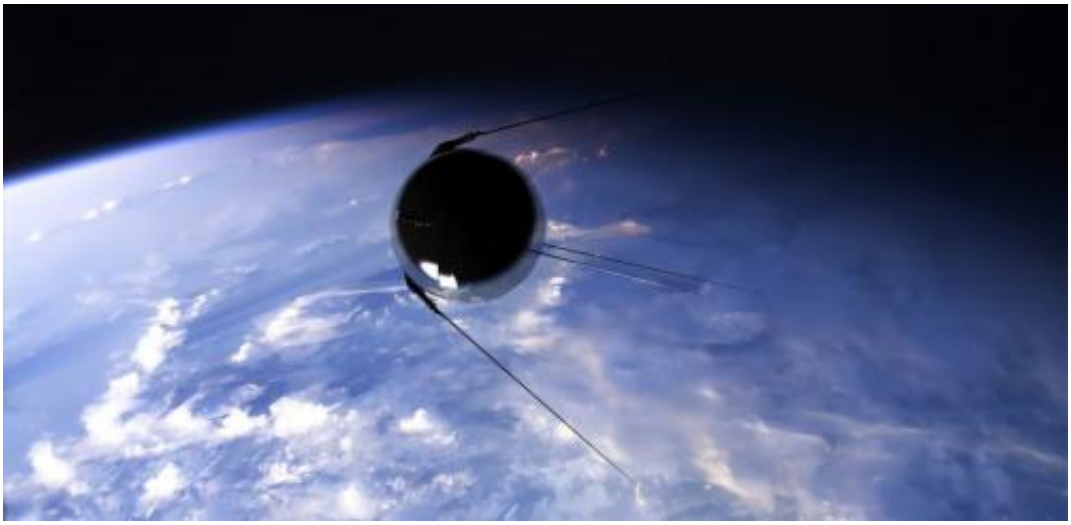
We must keep exploring space to answer the big questions humanity faces

October 10 2014, by Chris Arridge



Sputnik 1. Credit: vitazheltyakov, CC BY-NC-ND

Launched by the Soviet Union in 1957, Sputnik 1 became the world's first artificial satellite – a "simple" battery-powered radio transmitter inside an aluminium shell about the size of a beach ball. This started a race to the stars, for both robotic space exploration and human spaceflight. This legacy continues today with our exploration of the solar system.

Space exploration is a challenge to human ingenuity, and celebrations this week, under the guise of World Space Week, are an ode to it. Spacecraft have to be kept warm against the cold of space, but cool

against the heat of the Sun – think of travelling from Antarctica to Africa without taking your coat off. They have to make electricity for themselves. They have to be able to work out what way they are facing. They need to be able to communicate with Earth – but even travelling at the speed of light it takes a radio signal about 40 minutes to get from Jupiter to Earth, so robotic spacecraft have to survive on their own.

A simple reason why space exploration is valuable is that in developing spacecraft to explore distant worlds, we get better at building spacecraft for more practical purposes. Engineers and space scientists today have their work cut out to meet these challenges, but they follow in the footsteps of the early engineers and scientists who pioneer space exploration.

From Sputnik to Mariner…

Sputnik was originally envisaged as a scientific satellite but due to the available technology, and the developing race between the US and Soviet Union, it ended up being vastly simplified and didn't carry any instruments. Nevertheless scientific work could still be done.

The familiar beep-beep radio signal from Sputnik was distorted as it passed through Earth's atmosphere. These distortions were used by scientists to study the atmosphere. These distortions affect GPS and satellite TV.

Many other missions followed which did carry a scientific "payload", Explorer 1 and Explorer 3 in 1958 discovered Earth's "Van Allen" radiation belts (Sputnik 3 made similar, but incomplete measurements), Explorer 6 in 1959 returned the first pictures of Earth from orbit, and Explorer 10 in 1961 detected the first explosion from the Sun in interplanetary space, among many other firsts as human-kind learned how to explore space. Looking down on our planet from space has

changed our perception of Earth and our place in the universe.

The first spacecraft to visit another planet was Mariner 2, which flew past Venus on December 14 1962, having survived a near fatal anomaly in September 1962 that may have been the result of a meteoroid hitting the spacecraft. Other spacecrafts in the Mariner programme made spectacular firsts: Mariner 4 took the first close-up pictures of a planet, in this case Mars, from space and Mariner 9 was the first spacecraft to enter orbit around another planet.

…then Venus to Saturn

Mariner was very successful and the spacecraft design was used to develop other space missions, such as the twin Voyager spacecraft that are still operating 37 years later, the Magellan spacecraft that explored the surface of Venus with radar, and the Galileo spacecraft that surveyed Jupiter, its moons, and its space environment.

Voyager was unique in that it undertook a grand tour of Jupiter, Saturn, Uranus and Neptune, exploiting an alignment of the planets in the late 1970s that will not occur again until the mid-2100s. Voyager 1 has now entered interstellar space – the space between stars – at a distance of 20 billion km from Earth.

The Cassini-Huygens mission is the first spacecraft to orbit Saturn and has made great discoveries in the Saturn system, such as lakes on Saturn's largest moon Titan, giant geysers erupting from the south pole of the moon Enceladus, and potentially witnessing the birth of a new moon from debris in Saturn's rings. Cassini is known as a Mariner Mark II spacecraft, continuing the 50-year Mariner legacy.

Future of space exploration

The European Space Agency's JUICE mission combines all of the challenges that we started with. Aiming for launch in 2021, the spacecraft will fly by Venus on its way to Jupiter, then enter orbit around Jupiter, study its moons and then enter orbit around the largest moon, Ganymede. JUICE must survive near Venus where sunlight is twice as strong as at Earth, to Jupiter where sunlight is 30 times weaker.

More extreme challenges are found across our solar system. In July 2015, New Horizons will be the first spacecraft to fly past Pluto. Pluto is so far from Earth that data will come back from the spacecraft about 5,000 times slower than your home broadband, mimicking the early days of spaceflight where images of Mars from Mariner 4 took hours to trickle back to Earth.

But it will provide a new window into a largely unknown alien world. What will we discover? What will we learn about the origins of the solar system? What will we learn about ourselves? Continued space exploration is the only way we can answer any of those questions.

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