CULTURE KEYS: SPACE EXPLORATION

AMERICAN FRONTIER, in United States history, refers to the **advancing border** that marked **those lands that had been settled by Europeans**. It is characterized by the **westward movement** of European settlers from the **original Atlantic coast** (**17th century**) to the **Far West** (**19th century**), known as American territorial expansion.

The historian **Frederick Jackson Turner** (1861-1932) noted that, "especially in the United States," the term referred to that "*belt of territory sparsely occupied by Indian traders, hunters, miners, ranchmen, backwoodsmen and adventurers of all sorts*" which formed "*the temporary boundary of an expanding society at the edge of substantially free lands*." Turner held that the **American character** was decisively **shaped** by **conditions** on the **frontier**, in particular the **abundance of free land**, the settling of which engendered such traits as **self-reliance**, **individualism**, **inventiveness**, **restless energy**, **mobility**, **materialism**, and **optimism**.

Kennedy's New Frontier

After squeaking by Richard Nixon in the election of 1960, John F. Kennedy set forth new challenges for the United States. **In his inauguration speech**, he challenged his fellow Americans to **"Ask not what your country can do for you — ask what you can do for your country**."

Earth's place in the universe was seen from a dramatic new perspective when American astronauts reached the Moon in the late 1960s.

Proclaiming that the "torch has been passed to a new generation of Americans," Kennedy, young and good-looking, boldly and proudly assumed office with a bravado. Many Americans responded to his call by joining the newly formed Peace Corps or volunteering in America to work toward social justice. The nation was united, positive, and forward-looking. **No frontier was too distant**.

The newest frontier was space. In **1957**, the Soviet Union shocked Americans by launching *Sputnik*, the **first satellite** to be placed in orbit. Congress responded by creating the **National Aeronautics and Space Administration (NASA)** under President Eisenhower (1953-1961, Republican). When Kennedy took office, the United Space fell farther behind. The Soviets had already placed a dog in space, and in Kennedy's first year, Soviet cosmonaut **Yuri Gagarin** became the first human being to orbit the earth.

Kennedy challenged the American people and government to put a man on the moon by the end of the decade. Congress responded enthusiastically by appropriating billions of dollars for the effort. During Kennedy's administration **Alan Shepherd became the first American to enter space**, and **John Glenn became the first American to orbit the earth.** In 1969, many thought of President Kennedy's challenge when **Neil Armstrong became the first human being to set foot on the moon**.

Domestically, Kennedy continued in the tradition of liberal Democrats Roosevelt and Truman to some extent. He signed legislation raising the minimum wage and increasing Social Security benefits. He raised money for research into mental illness and allocated funds to develop impoverished rural areas. He showed approval for the civil rights movement by supporting James Meredith's attempt to enroll at the University of Mississippi.

In his abbreviated Presidency, Kennedy failed to accomplish all he wanted domestically. But the ideas and proposals he supported survived his assassination. Medicare, federal support for education, and wilderness protection all became part of Lyndon Johnson's Great Society.

Lee Harvey Oswald assassinated Kennedy in November, 1963. His death provided a popular mandate for these important programs. In the tumultuous years that followed, many yearned for the happy Kennedy years.

http://www.ushistory.org/us/56b.asp (abridged)

NASA /ˈnæsə/: In 1958, the U.S. Congress passed legislation establishing the **National Aeronautics and Space Administration** (NASA), a **civilian** agency responsible for coordinating America's activities in space. NASA has since sponsored **space expeditions**, both human and mechanical, that have yielded **vital information** about the solar system and universe. It has also launched numerous earth-orbiting satellites that have been instrumental in everything from weather forecasting to navigation to global communications.

NASA was **created** in **response** to the Soviet Union's October 4, **1957** launch of its first satellite, **Sputnik I**. The Sputnik launch **caught Americans by surprise** and **sparked fears** that the **Soviets** might also be capable of **sending missiles** with **nuclear weapons** from Europe to America. The United States prided itself on being at the forefront of technology, and, embarrassed, immediately began developing a response, signaling the **start of the U.S./Soviet space race**.

