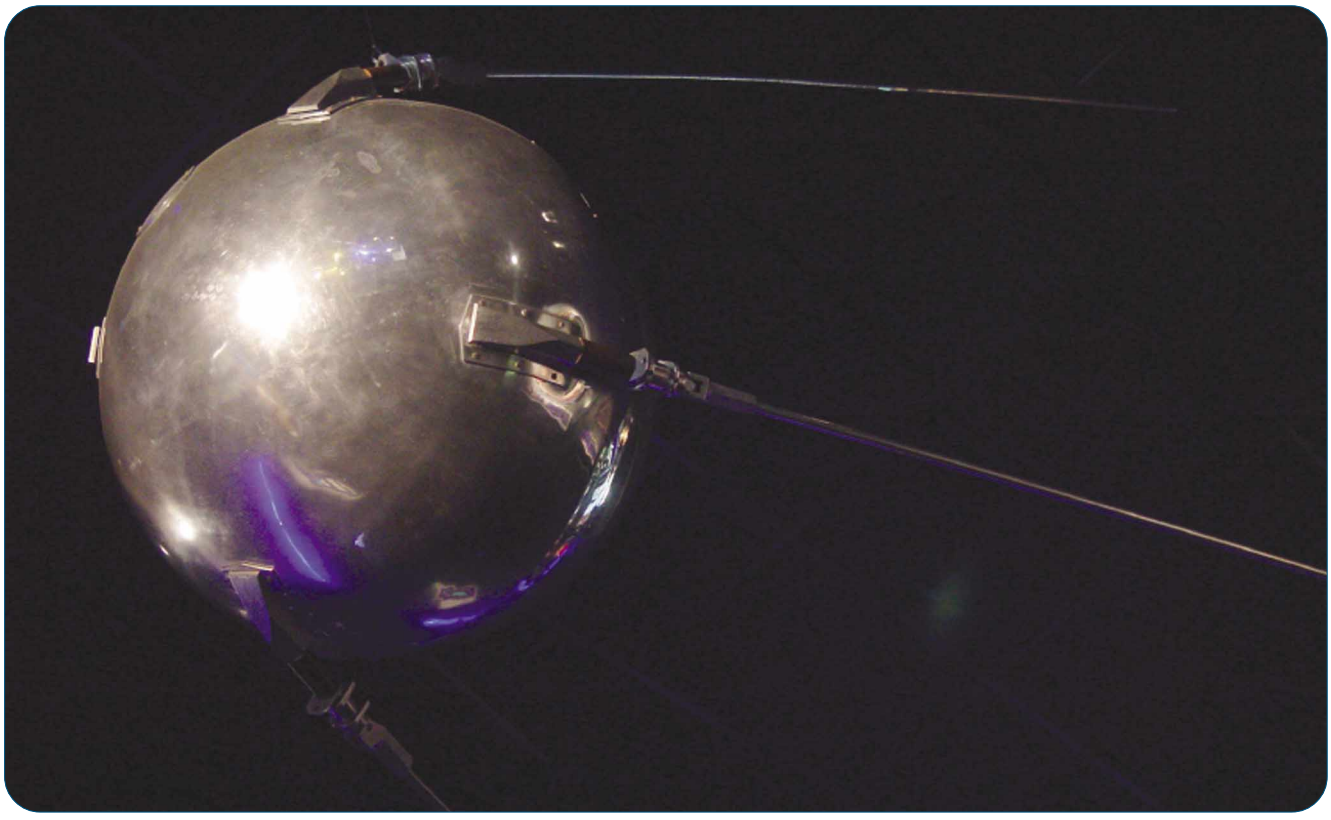

Photo courtesy of iStockphoto.

The beeps that changed the world

On 4th October 2007 we celebrated the 50th anniversary of the launch of Sputnik. The small, strange –looking satellite heralded the start of the space age for us all. The advancements we have witnessed in the 50 years since have changed our lives. Helen Jameson looks back at the launch of Sputnik and the impact it had on the world.

