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Next Giant Leaps: From NASA to Life Beyond Earth

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*"**Next Giant Leaps: From NASA to Life Beyond Earth -** How has space science—from NASA's past missions to future Mars plans—changed our world? Investigate key milestones in space exploration and what we're learning to help humans live beyond Earth. "*

If a singular footfall affected our world greatly once, might you wonder what would happen if that step landed over 225 million kilometres away?
Space science is a multifaceted field of study that encompasses research in areas such as observational astronomy, atmospheric sciences, theoretical physics, aeronautics and astronautics, now incorporating branches of astrophysics, cosmology and rocket technology. When studying space science, we aim to explore the universe; accumulating observations and knowledge to advance our understanding and technology; seek life and habitability beyond Earth and protect present life. Many people who study within these fields are part of NASA (National Aeronautics and Space Administration). NASA, established in 1958, is an agency that works alongside the U.S federal government; responsible for space exploration and the U.S civil space program. In this essay, we will explore how past missions and space science have shaped what we are doing in the present and future.

Scientific revelations have reshaped the world throughout history. Breakthroughs like these have led to inventions like GPS tracking, memory foam, Cardiac Resynchronisation Devices and scratch-resistant lenses. A particularly significant invention is GPS tracking, due to its widespread use in navigation and coordination. To monitor and determine precise location, GPS systems use data from networks of satellites orbiting Earth; receiving a minimum of four satellite signals, which we calculate into precise coordinates. NASA played a role in GPS technology development through their use of the Doppler Effect to track satellite signals in the 1960s. NASA developed advanced receivers, such as the Blackjack receiver, which can track GPS signals for navigation in space.

While inventions assist with daily life, another instance of space science changing our world is the understanding of the climate and environment around us.

"Sometimes, you need to leave home to understand it." (Garthwaite, 2020, March 4th)

Somehow, that could tell truth. Observations from other planets; planets with similarities in structural development and climate factors, like Venus and Mars, can contest and refute Earth-based assumptions and theories. This provides context and substantiates geological theories, leading to improved perspective and accurate representation. An example of this is when scientists studying Mars discovered a unique sand dune ripple pattern unique to the planet. This breakthrough began with NASA's Curiosity Rover when it crossed a dune field in 2015. Researchers who were studying the Rover's movements could detect three main ripple patterns: large dunes, small, Earth-like ripples and the unfamiliar category. This new class of ripples required astrogeologists to revisit their previous theories and models, recreating them to correctly apply their discoveries about how sediment moves. Using this information, astrogeologists were able to uncover a correlation between ripple size and fluid density. Scientists could now find and conclude what temperature and salinity levels the water was during the sedentary process.

Before machines roamed the Red Planet, humanity first experimented much closer to home: on the surface of the Moon. The Apollo program, established formally on May 25, 1961, were a U.S national attempt to land humans on the moon, and return safely back to Earth.

"Apollo started out as a demonstration of America's technological, economic and political superiority to communism. It met its goals in those areas when the United States landed astronauts on the Moon before the Soviet Union could." (Dunbar, 2026).

Apollo was originally initiated to prove that America was far superior then the Soviet Union. While most of Apollo's recognition stems from Mission 11 (the moon landing), alternative factors sparked its legacy. Discoveries made throughout Apollo 11's mission, deepened our knowledge and proved lunar geological studies. Three of these astrobiological discoveries are most prominent. The first being the Moon's surface, where it its crust, asymmetrical shape, and its genetic relation to the Earth being the most significant. Another being the discovery that the oldest rocks on the moon are older than Earth's oldest. Revelations like these influenced aspects of life, such as technological advancements and developing human capability to work in the lunar environment.

"The Apollo Guidance Computer was the first computer that people staked their lives on – a digital computer in the loop of the thing that they were flying," says Mindell. "That was a very important moment of showing people that computers could be reliable and could be built into things."
(Hollingham, 2023)

While Apollo studied the Moon and its properties, the Voyager Missions, another notable space mission, explored deeper into the solar system, and met the Gas Giants, even strobing deeper into the cosmos, crossing into the medium between stars. NASA's Voyager Missions are a deep-space exploration program that features a twin spacecraft; Voyagers 1 and 2. Launched in 1977, their main mission was to conduct close-up observations and studies of Jupiter and Saturn and now stand as the only spacecraft mission to have explored the outer solar system in great depth.
The Voyager Missions were able to uncover Jupiter's faint rings, which were found to be composed of finer, darker particles. It was found that the rings were split into four components: The Halo ring, which is the innermost ring, thicker and doughnut-shaped ring. The Main ring; relatively thin, bright ring. The Gossamer rings: Two faint, outer rings made of microscopic debris from the small moons Amalthea and Theb.