NASA **has continued** to make **great advances** in space exploration since the first moonwalk, including playing a major part in the construction of the **International Space Station (ISS)**. The agency has also **suffered tragic setbacks**, however, such as the disasters that killed the crews of the **Challenger** space shuttle in **1986** and the **Columbia** space shuttle in **2003**. In 2004, President George Bush challenged NASA to return to the moon by 2020 and establish "*an extended human presence*" there that could serve as a launching point for "*human missions to Mars and to worlds beyond.*"*From History.com*

SPACE EXPLORATION: A TIMELINE

- **1947:** first animals are launched into space
- **1957: Sputnik 1** is the first satellite in space
- **1961: Gagarin** is the first man in space
- **1963: Kennedy** launches America's Moon program, promising success before the end of the decade
- **1963:** Soviet cosmonaut **Valentina Tereshkova** becomes the first woman in space during the three-day Vostok 6 flight.
- **1969: on July 20th, Armstrong and Aldrin** land on the Moon, taking "one small step for man, but one giant leap for humanity".
- **1970: Apollo 13** is nearly destroyed in an explosion, but returns safely to Earth.
- **1986: Space Shuttle Challenger** explodes shortly after launch, killing all 7 astronauts
- **2000:** In 2000 the first permanent crew moved into the International Space Station (ISS), where crews of astronauts have been living ever since. In partnership with the United States, Russia, Japan and Canada, Europe is sharing in the greatest international project of all time - the International Space Station. The ISS is a huge space station for research and space exploration that began construction in 1986, with the final major module arriving in 2010.
- **2001: Dennis Tito**, an American millionaire, is the first space tourist after buying a $20m ticket for a ride on a Russian Soyuz spacecraft.
- **2003: Columbia** disintegrates on returning to the Earth's atmosphere, killing 7 astronauts.
- **2004: SpaceShipOne** is the first ever privately funded manned space flight.
- **2011:** America's space shuttles, **Discovery and Endeavor**, make their final flights before retirement, leaving America with no working spacecraft.
- **2012**: on October 7th, SpaceX, a private company, sends an unmanned capsule with supplies to the International Space Station. It is the first commercial space mission and the first under contract with NASA.
- **2014:** Launched in 2004, it took European Space Agency's Rosetta probe ten years to reach Comet 67P/Churyumov–Gerasimenko. The World watched as the ESA team successfully oversaw a soft landing by their Philae lander, which conveyed valuable data from the Comet's surface.
- **2015**: NASA announces that liquid water has been found on Mars; SpaceX lands a Falcon 9 rocket, the first reusable rocket to successfully enter orbital space and return
- **2030:** The U.S. National Space Policy of 2010 set out goals for space exploration; to send humans to an asteroid by 2025 and to the planet Mars in the 2030s.

The Financial Times | By Peggy Hollinger and Clive Cookson in London | February 24, 2024

First commercial spacecraft lands on the Moon

A commercial space flight has successfully landed on the Moon for the first time, opening a new era of private lunar exploration.

After an eight-day flight, US-based Intuitive Machines' unmanned Odysseus lander touched down safely on the lunar surface on Thursday, an estimated 2km from its target, the Malapert A crater near the Moon's south pole, according to mission director and chief technology officer Tim Crain.

In a briefing on Friday night, Crain said the lander and the scientific experiments it was carrying for the US space agency Nasa were now transmitting data. […]

The landing marks the successful return of the US to lunar exploration for the first time in more than 50 years, after the Apollo programme ended in 1972. It is an important milestone in Nasa's plans to send humans to the lunar south pole in 2026, relying on private companies to help cut the costs of services such as transport, navigation and communications.

Bill Nelson, Nasa administrator, said: "The US has returned to the moon. Today for the first time…a commercial company, an American company has launched and led the voyage up there. This shows the power and promise of Nasa's commercial partnerships. What a triumph!"

Nasa has said the creation of a commercially viable lunar economy will be vital to its ambition for a permanent human base on the Moon and, eventually Mars.

Thomas Zurbuchen, professor of space science at ETH Zurich who ran Nasa's science missions until 2022, said the landing "changes the whole paradigm of planetary exploration. Until now everything has been done by governments. With companies we can do it a lot cheaper."

[…] Odysseus's safe landing was greeted with elation at Intuitive's mission control in Houston, Texas.

Nasa paid Intuitive $118mn to carry six scientific payloads, including instruments to observe space weather from the Moon and a radio beacon to aid navigation. The company was also carrying six commercial packages, including mini-sculptures by artist Jeff Koons, a camera to record the landing and a lunar archive.

The solar-powered lander will carry out experiments near the lunar south pole and is expected to operate for about 14 days in sunlight. It is the first of three Intuitive missions planned by Nasa in preparation for the agency's Artemis missions to the lunar south pole.

The region is rich in resources such as ice water, which could be broken down into hydrogen and oxygen to help sustain a permanent human presence on the Moon. India last year became the first country to land a spacecraft in the south pole region.

Intuitive's soft landing comes just over a year after the company floated on the market through a merger with a special purpose acquisition company.