The Sputnik Programme was initiated by the Soviet Union during the Cold War. The aim of this series of unmanned space missions was to demonstrate the viability of artificial satellites for exploring the upper atmosphere. Translated as 'travelling companion', Sputnik was launched on October 4th 1957 and measured 58cm in diameter and weighed 83.6 kg – very different to the satellites of today. Its distinctive shape is something that even young space enthusiasts will recognise. Once launched by a Soviet R-7 rocket, each elliptical orbit took a total of 96 minutes, and the progress of the satellite was monitored by amateur radio operators. The familiar 'beep, beep, beep' was the first sound ever to be heard from space and the impact that this had on the ordinary citizen was understandable. In the Cold War climate, to have something circling the earth that was of Soviet design and alien to the majority of the global population was a disturbing and potentially dangerous thought. Was this a threat? Where would this end?

The International Geophysical Year, 1957-8

The launches of Sputnik and the US satellite Explorer-1 were responses to the International Geophysical Year (IGY) that took place over an 18-month period from January 1957 to December 1958. This was an international scientific effort where countries were challenged by the International Council of Scientific Unions to launch an artificial satellite. The satellites launched during this year were not part of a 'race' but were used to fulfil aims and objectives as part of the IGY. The IGY research comprised eleven earth science areas:

- Aurora and Airglow;
- Geomagnetism;
- Gravity;
- Cosmic Rays;
- Ionospheric Physics;
- Longitude;

- Latitude;
- Meteorology;
- Oceanography;
- Seismology; and
- Solar Activity.

Sputnik 1's successful launch was followed by Sputnik 2 on November 3rd 1957, less than one month since the first launch – a result of Nikita Khruschev's demand for more. This satellite carried a dog, Laika, into space but there were no plans in place for the safe return of the dog or the spacecraft.

The first attempt to launch Sputnik 3 failed in February 1958 but the second did succeed on 15th May in the same year. This satellite carried a variety of instruments for geophysical research.

Sputnik 4 was launched on 15th May 1960 and was followed by Sputnik 5 on August 19th 1960. This satellite carried a load of two dogs, forty mice, two rats and several plants. The satellite returned to earth the next day and all the animals and plants were safely recovered.

The R-7 rocket was used to launch the first Sputnik satellite in 1957 and was the biggest leap in world rocketry since the German A-4 rocket. It was originally developed to be the first Soviet ICBM, but it was obselete as a weapon before it started flying. The R-7 went on to serve the Russian space industry for a further 50 years and it's legacy lives on in space boosters derived from the R-7 that are used in the only vehicles delivering manned Russian spacecraft into space and are also involved in launching supply ships and lifeboats for the International Space Station crews.

An unexpected surprise – the US reaction

The launch of the Sputnik satellite was a triumph for Soviet scientists but a shock for the rest of the world, especially to the United States as they had, at virtually the same point, failed to launch their first satellite, Vanguard. It also was a realisation of Russian advancement and fear of what they may be capable of. George Reedy, an aide of Senate Majority Leader, Lyndon B. Johnson, was very concerned at Russia's 'out of the blue' achievement and said: "The simple fact is that we can no longer consider the Russians to be behind us in technology. It took them four years to catch up to our hydrogen bomb. Now we must catch up with their satellite."

Reaction to the space build-up in the west was somewhat negative. There was concern that the demand, or even rush, to put these satellites into space was affecting other national interests of the day. It also gave rise to arguments on nuclear armament and many felt that it was a dangerous and costly competition that had been initiated.

To all intents and purposes, at this point in time, the United States and Russia were at war but President Eisenhower was not as concerned as the rest of the population. He had seen evidence of Soviet launch failures from intelligence gathered by U2 flights over Russia but he was not in a position to disclose this information at the time.

The United States respond

The United State's initial response to the Sputnik launch was to launch the Vanguard satellite on December 6 1957. The US Secretary of Defence, Neil McElroy directed the army to use the Juno 1 launch vehicle. It was, however, a huge failure and it was there for all to see on live television. The rocket used was called TV-3 for 'Test Vehicle 3'. This was precisely what it was – a test. The US test to launch a satellite into orbit was brought forward by several months due to the Russian pressure and was made into a full blown satellite launch. Vanguard only lifted from the launch pad four feet before falling back down and exploding. Not a great start. Pravda, the Russian national newspaper described the launch as 'Flopnik'.