The Voyager missions also made discoveries of subsurface oceans on Europa, one of Jupiter's many moons, and uncovered tidal heating and organic chemistry. They captured detailed images of Europa's densely cracked icy surface and the dark lines on the crust suggested there was a high probability of a massive liquid ocean beneath. These revelations sparked proof that habitable zones could exist beyond traditional means on Earth.

NASA's Space Shuttle program, launched in March 1972, is highly relevant to my argument. The Space Shuttle was the world's first reusable spacecraft used for human spaceflight, and the first to carry large satellites in and out of orbit. It launches like a rocket, acts as a spacecraft in orbit, and lands like an airplane.

"The first goal of the Space Shuttle program was to provide NASA with an efficient, re-usable method of carrying astronauts to and from a permanently manned space station." (Lethbridge, 2026)

At this time, NASA had imagined a space station that would be staffed with up to 24 people. A space station that would act as a permanent space presence following Apollo's mission 11. It would support a surplus of scientific research topics, provide and feed information back to Earth, and act as a support base for space missions to other planets. The shuttle could accommodate crews of up to eight passengers (astronauts) and could carry substantial cargo into space. Over the span of a few decades, the shuttles completed various missions, which included deploying satellites, conducting astronomical research and functioning as the facilitator for international collaborations; contributing to the International Space Station's construction.

The International Space Station (ISS) provides us with unique, valuable research, for example, microgravity, which has and can capacitate breakthroughs in medicine and technology. ISS itself functions as a massive microgravity laboratory, rather than a single room. The structure and simple lack of gravity allow space scientists to conduct experiments at nearly weightless states, sanctioning studies of physical, chemical and biological processes. A discovery made on the ISS was that spaceflight prompts rapid bodily changes comparable to chronic disease or aging (muscle atrophy, bone density loss, immune dysfunction). In space, long-term radiation exposure to high-energy cosmic rays damage DNA, and stem and skin cells. It significantly increases risks of cancer, and damages the nervous system (central), which can lead to cognitive dysfunctions and memory problems. Along with testing life support systems, the ISS researches, experiments and records data from psychological and social research on living in confined spaces and tests water recycling techniques, and controlled-environment food growth. The ISS acts as a "testing ground" for mars life. As the ISS continues to show us how humans could adapt to the harsh survival conditions beyond Earth, NASA is now transferring this knowledge into action for the next phase of our plan for humans. This phase includes, and leads directly into current and future Mars plans, beginning at the Artemis Program.

"Under Artemis, NASA will send astronauts on increasingly difficult missions to explore more of the Moon for scientific discovery, economic benefits, and to build on our foundation for the first crewed missions to Mars." (Bowman, Artemis, 2026)

The Artemis Program aims to return to the Moon, building on their missions until eventually the plan of Mars missions are possible through the appropriate preparation of technology and spacecraft design perfection. As a stepping-stone, we aim to stretch from a temporary visit to the moon, into a permanent lunar base in which we can experiment with life-support, power sources and mining systems.
Current and future Mars plans focus heavily on obtaining sample returns, developing the technology for in-situ resource utilisation (ISRU) and preparation for human missions in the 2030s. There are a few active rovers on Mars, *Perseverance* and *Curiosity,* feeding information and analysing geological data to us on Earth.

While we wait for these advancements, you might begin to wonder what life could be like on Mars, if we succeed in establishing human life there. In short, living conditions on Mars would be significantly opposite to those on Earth, with constant radiation, low gravity, extreme cold and dust storms as the smallest changes. People may live in inflatable structures or underground bases with gathering food and water being a challenge. To source water, we would extract ice and establish similar recycling systems to those in the ISS. Overall, Mars life will be challenging, but possible with the right sciences, it's possible.

That footfall on the Moon redirected history forever, but the knowledge we've gained since then has expanded our understanding of what it means to survive and explore. As we look towards Mars, we stand upon the next giant leap for humanity.