Stephen Altemus, co-founder and chief executive, told the Financial Times the company aimed to eventually provide a range of lunar services from communications to navigation and even power generation. "We will have the most data about the moon, the most understanding," he said. "You take that first step and then a whole series of unpredicted and forecasted activities [follow] from that."

[…] A lunar landing attempt by Pittsburgh-based Astrobotic Technology failed last month when problems with the spacecraft's propulsion system resulted in a critical loss of fuel soon after its launch.

An unmanned Japanese rover touched down on the Moon in January but an upside-down landing made it difficult to generate solar power, curtailing its ability to explore the lunar surface.

The Financial Times | Stephen Bush | September 5 2023

The new scramble for space requires a fresh set of rules

In space, no one can hear your pleading about the value of soft power. Just ask Colombia. In 1976, the South American country hosted a meeting attended by Brazil, Ecuador, Uganda, Kenya, Indonesia and both Congos. The gathered nations declared that the stretch of geostationary orbit above them was not part of outer space, but belonged exclusively to their respective countries.

The Bogotá Declaration was a total failure. Although Colombia's territorial claim remains written into its constitution, the declaration never gained wider purchase, and the exploitation of 'their' real estate has continued.

The group of countries had a common diagnosis: that the laws governing space were drawn up to benefit the world's great powers, rather than all nations. And they were right, though that will be little comfort to them. Since the 1967 Outer Space Treaty, which states that any space exploration shall be carried out "in the interests of all countries", was first signed by the US, the Soviet Union and the UK, a country's ability to assert itself in space has always been inextricably bound up in its ability to exercise hard power on Earth. One good demonstration of that is the US unilaterally setting laws on matters where the 1967 treaty is silent or ambiguous, such as commercial activities like lunar and asteroid mining.

Last month's Chandrayaan-3 landing on the Moon was a significant moment because it provided a romantic illustration of something we already know: India is an ascendant power in the 21st century. But the moment was also significant for another reason: the country managed to reach the unexplored South Pole for reportedly as little as $74mn: a little more than Arsenal Football Club paid to secure the services of German footballer Kai Havertz. The low cost of this lunar mission is, in some ways, non-replicable for many other countries, and driven to some extent by knowhow acquired during India's 54-year-old space programme.

But is also part of a broader fall in the cost of rocketry, driven by private companies such as SpaceX. Some of India's success is a demonstration of its hard power. But the rest is that, thanks in part to Indian innovation, even diminishing world powers, such as the UK, may be able to afford their own lunar missions, as may private companies and individuals with much smaller fortunes than Elon Musk or Amazon founder Jeff Bezos, whose interest in colonising space goes back to his valedictory speech as a high school student.

The falling cost of rockets removes one of the barriers to establishing space settlements. An excellent new book, Kelly and Zach Weinersmith's A City on Mars, sets out persuasively and amusingly why you would have to be wildly optimistic or crushingly stupid to want to set up a space settlement any time soon. Unfortunately, a lot of us are one, the other, or both.

The history of great power competition suggests that countries do an awful lot of crushingly stupid things just in case it turns out they are missing a trick. It's possible that there are lunar resources yet undiscovered on the moon's South Pole: but it's equally possible that the moon's southern pole is as illusory as the dream of an "El Dorado" in the heart of Africa.

One consequence of the scramble for Africa was the displacement and murder of millions of Africans. Fortunately, there are no lunar people or Martians for us to dispossess. But another consequence of the scramble was that it caused direct conflict between Europe's established powers. The race for real, or perceived, advantage in space is already doing the same thing.

The switch in focus of India's space programme from domestic development to lunar missions and the ability to defend Indian assets in space is a response to China's testing of anti-satellite missions, while the United States' re-embrace of lunar missions is more about the certainty that China is heading to the Moon than the remote possibility there is something worth finding on the moon's South Pole.

The falling cost of rocketry means that, unlike during the cold war, space exploration is not going to be a game largely played by great powers. The 1967 treaty that underpins the sharing of space still assumes a world in which that activity is largely an affair for Americans, or for two now defunct empires: Britain's, and the USSR's. These days, the space race is led by the US and China.

"Nothing about the space environment so far appears to imbue the human heart with a desire for peace," the Weinersmiths warn. As the world prepares for a scramble for Mars, space exploration badly needs a new set of global rules.

