a practice for future reusable launch vehicles.

## 2. Lack of Incentives for Private Capital Investment

In addition to the long-term government-funding obstacle, there are few financial incentives for private investors to provide the huge sums of money required to fund the capital costs of space transportation systems and facilities. If the world governments want private industry to take over funding of space development, some form of short-term transition incentive program must be created to attract private investors.

## 3. Lack of Affordable Space Transportation to Space

Despite the dreams, plans, and claims of the past 30 years, launch vehicle developers have not found a way out of the launch vehicle "Catch 22" trap: (1) individual launch costs can only be greatly reduced by spreading the huge cost of launch vehicle development over a large number of flights; (2) the market to demand a large number of flights can only exist once individual launch costs are greatly reduced.

## 4. Lack of Sovereignty

Both the Outer Space Treaty of 1967 and the Moon Treaty of 1979 forbid nations from claiming any part of the Moon or other celestial body. Article 11, Paragraph 2 states "The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means." This has left a void of any legal system that would enable private

entrepreneurs and companies to plan and execute commercial space activities on the Moon and other celestial bodies.

## 5. Liability Insurance Costs and Conditions

Liability insurance premiums are one of the largest cost components of an individual launch vehicle mission, averaging about ten percent of the total cost. Since the reason for this is primarily due to poor launch vehicle reliability, improving reliability should decrease insurance premiums; however, the need for such large liability coverage needs to be questioned. Most, if not all, launch accidents happen in restricted zones and yield little if any collateral damage, yet government requirements for liability insurance are based on worst-case scenarios that have not happened in the entire history of rocketry. The liability conditions specified in the Outer Space Treaty also cause problems for private launch companies launching rockets made by companies from other nations.

## 6. Proposed Passenger Restrictions

Government agencies currently considering establishing limits on who can and cannot go into outer space, could adversely affect future space tourism markets, if such limits are much more detailed than the general guidelines provided to the airline industry.

## 7. Lack of Public Interest

The general public is rapidly losing interest in space development: (1) because the pace of space development is frustratingly slow, especially when compared to the incredibly fast pace of the home computer revolution; (2) because NASA is forced by taxpayer watchdogs to portray human space activities in the most boring manner; (3) because the real and exaggerated perceived risks of outer space frightens them; and (4) because little activity, planning, and public discussion occurs regarding private trips into space.

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Please visit the  
NSS Roadmap Web Site at:  
<http://www.nss.org/community/roadmap/>

## **8. Moon Treaty and “Common Heritage” Principles**

The Moon Treaty, passed by the United Nations in 1979, yet ratified by only four nations (none of which were space-faring at the time) strictly forbids the private ownership of any part of the Moon or other celestial body. Article 11; Paragraph 1 states “The moon and its natural resources are the common heritage of mankind.” Article 11, Paragraph 3 states “Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person.” Despite the lack of ratification, no space-faring nation has ever publicly challenged this treaty.

## **9. Perceived Risk of Space Activities**

In addition to the real measurable risks associated with launch vehicle reliability, both the private and public sector have been led to believe that outer space itself is inherently dangerous, because of (1) the “effects of weightlessness,” an artificial risk created by government space agencies’ preoccupation with micro-gravity, an environment not conducive to human life; and (2) space radiation, a true hazard whose risk has been temporarily heightened by the short-term need to make spacecraft walls thin to reduce launch weight.

## **10. No Closed-loop Life Support System**

Having to launch everything necessary for life support for any extended period of time, long duration space travel (such as missions to Mars), and space settlements will be cost prohibitive. Budget cuts to the International Space Station program have severely delayed if not canceled research and experimentation of components of closed-loop life support systems that are necessary to reduce the dependency of space settlements on support launched from Earth. Being able to reuse human wastes will also avoid space and planetary environmental pollution issues.

## **11. U.S. National Space Policy Limitations**

The U.S. National Space Policy set in 1996 effectively forbids the U.S. government not only from funding any human mission beyond Earth orbit, but also from funding any research and development that might lead to future human missions beyond Earth orbit.

## **12. Launch Vehicle Reliability**

Expendable launch vehicle reliability is averaging about 0.90 (one catastrophic failure every 10 flights); reusable launch vehicle reliability will need to average about 0.99 (one catastrophic failure every 100 flights). Space tourism, the greatest potential market for large numbers of launch vehicle flights, cannot exist until reliability is increased by at least a factor of 100 over today’s average.

## **13. Government Obstacles to Commercialization**

Commercial space activities offer the best near-term solution to provide a market for affordable launch vehicles, yet there exists both real and perceived obstacles from many governments. In the United States NASA is repeatedly accused of not understanding the needs of private industry and therefore not correctly implementing space commercialization laws passed by Congress. The FAA and Department of Commerce have only recently begun revising and creating regulations to encourage and not hinder commercial space activities.

## **14. Lack of Adequate Funding for Asteroid/Comet Research**

The lack of adequate funding from the U.S. and other government entities is severely hindering the advancement of Near Earth Object (NEO) and other asteroid and comet research, and is thwarting the development and testing of planetary defense measures against the periodic collision of these objects with Earth. This lack of adequate funding is also delaying the research and development of technologies for asteroid utilization and settlement.

## **15. Lack of Space Resource Utilization Demonstrations**

The richest source of mineral resources lies outside the Earth, throughout the asteroids, comets, moons and planets of the Solar System. The cleanest and most readily accessible source of energy to support industrial civilization is the unfiltered sunlight available in space. Humanity must tap these resources to support growth and improvement in the human condition here on Earth (NSS Rationale III.C.1). Since private sector energy and mining interests will probably not initially invest in such technically risky endeavors, government must conduct the necessary pilot programs to demonstrate the technical, environmental and financial feasibility of extracting energy and material resources from space.