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Bibliography

Agency, A. S. (2024, August 29). *The Voyager missions have been probing the universe since 1977*. Retrieved from Australian Space Agency: https://www.space.gov.au/news-and-media/voyager-missions-have-been-probing-the-universe-since-1977

Australia, S. A. (2026). *Space environment advancing medical science*. Retrieved from Austrlaian Space Agency: https://www.space.gov.au/space-environment-advancing-medical-science

Benge, R. D. (2024). *Space Science*. Retrieved from EBSCO: https://www.ebsco.com/research-starters/science/space-science

Betts, D. B. (2024, June 27). *Protect Our Shared Future*. Retrieved from The Planetary Society: https://connect.planetary.org/72?s_pkgsrc=defense2026-unsol&s_src=defense2026&s_subsrc=lowerbar

Bowman, A. (2017, April 13). *Why Space Radiation Matters*. Retrieved from NASA: https://www.nasa.gov/missions/analog-field-testing/why-space-radiation-matters/

Bowman, A. (2026, April 10th). *Artemis*. Retrieved from NASA: https://www.nasa.gov/humans-in-space/artemis/

Bowman, A. (2026, June 16). *The Apollo Program*. Retrieved from NASA: https://www.nasa.gov/the-apollo-program/

Brinson, L. C. (2024, March 7th). *What breakthroughs in medicine came from NASA?* Retrieved from howstuffworks: https://science.howstuffworks.com/innovation/nasa-inventions/nasa-breakthroughs-in-medicine.htm

Chancellor, J. C. (2010, September 11). *Space Radiation: The Number One Risk to Astronaut Health beyond Low Earth Orbit*. Retrieved from PMC: https://pmc.ncbi.nlm.nih.gov/articles/PMC4206856/

Deel, D. G. (2024, March 15th). *Why Should We Explore Space? What Are the Benefits for Us?* Retrieved from APU: https://www.apu.apus.edu/area-of-study/math-and-science/resources/why-should-we-explore-space/

Dooren, J. M. (2026, April 2). *The Apollo Program*. Retrieved from NASA: https://www.nasa.gov/the-apollo-program/

Dunbar, B. (2026, May 6). *NASA: What We Learned*. Retrieved from NASA: https://www.nasa.gov/specials/apollo50th/learn.html

Emilee Richardson, Alicia Cermak. (2016, May 20). *20 Inventions We Wouldn't Have Without Space Travel*. Retrieved from NASA: https://www.jpl.nasa.gov/infographics/20-inventions-we-wouldnt-have-without-space-travel/

Flynn, G. J. (2021). *Space shuttle*. Retrieved from EBSCO: https://www.ebsco.com/research-starters/history/space-shuttle

Garthwaite, J. (2020, March 4th). *What other planets can teach us about Earth: Stanford researchers explain*. Stanford Report.

Gaskill, M. L. (2024, May 13). *Station Science 101 | Research in Microgravity: Higher, Faster, Longer*. Retrieved from NASA: https://www.nasa.gov/missions/station/iss-research/station-science-101-research-in-microgravity-higher-faster-longer/

Hollingham, R. (2023, May 18). *Apollo: How Moon missions changed the modern world*. Retrieved from BBC: https://www.bbc.com/future/article/20230516-apollo-how-moon-missions-changed-the-modern-world

Lethbridge, C. (2026, June 25). *SPACE SHUTTLE*. Retrieved from Spaceline: https://www.spaceline.org/united-states-manned-space-flight/space-shuttle-program-history/

Logreira, D. (2026, January 7). *Overview*. Retrieved from NASA: https://science.nasa.gov/mission/voyager/mission-overview/

Mehta, J. (2018, July 18). *How the Apollo missions transformed our understanding of the Moon's origin*. Retrieved from The Planetary Society: https://www.planetary.org/articles/apollo-moon-origin

Museum, N. A. (2023, November 12). *Ten Scientific Discoveries from the Apollo Missions*. Retrieved from National Air and Space Museum: https://airandspace.si.edu/stories/editorial/ten-scientific-discoveries-apollo-missions

NASA. (2019). *NASA Brings Accuracy to World's Global Positioning Systems*. Retrieved from NASA: https://research.open.ac.uk/news/dynamic-climates-what-can-other-planets-tell-us-about-earth

Nathan Cranford, J. T. (2021, February 2). *The Human Body in Space*. Retrieved from NASA: https://www.nasa.gov/humans-in-space/the-human-body-in-space/

Ostovar, M. (2023, June 2). *Space Shuttle*. Retrieved from NASA: https://www.nasa.gov/reference/the-space-shuttle/

Uri, J. (2020, November 12). *40 Years Ago: Voyager 1 Explores Saturn*. Retrieved from NASA: https://www.nasa.gov/history/40-years-ago-voyager-1-explores-saturn/

Walker, J. (2012, October 27). *Global Positioning System History*. Retrieved from NASA: https://www.nasa.gov/general/global-positioning-system-history/

Wells, S. (2025, January 9). *The biggest discoveries of Voyagers — NASA's most distant explorers*. Retrieved from ScienceNewsExplores: https://www.snexplores.org/article/voyagers-biggest-discoveries-nasa-space

Wikipedia. (2026, June 19). *Voyager Program*. Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Voyager_program