Robotics in Space Exploration

Robotics have been at the forefront of space exploration ever since the late 1950s when on the 4th of October, 1957, the Soviet Union laid the foundations of a new era by successfully launching Sputnik I, the world’s first artificial satellite. Sputnik’s satellite was roughly the size of a beach ball (58 cm in diameter), weighed just 83.6 kg, and took 98 minutes to orbit the earth on an elliptical path.

The robotics found on Sputnik I were primitive at best but undoubtedly laid the path for world altering robotics and technologies that power our lives to this very day. The launch of Sputnik I also spurred the Americans to create the “National Aeronautics and Space Administration”. More commonly known to us today as NASA.

On the 31st of January, 1958, just 4 months proceeding the Soviet unions success on Sputnik I, the United States launched Explorer I, the USA’s counter to Sputnik I. Explorer I carried a small scientific haul that discovered the magnetic belts that surround the planet.

Today however, after the “Space Age” has ran its course and manned missions have become few and far between, robots are at the forefront of modern Space Exploration. In the darkest and deepest depths of space, robots are exploring our universe like no human ever has before, or ever will for a long time.

Launched on the 5th of September 1977, Voyager I, at the time of writing, is 13.79 billion miles away from Earth. Further than any human made object has ever been from our planet. Voyager I is expected to continue to relay information back to Earth until 2025, wherein its “radioisotope thermoelectric generators” will no longer have enough power to keep its scientific instruments running. However, Voyager I will not stop. As a testament to the knowledge put into the robotics of Voyager I, the probe will continue to fly out to the depths of space forever.

The launch of the Hubble Space Telescope in April 1990 is marked as the most the biggest advancement in astronomy and robotics since Galileo developed and created his telescope in 1610. Since the launch date, the Hubble Space Telescope has made over 1 million observations of the cosmos. One of the most famous astronomical observations made by the Hubble telescope was the Eagle Nebula – more famously known as [The Pillars of Creation](https://www.nasa.gov/image-feature/the-pillars-of-creation).

The high-tech mirrors and cameras assisted by the state-of-the-art robotics and technologies found on the Hubble Space Telescope allow the telescope to capture high resolution images of astronomical phenomena. The Hubble Telescope is not outfitted with any thrusters or engines, instead it uses a sophisticated set of wheels and robotics to spin its interior motors in the opposite direction to utilise Newton’s third law and rotate at a rate of 90 degrees every 15 minutes. After 30 years of service and 5 servicing missions, the Hubble Telescope is still up and running. Thanks to a set of two 25ft square solar panels that absorb the Suns energy, the Hubble Space Telescope has a long life of science ahead of it.

The biggest advantage of using “Space Robots” is that they don’t need food, drink, or sleep, and can survive in the most inhospitable of climates. On top of this, while even though robots are expensive to design and create, the loss of mechanical components is always preferred to the loss of human life if a mission goes wrong.

Closer to home however, robots do an enormous amount of work on the International Space Station (ISS). There are an uncountable number of sensors and robotic assistances on the International Space Station, everything from terrestrial data gathering to astronomical observation equipment.

However, the newest “crew members” of the ISS are three cubical floating robots named “Astrobees”. The Astrobees are about 1ft² and is fitted with numerous cameras and sensors to assist the astronauts on the ISS. Like a trio of 3D Roombas, the Astrobees will use their multidirectional fans and 360° cameras to navigate the zero-gravity space within the International Space Station. They can move in any direction and turn on any axis. The Astrobees can either be operated autonomously or operated remotely by astronauts within the ISS or by mission control. (Gonzalez, 2019)

One of, if not the, most famous robot to ever be launched into space is the Mars exploration rover, Curiosity. The Curiosity robot has been transmitting data of the Martian surface for over 8 years at the time of writing. Two of Curiosity’s biggest discoveries so far have been, volcanos and manganese oxide. The evidence of volcanos on Mars proves that at one point in its long history, Mars was geologically active. However, the manganese oxide has led scientists to conclude that Mars might have had an oxygen-rich environment at some point. (Thompson, 2016)

However, the rover isn’t always on the go. Curiosity in fact spends the majority of its time idle. The rover will spend extended periods of time at significant waypoints set by the scientist back home. As of the 27th of April 2020, the Martian rover as been active for only 800 Martian days out of a total of 2736. This stems from the fact the Martian rover cannot communicate with Earth instantaneously. Usual transmission delays can take anywhere from 4 minutes to 24 minutes, however on average it takes 14 minutes to relay information either to or from the rover. As the end result of this delay, ground control will send a command such as “drive forward Xm”, then Curiosity will use its computer and a state-of-the-art set of cameras to drive in that direction autonomously, avoided as many dangers as is achievable.

Thanks to robotics, space exploration has progressed exponentially over the last 60 years. Without the help of robotics, we wouldn’t have the unrivalled view into the cosmos that we have thanks to Voyager. We wouldn’t have a view of the surface of our closest celestial neighbour, and the human race would have never made that small step on the surface of the moon, and the giant leap into our orbit and beyond.