After the Sputnik 2 launch, preparations were well underway for the launch of the US Explorer-1 satellite. James Van Allen of Iowa University was asked to make the package of scientific instruments ready and compatible with the Explorer's launch vehicle Jupiter C. These instruments were to sense the radiation bands that surround the earth now known as the Van Allen Belts, a discovery narrowly missed out on by the Russian's Sputnik 3 satellite. Explorer-1 became the first US artificial satellite to be placed in earth orbit. This was the world's first solar powered satellite and measured 152mm in diameter and weighed 1.4 kg and was described by Soviet Premier Nikita Kruschchev as the 'grapefruit satellite'. It is the oldest artificial satellite still in space and is expected to stay there for hundreds of years to come.

On March 17 1958, Vanguard satellite TV-4 was launched. Vanguard met all of its objectives. It gathered a great amount of information on the size and shape of the earth, air density, temperature ranges, proved the earth is slightly pear shaped, not perfectly round. It also introduced technology that has been used in later US satellite programmes, for example, solar cells. On Vanguard they operated for seven years. Its 'voice' became silent in 1964 but it continues to serve the scientific community.

NASA is established

When Sputnik 3 was finally launched after a series of setbacks, Lyndon B. Johnson demanded a congressional investigation on the impact of Sputnik-1. He recommended that work should immediately begin on the development of a rocket motor with a million pound thrust, that more effort should be put into the development of satellites and that research should be accelerated and expanded with control and administration through the US department of Defense or an independent agency. President Eisenhower concluded in early 1958, that a civilian space agency was required and on 29 July 1958 the President called for the National Aeronautics and Space Administration to be created. Considering Eisenhower claimed to have been utterly unfazed by the Sputnik-1 launch it was a considerable u-turn!

Sputnik, Explorer and Vanguard 1957/8 – A Chronology

1957

- October 4, 1957 USSR: Sputnik 1 (83.6 kg) launched.
- November 3 USSR: Sputnik 2 (508.3 kg), with dog Laika as passenger, launched.
- December 6 USA: Vanguard TV-3 explodes on launch pad.

1958

- January 31, 1958 USA: Explorer 1 (14 kg), America's first satellite, discovers the Van Allen radiation belts.
- February 3 USSR: First attempt to launch Sputnik 3 fails.
- February 5 USA: A second Vanguard launch attempt fails.
- March 5 USA: Explorer 2 fails to orbit.
- March 17 USA: Vanguard 1 (1.47 kg) successfully orbits, establishes the pear-shapedness of the Earth.
- March 26 USA: Explorer 3 orbits, collects radiation and micrometeoroid data.
- April 28 USA: Another Vanguard fails to orbit (third failure).
- May 15 USSR: Sputnik 3 (1,327 kg) orbits, carrying large array of scientific instruments, but tape recorder fails, so it cannot map Van Allen belts.
- May 27 USA Vanguard fails for the fourth time.
- June 26 USA Vanguard fails for fifth time.
- July 26 USA Explorer 4 orbits and maps Van Allen radiation belts for 2 1/2 months.
- August 24 USA Explorer 5 fails to orbit.
- September 26 USA Vanguard fails for the sixth time.

By 1969 the United States had taken the lead in the space race and cemented their superiority by landing on the moon.

Over the years, the Russian space programme set many precedents but also suffered many setbacks. Since the break-up of the former Soviet Union and the dissolution of the Soviet Space Programme, the Russian Federal Space Agency (Roskosmos) is now

responsible for Russia's space science programme. The lack of funding available for the agency has significantly held up Russian space ambitions such as a moon mission and also co-operation with the International Space Station. In the 1990s, the lack of cash led Roskosmos to diversify and to seek other assured revenue streams resulting in its now leading role in commercial satellite launches and space tourism. Despite the problems, Roskosmos continued to operate the Mir space station way past its expected life span and has also continued Soyuz launches. Russia's involvement in the International Space Station continues to be high. It contributed the Zaraya and Zveda space modules and has been responsible for crew launches and resupplying the space station. Roskosmos provides space tourism for fare-paying passengers through the US based Space Adventures company and will provide two additional modules to the International Space Station in 2009 and 2010.

Sputnik's legacy

1957 was a crucial year – a turning point as a civilisation. No longer were we to be earthbound. Developments in space technology over the past 50 years have exceeded, I am sure, everyone's expectations and space exploration has become a global endeavour that will continue to gather momentum.

