

Future Direction of Space Exploration with Respect to Manned or Unmanned Missions

Lavanan Vengadasalam



Space Era began with the successful launch of Sputnik 1 satellite in 1957, and Vostok 3KA spacecraft was the first manned flight to take a human being to space in 1961. Along with these and the continuously progressing milestones in space exploration, the human race's astonishing event took place in 1969, with man landing on moon. Since then many manned missions were limited to only the Low Earth Orbit (LEO), and most robotic missions that took place beyond that were curiosity rover on Mars. Currently the greatest ongoing debate in space exploration is manned vs unmanned missions.

History of Space Exploration

The universe is a place filled with mysteries and myths. When humans looked up at the night sky and tried to explain the universe and its contents, their inability to observe them close enough limited their

understanding. Human race always tends to seek meaningful answers for any phenomena, and in fact this is a function of left hemisphere of the human brain. This behaviour led human beings to discover, study and analyse the origins of the Universe and its contents, which in turn led to the beginning of space exploration.

In ancient times, human being believed that the Earth was the centre of the Universe which was the proposed argument of Greek scientists Aristotle and Ptolemy. The Polish astronomer Nicolai Copernicus argued that the Sun was the centre of the solar system in his book *On the Revolutions of the Heavenly Bodies* in 1543. Italian astronomer, Galileo Galilei supported this argument following his invention of the astronomical telescope in 1609. Since then telescopes have been used to observe the universe, and this led to the path of observational astronomy.

It would be best to say that Galileo Galilei's astronomical telescope was a milestone for astronomers. The use of astronomical telescopes helped the German astronomer Johannes Kepler and English scientist Sir Issac Newton to invent their laws in astronomy. Since then, these have become the most important contributions in spacecraft mission analysis and design.

The concept of a satellite was first mentioned in a story entitled *The Brick Moon* written by Edward Everett Hale in 1869. It mentioned that a satellite functioning in the polar orbit would provide accurate measurement of longitude for sailors. In 1909, Russian teacher Konstantin Tsiolkovsky mentioned in an academic paper the possibility of using rockets to launch spacecraft. Following these events, Russians launched the first satellite, Sputnik 1 in 1957, and this event marked the beginning of the space age.

Debate on Manned or Unmanned Missions for Future Space Exploration

Stephen Hawking who holds Issac Newton's Lucasian Chair in Cambridge University, and an expert on the cosmological theories of gravity and black holes, expresses his point of view on the debate Manned vs Unmanned missions as follows:

"Robotic missions are much cheaper and may provide more scientific information, but they don't catch the public imagination in the same way, and they don't spread the human race into space, which I'm arguing should be our long-term strategy. If the human race is to continue for another million years, we will have to boldly go where no one has gone before."

According to Stephen Hawking, it is clear that if human race has to be sustained for another million years and beyond, then manned exploration has to go beyond its current constrained limits, as robotic missions would not be able to detect any life forms that are different from the earth type organic structure. This is due to the lack of programming capabilities to recognise weird things that might be below the surface of Saturn's moon Titan, or beneath the seas of

Jupiter's biggest moon, Europa.

The debate extends to point out NASA's Viking program where the two Viking vehicles carrying miniature chemistry laboratories to test samples for alien life on



Mars reported in their findings, that the chemical reactions with the Martian soil were strange and not comparable to any thing seen on Earth, as well as to what any living organism would produce on Earth. This event reflects the crux of the debate bringing up arguments that robotic machines in this mission did what they were programmed to do, and were not capable of detecting any weirdness or to identify any strange non-carbon life. If it was a human biologist or biochemist this would have been resolved in few hours of time.

Casey Kazan (2011) reported the statistical figures of current and future mission of NASA as fifty plus robotic missions, researching and studying Earth as well as from

Mercury to Pluto and beyond in the solar system. Forty unmanned missions are in the development stage, and would be launched at the appropriate times carrying more advanced state of the art equipments to increase the depth

of research and study. Currently more space agencies such as ESA, RFSA, CNSA, ISRO, JAXA etc. are also developing their own unmanned missions. The main reason being that, unmanned missions are not costly and risky as manned missions.