Texte 15

AN ASTRONAUT'S VIEW ON PROTECTING THE EARTH

French astronaut Thomas Pesquet, who has recently become a UN Food and Agricultural Organization Goodwill Ambassador, spent six months aboard the International Space Station last year. Long periods with his feet off solid ground gave him a unique and privileged perspective on our planet. His Instagram account is bursting with beautiful images of "the blue ball we call home." But the beauty is tainted. Pesquet says that even from space the effects of climate change are visible, with glaciers visibly retreating, and a rise in extreme weather events. […]

"When you look at the Earth from the space station, he adds, it's absolutely magical. […] It is absolutely breathtaking the first time you see it. It's the most beautiful scenery you could possibly imagine.

When you're on the Earth, you feel that everything is vast, that everything is endless. You have a hard time understanding how limited we are, whereas, when you take a step back and you see the Earth in its entirety, you suddenly understand that we live in an oasis in the cosmos. All around us is nothing, no life, blackness, emptiness – apart from this blue ball with everything we need to sustain human life, and life in general, which is so fragile. It makes you want to cherish the Earth and protect it, particularly because, from space, you can see a lot of the consequences of human activities. The most visible effect is glaciers retreating together with extreme weather phenomena.

And we, up here, can do more than simply observe… First of all, as a space agency, we have satellites that can take precise measures.

Then, the way we deal with our limited resources on board the space station gives us techniques to recycle oxygen and water that could be applied on Earth.

It is all the more important for us to contribute to improving the Earth, as space travel has an impact on the environment. Even though it is negligible when compared to aviation, cars or other industries. We need activity in space to get satellite research done. This benefits the planet a lot. So space travel is a necessary evil.

Besides, if we set ourselves on the right path, there's nothing we cannot do. We built this unbelievable facility in space for good reasons. We're using it every day, in peaceful cooperation between countries that were not always friends. So if we can transfer that model to the way we deal with the environment on Earth, I think we'll get there.

We're creative enough, we have the technology and we have the will. So, I'm optimistic for the future. If we can make a space station fly, then we can save the planet."

Adapted from *CNN*
January 2022
(449 words)

The Financial Times | Anders Fogh Rasmussen | November 21 2022

Ukraine shows how space is now central to warfare

Russia's brutal invasion of Ukraine has made clear how vital space is to our security. In January, GPS images of Russian troops massing at Ukraine's borders signalled an imminent invasion. Throughout the war, satellite links have kept frontline troops connected with their commanders. Meanwhile, GPS-guided Himar rocket launchers have helped shift the balance of the war in Ukraine's favour, allowing them to pinpoint and destroy Russian ammunition dumps and artillery well behind enemy lines. This is the first major conflict where both sides have been heavily reliant on space-based capabilities. It will not be the last.

The importance of space during the war in Ukraine reflects how central activity in Earth's orbits has become to all our lives. In recent years, the US, Russia, China, and India, have significantly strengthened their space capabilities. In a time of heightened geopolitical tension, Europe must not be left behind.

This week European ministers meet in Paris to discuss the future of Europe's space programme. One conclusion is already clear — our continent's security and prosperity will increasingly rely on our ability to act in space. For this we need secure infrastructure, open and safe access, and sustainable human activity.

In Ukraine, Russia is increasingly targeting critical civilian infrastructure. Moscow has launched repeated missile attacks against the country's power plants and electricity grid. The aim is clear: to make life as hard as possible for civilians this winter. Russia has even targeted infrastructure outside Ukraine, allegedly sabotaging underwater pipelines carrying gas to Europe.

Moscow is making clear that it perceives critical infrastructure as a legitimate target in any future conflict. This includes assets in space. In the early days of the war, Russia launched cyber attacks on Ukraine's satellite communication systems. Last year it carried out anti-satellite tests in low-earth orbit, proving it has the capacity to conduct physical strikes in space if it chooses to do so. This threat was made explicit last month, when a senior Russian official told the UN that commercial satellites from the US and its allies could be "legitimate targets for retaliatory strikes".

Europe must be able to act autonomously in space. Last month, SpaceX owner Elon Musk tweeted a "peace plan" for Ukraine, and has also threatened to cut access to the company's Starlink satellites. This plan could have been taken straight from a Kremlin disinformation unit. It called for Kyiv to cede swaths of territory to Russia and commit to military neutrality. Musk's foray into geopolitics highlighted the dangers of space monopolies. Europe cannot allow its critical infrastructure to be subject to the whims or tweets of billionaires.

The best way to avoid this is for European leaders to push for a more open and competitive market in space. Our companies must be able to compete on a level playing field, while ensuring we maintain essential capabilities within the continent. This is important because space exploration drives innovation. It expands our technological horizons, creates new industries and drives understanding about our place in the universe. However, it can only bring these benefits if our activity there is safe and sustainable. Right now, it is not clear that is the case.