We have seen man on the moon, space stations, environmental programmes, even the first space tourists.

China, Japan and Europe are all serious contenders and serious about joining the space race, the definition of which may have changed but is still very much 'on'.

Today, as a result of the Sputnik and Explorer programmes the hunger to push the boundaries further only gets more intense. Space is now simply an extension of our planet. It is not something to feel threatened by but rather to explore and exploit for the good of humankind, to provide us with a deeper knowledge of the solar system in which we revolve.

Where in space will we be in the next 50 years? I hope I will still be here as I am sure that it will certainly be something to write home about. ■

Leading space scientists, visionaries, and entrepreneurs from around the world met at Boston University to discuss the future of space exploration.

Gathered on the 50th anniversary of the space age, following the launch of Sputnik in 1957, and the 40th anniversary of the Outer Space Treaty, participants of The Future of Space Exploration: Solutions to Earthly Problems? recommended visions for the next 50 years of space activities.

Commenting on the importance of the conference Professor Keith Mason, CEO of the Science and Technology Facilities Council and Chairman of the UK Space Board [British National Space Centre's governing body] and conference speaker said," During the past 50 years space-based assets have become an integral part of our daily lives for communications, navigation and weather forecasting etc. The opportunities for the next 50 years are even greater, for developed and developing nations alike, and it is important to think about a framework that will maximise the benefits of space for all the inhabitants of the Earth".

Hosted by the Boston University Center for Space Physics the three-day conference featured discussions led by noted researchers, including Dr. John C. Mather, 2006 Nobel Prize Winner in physics and Chief Scientist, NASA Science Mission Directorate , and a keynote address by Lord Rees of Ludlow, Astronomer Royal and President of the Royal Society.

Opening remarks were made by President A.P.J. Abdul Kalam of India who stated that, "the best thing space can do is enhance the quality of life of those on Earth," and that in the long-term, humanity has to "build the way for an alternative habitat in our galaxy".

Conference participants worked together to imagine the next half-century of space exploration and identified five key areas that require attention if humans are to thrive in space over the next 50 years:

- Space Governance. In anticipation of emerging space activities, a system of laws, regulations and agreements are needed in space. Particular areas that need addressing include: (1) prohibiting space weapons; (2) managing traffic of space vehicles to avoid collisions and ensure uninterrupted satellite services; (3) managing the global environment and security; and (4) enabling and encouraging private and national space utilisation.
- Public participation. To ensure the long-term sustainability of human endeavours in space, the public can be, and should be, directly integrated with space missions. We would like more communication of the benefits of space exploration to society, emphasising that survival is the foremost incentive – both in terms of space providing knowledge of our environment and natural disasters, and through the potential of self-sustaining settlements off our home planet.
- Resources and Energy. Material resources, energy sources and other sources of economic value in space need to be developed. These assets have the potential to improve the quality of life on Earth, and will require the development of new space technologies and infrastructure.
- Biotechnology. The coming biotechnology revolution that will change the health and survival capabilities of the human race should be fully exploited. Developments in biotech may allow humans to live in space without harmful effects of space radiation or bone degradation. This will have profound effects on the limits of human experience and our presence in the solar system.
- Strategy. We believe that a 50-year global vision should be developed that can provide guidance for the future of human endeavours in space. Concurrently, a 10-year horizon rolling plan, considering the needs of all peoples, is necessary to ensure sustainable progress towards the longer-term goals. We urge development of suitable mechanisms for this that could involve the world's space agencies.

"Spectacular advances in astronomy, and solar and geophysics have been made due to the access to space," said Supriya Chakrabarti, conference chairman and Director of the Boston University Center for Space Physics. "It is our hope that with these recommendations we can continue to build upon the achievements and discoveries already made in space."

"Since 1957, the world has witnessed many feats: the first artificial satellites, the first visits to space, footsteps on the Moon, a permanent International Space Station, and now the emergence of the private space industry. Spectacular advances in astronomy, and solar and geophysics have been made due to the access to space," said Chris Boshuizen, executive director of the Space Generation Advisory Council. "With this heritage, which was based upon a robust body of research, humankind can look to the future with confidence."