

Lesson 6 Voyage Across The Universe

Technologies for a Space Odyssey

Since ancient times, we have looked to the sky with wonder, curious about what lies beyond our world.

This inherent desire to explore the universe has encouraged technological innovations that can aid us in this pursuit. Among these advancements are space telescopes and space robots, which have paved the way for our journey toward understanding the mysteries of space.

Observing the Universe: Space Telescopes

When we observe space from the ground, Earth's atmosphere creates obstacles for our vision. It absorbs specific types of lights such as ultraviolet and infrared, causing distortions in our observations and making some objects beyond the atmosphere invisible. Consequently, the space we see from Earth's surface can differ significantly from its actual appearance. To overcome these limitations, telescopes are launched into space beyond Earth's atmosphere.

Space telescopes are specifically designed to capture a spectrum of light that is not visible on Earth. This capability provides us with a clear and uninterrupted view of celestial objects, allowing us to better observe stars, black holes, and galaxies located billions of light years away from Earth. The data and images gathered by space telescopes are invaluable to scientists, enabling them to study the birth and death of celestial bodies and their unique characteristics.

Among the various space telescopes in operation, the Hubble Space Telescope, launched in 1990, stands out as an unprecedented achievement in space technology. Orbiting approximately 600 kilometers above Earth's atmosphere, Hubble has transmitted incredibly detailed images of space, revolutionizing our understanding of the universe. It has played a crucial role in facilitating pioneering discoveries about the relationships between celestial bodies, the formation of galaxies, and the expansion of the universe. Moreover, its breathtaking images have sparked people's imaginations and made space exploration an even more intriguing journey.

To prepare for Hubble's retirement, the James Webb Space Telescope was launched as its successor in 2021. Webb is a state-of-the-art space telescope with capabilities superior to those of any other telescope. It features a honeycomb-patterned mirror that is about three times larger in diameter than Hubble's round-shaped mirror, resulting in an image collection area that is 6.25 times wider. Positioned 1.5 million kilometers from Earth, Webb orbits the Sun alongside Earth, while Hubble orbits Earth itself. Webb also specializes in capturing infrared light, which can pass through dusty regions more effectively than the visible light used by Hubble. These features enable Webb to offer a view of space with greatly enhanced clarity and minimal interference. As Webb continues its mission, it is expected to offer deeper insights into the birth of the universe and the evolutionary processes following the Big Bang.

Exploring the Universe: Space Robots

Thorough space exploration goes beyond remote observations and includes up-close examinations of celestial bodies, material collection, and on-site experiments. While human astronauts can be sent on these missions, it is often safer and more cost-effective to use robots. Robots can better withstand the harsh conditions of space, including extreme temperatures and high radiation levels that can pose serious risks to human astronauts.

A variety of robots have been developed for space missions. Some are designed to land on celestial bodies, while others are built for flyby missions. Some robots remain in fixed positions, while others are engineered for mobility. Robots also come in a range of shapes, resembling those of spacecraft, vehicles, or even humans. They are categorized and named according to their specific functions.

Probes are one notable type of space robots. These spacecraft-like robots are designed to capture photos and gather data without needing to land on celestial bodies. For example, the twin Voyagers launched in 1977 are historic probes. These probes successfully flew by the major outer planets of our solar system — Jupiter, Saturn, Uranus, and Neptune — discovering numerous fascinating details about them. One of the Voyagers' significant findings was the presence of highly active volcanoes on Io, one of Jupiter's moons, marking the first evidence of geological processes observed on other planets. After completing their planetary missions, these probes continued their journey beyond our solar system. Voyager 1 first entered interstellar space in 2012 and became the farthest human-made object from Earth.

Another widely recognized type of space robot is the rover, a robotic vehicle designed to move across the surface of planets and moons to explore their environments. Equipped with various scientific instruments, rovers conduct experiments and investigations while in motion, functioning like roaming laboratories. An iconic example is Curiosity, which landed on Mars in 2012. This car-sized rover made significant discoveries about Mars's past.

It found signs of a water stream on a crater's floor and identified chemicals such as carbon in a powder sample drilled from a rock. These findings suggest the possibility that some form of life might have existed on Mars in the past.

While humanoid robots, which resemble humans in structure and movement, have not yet become common in space exploration, there have been significant advancements in this area as well. A humanoid robot named Robonaut 2 was sent to work on the International Space Station in 2011. Robonaut 2 was designed to assist astronauts in spacewalks and perform various tasks in dangerous environments. Despite their diversity, these robots share a common mission: to fearlessly venture into the unexplored territories of the universe.

As we journey through the vast universe, telescopes and robots have been our eyes and hands. Their lenses and sensors reveal the beauty and mysteries of galaxies, planets, and celestial wonders. As technology advances, we find ourselves closer to the secrets of the universe than ever before. The future of space exploration promises wonders beyond our imagination, and this fills us with great excitement.