In particular, low-Earth orbit risks becoming dangerously congested with larger and larger objects. This is due to the launch of mega-constellations of satellites by companies such as SpaceX and Amazon. In 2018, there were just 2,000 satellites in orbit. By the end of this decade this could be 100,000: a 50-fold increase. Both the European Space Agency and Nasa have raised the alarm on the growing threat of overcrowding, collisions and the generation of debris.

Just like air, land and water resources, near-Earth space is fragile. New rules are badly needed to govern human activity there. Unfortunately, global consensus is impossible in the current climate. It is time for Europe to step up. We have been at the forefront of addressing environmental concerns on Earth, we must do the same in space.

We must understand and address the risks before it is too late. Our academics and companies must work with allies to understand what activity Earth's orbits can sustain, as we did for sea lanes and civilian airspace. Regulators should then set clear conditions when granting market access to satellite companies, which lower the risk of collisions.

Europe must be bold. If we fail to address security concerns, we will be weaker. If we fail to deliver a level playing field, we will be poorer. And if we fail to make our space activity safe and sustainable, then future generations will pay the price.

- In your opinion, is space exploration worth the cost? (essai)

Bloomberg | By Adam Minter | September 4, 2022

NASA's Artemis Rocket Is a Gigantic Waste of Money

For the second time in a week, NASA scrubbed the launch of the Space Launch System designed to return Americans to the moon. First conceived in 2010, and initially scheduled to have its first test flight in 2017, the rocket is now scheduled to take off no earlier than late September, and possibly much later. NASA, for its part, is hoping Americans will overlook a decade of expensive failure and pray for the best.

They shouldn't. The SLS's path to the launch pad should never have happened. Conceived as a means to maintain US aerospace employment, and based in part on older rocket designs and parts, the project has siphoned funds and energy.

Some proponents argue that the SLS launch marks the beginning of a "renaissance" for the US space program. It's the first mission of NASA's Artemis program, designed to land Americans on the moon mid-decade and eventually lead to a permanent lunar base. All of that will require a working and successful SLS, and this mission - Artemis I - would stress test its capabilities and send Orion, a vehicle that will eventually hold astronauts, on a trip around the moon. It sounds groundbreaking, but the reality is that private-sector space companies have been pushing boundaries for more than a decade while the SLS lingered through delays and blown budgets.

The last humans to visit the moon's surface arrived via the Apollo 17 mission in 1972. Congress canceled an additional three missions due to cost, safety and waning public and policy-maker interest. Instead, NASA pursued the space shuttle, the International Space Station and a rich robotic exploration program of the Earth and beyond. [...]

In 2010, President Barack Obama canceled the *Constellation lunar program*, arguing "we've been there before." The plan was to visit an asteroid, then proceed to Mars. Congress wasn't on board with canceling the jobs that the Constellation supported. So it added a provision to NASA's 2010 authorization requiring the agency to "extend and modify" existing contracts for Constellation and the space shuttle into contracts to build the SLS and the Orion crew vehicle that's riding atop it today. The goal was to maintain a workforce totaling in the thousands along with their skills and capabilities.

But early on, NASA made it clear that the SLS would only fly every two to four years, calling into question whether engineers could really be kept sharp and the missions safe with such a low frequency of launch. By contrast, SpaceX is sending up craft almost weekly in 2022; RocketLab USA Inc. has already launched six times this year. Who's really keeping US aerospace skills sharp while advancing aerospace engineering? [...]

Overall costs are tipping $23 billion. That's a far cry from what NASA promised Congress, and Congress promised the American people, when the program was conceived. "If we can't do a rocket for $11.5 billion, we ought to close up shop," said Senator Bill Nelson of Florida in 2010, when he was a major sponsor of the program. These days, he serves as NASA's administrator.

It's possible to do better. For example, the fully reusable engines that power SpaceX's Falcon 9 cost around $1 million. In 2019, SpaceX Chairman and CEO Elon Musk tweeted that he hopes that the company's Raptor engine, which will power its in-development Starship rocket, will eventually run $250,000. [...] In fact, the successes of the private space industry appear to have caused Congress to dig in its heels on the SLS. Every year between 2012 and 2022, it appropriated more money for SLS than NASA requested, in spite of the blown deadlines and budgets.

Congress appears to have learned nothing from the backward-looking failure that the SLS represents, and will continue to throw money at it for years to come. This week's scrubbed launches are the latest reminders of that ongoing, sorry legacy.