

Is a Manned Space Mission Necessary?

<https://www.firstpost.com/india/indias-manned-space-mission-may-not-be-a-giant-leap-6734121.html>

On 12th April, 1961, at 6.07 am GMT, the Soviet spacecraft Vostok 1 was launched from the Baikonur space facility in south Kazakhstan. A 27 year old pilot of the Soviet Air Force, Yuri Gagarin was blasted off into a low earth orbit and orbited the earth for 108 minutes before landing on the Kazhak steppe. This was the beginning of the era of manned space flight.

The space era had started 4 years earlier with the Soviet satellite Sputnik. This was also the beginning of the space race between the USA and the USSR. The Apollo program, part of the American effort to catch up with the Soviets in the space race was launched in 1960 and in 1969 Neil Armstrong became the first human to set foot on another heavenly body.

India's tryst with space started modestly with the launch of sounding rockets from Thumba in Kerala. The Indian space establishment, initially led by the visionary industrialist-scientist, Vikram Sarabhai, has evolved steadily into a giant scientific and technological complex. Established in 1969, Indian Space Research Organisation (ISRO) today employs more than 18000 people directly and runs more than a dozen research and manufacturing centers.

By almost any benchmark, our space establishment has performed remarkably well. Although initially it was dependent on technology from the US and the USSR (and later Russia), it has managed to indigenously develop some of the most complex and advanced technologies in the field. These include its workhorse, the Polar Satellite Launch Vehicle (PSLV) and the cryogenic engine required for its marquee launch vehicle GSLV.

ISRO has also demonstrated its technological capabilities in the field of satellite fabrication and launch. In 1975, it designed and manufactured India's first satellite Aryabhat which was launched by the Soviets. Since then, it has deployed many communications, remote sensing, broadcasting, navigation and scientific satellites. In addition, the vast satellite network is also being used for military purposes. ISRO is

currently one of the cheapest options available globally for launching commercial satellites. The two extraterrestrial missions, the lunar orbiter Chandrayaan 1 in 2008 and the Mars Orbiter Mission (MOM) in 2014 have been the crowning glories of India's 5 decades of engagement with space. These unmanned missions were not just state of the art technologically; they also showcased ISRO's ability to undertake complex missions at a fraction of the cost of the other space powers. Thus, the total cost of the Mars mission was around \$75 million, about a tenth of what NASA spent on a similar mission. The scientific payoffs of the satellite program as well as these unmanned extraterrestrial missions were substantial. Buoyed by the success of these missions, ISRO is planning future missions not just to the Moon and Mars but also to the Sun, Venus and even Jupiter.

However, what has grabbed the headlines is ISRO's plan to put humans into space in 2022. 15th of August, 2018, the Prime Minister, from the ramparts of the Red Fort, declared that India will send humans into space by the 75th anniversary of our independence in a program termed Gaganyaan. With this, India hopes to join the select club of Russia, USA and China who have put humans into space. Soon after the PM's speech, ISRO was granted Rs. 10,000 crores for the mission. The mission's 3 member crew will orbit the earth for about a week at a height of around 300-400 km.

Manned missions are of course more prestigious but also far more expensive and technologically challenging. They are expensive because unlike unmanned missions, one has to ensure that the crew comes back safely to earth. This means having a crew module with extra redundancies built in as a precaution against equipment failure. This in turn implies that the launch vehicle has to carry the extra weight of the crew module which means a whole new generation of launch vehicles which can carry the heavier payload. ISRO has already successfully developed and launched GSLV Mk3 which has this capability. Incidentally, this launch vehicle will also allow ISRO to launch heavier satellites.

The crew module being planned would splash down in the Arabian Sea after its mission is complete. When the module re-enters the atmosphere, the atmospheric friction generates a lot of heat. To keep the crew safe requires a special design for the module as well as specialized materials for the heat shield. These are being developed and a prototype has been tested. ISRO plans 2 unmanned missions to test all the systems before launching the manned mission in 2022.

The total cost of the mission will certainly be more than the 10,000 crores. The question then is whether it is worth spending so much on a manned mission? There is of course the issue of national pride which such achievements bring with them. Apart from this nebulous and hard to measure benefit, it turns out that there is almost nothing which a manned mission can achieve, which cannot be achieved by an unmanned mission, at a fraction of the cost. The usual benefits cited are carrying out experiments, developing materials with novel properties and growing protein crystals in the microgravity environment in space. However, the International Space Station's experience in this regard has been less than satisfying and the advertised benefits have not materialized. The other benefit cited is technology transfer to industry. Here too, the oft cited examples are of Velcro and Teflon being developed by NASA. It turns out that neither of these was developed by NASA. There is however one area in which humans in space can outperform robotic machines- the deployment and repair of instruments in space. The best example of this was the repair of the Hubble Space telescope's mirror in 2009.

Thus apart from a boost to our national pride, the scientific and economic rationale of an extremely expensive manned space mission remains unclear. The resources might have been better used for many unmanned missions as well as satellite development. However, we as a nation don't seem to have any issues with our elected leaders spending more than 3000 crores on a Made in China bronze behemoth so that we can boast of the tallest statue in the world. By that yardstick, the Gaganyaan mission is certainly money well spent.

Shobhit.mahajan@gmail.com

9811222582

May 19, 2019