Even though all the space agencies are keen on developing more unmanned missions, and while governments' are cancelling their manned missions as evidenced in President Obama cancelling of the NASA's Constellation program, more experts support manned missions in this debate. An astronomer and planetary scientist at Cornell University, Jim Bell supports manned missions along with Stephen Hawking, and his argument is as follows:

"Although astronaut missions are much more expensive and risky than robotic craft, they are absolutely critical to the success of our exploration program."

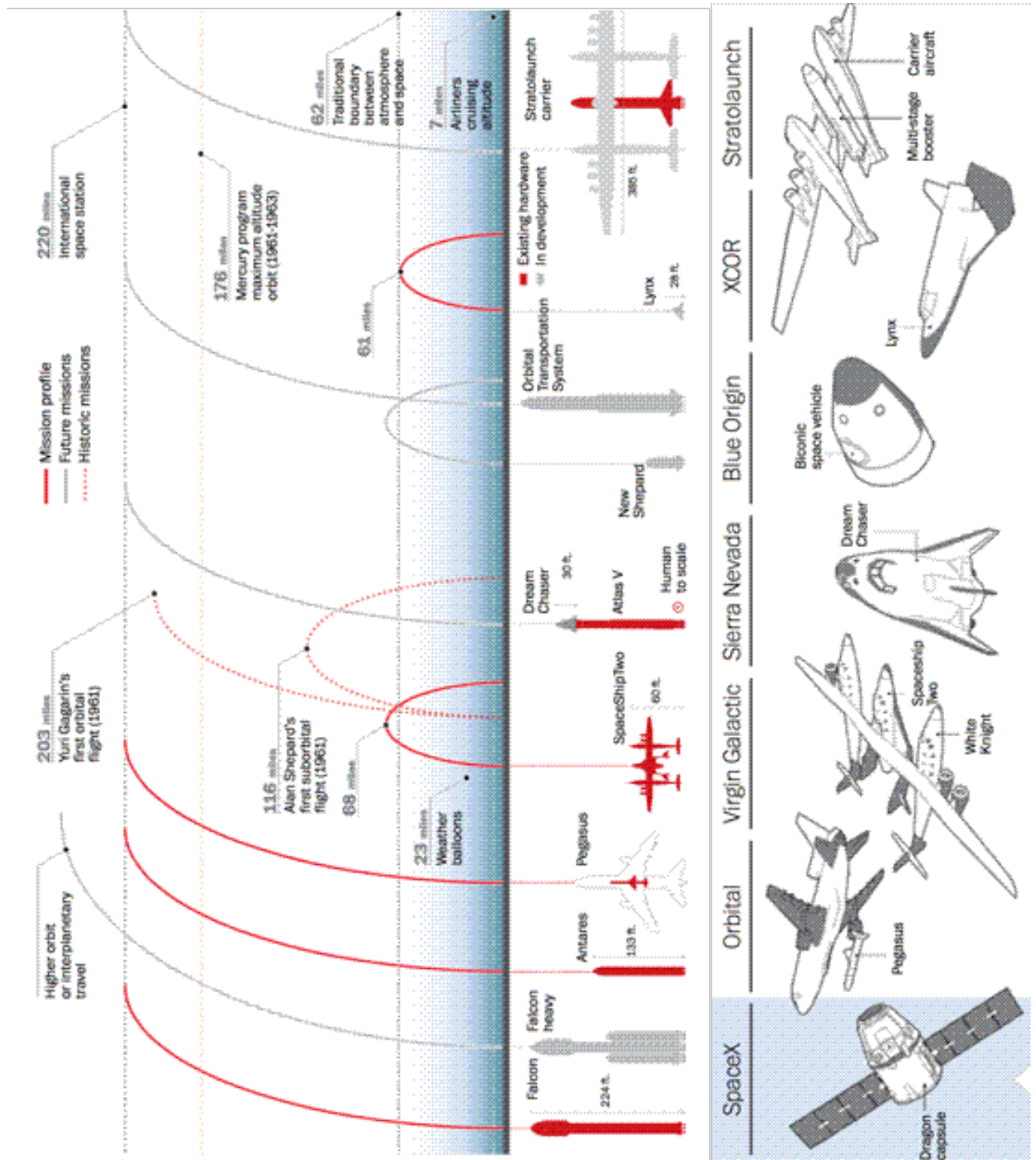


Fig.1: Launch capabilities of private space companies [Alberto Cuadra and Katie Park (2013)]

Current Focus on Space Exploration

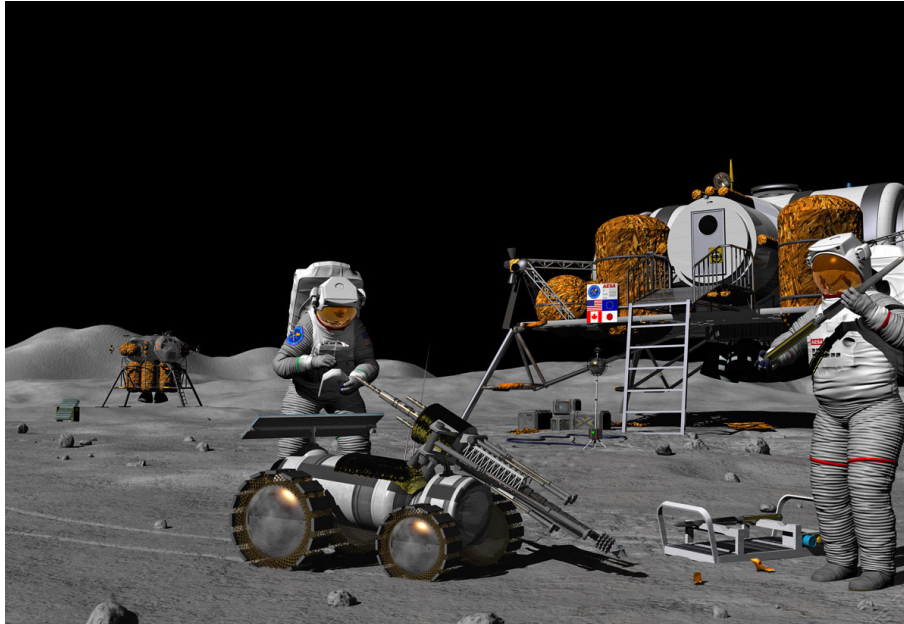
During NASA's 50th anniversary, Hawking proposed the allocation of 0.25% of the world's collective Gross Domestic Product (GDP) for space exploration and space colonization arguing that, "isn't human race's future worth a quarter of a percent?", but the arguments of Hawking will only save the seed of human life not the entire Earth's inhabitants.

While the survival of human race is looked up far into the future, the search for extra-terrestrial intelligence continues. So far no alien civilization has been detected and the physicists have offered three possible reasons which are given below. Most scientists favour the second option as a reason.

1. Life of any kind is very rare in the universe.
2. Simple life forms are common, but intelligent life rare.
3. Intelligent life tends to quickly destroy itself.

Since the cancellation of Constellation Program of NASA, most private companies have been involved in the space sector for various transportation requirements, such as the Space X company's dragon capsule to take

cargo to the International Space Station (ISS). At the same time, commercial space transportation is taking off and many of these projects are at their complication phase such as Virgin Galactic's space tourism. As has been said, previously most of launch vehicle capabilities were only a capability



of governments but now there is wide private sector involvement in having these capabilities. Following diagram (Figure 1) describes the launch capabilities of the private space companies.

As seen in figure 1, the private space company Space X has shown successful launch capabilities in the recent years, and they have been contracted by NASA to transport astronauts to International Space Station which is yet to be proven. At the same time, the company is planning to use their falcon heavy rockets to launch payloads to Mars. Virgin Galactic is another private space company mainly focusing on space tourism, making available facilities to public to explore space.

They had their successful test, and are now making arrangements to begin tourist flights in due course with the price tag of \$250 000 per seat.

Future trends in space exploration has been seen to take many dimensions starting from the

concept of spreading human race across the universe through the allocation of a significant fraction of the world's GDP for extensive research, and thereby inventing state of the art technologies to make it possible. An alternative proposal to provide access to public to explore space as space tourism is also

been projected.

The future is however, on the balance for manned or unmanned missions due to the consideration of their advantages and disadvantages. Nevertheless most scientists and engineers prefer to support manned mission to Moon and Mars in the future.

Lavanan Vengadasalam
Research Engineer – Space
Technology Division
Arthur C Clarke Institute for
Modern Technologies, Katubedda,
Moratuwa.