



HUMAN SPACEFLIGHT - A TIMELY AND BOLD DECISION BY INDIA

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Seeking to put humans in orbit or land them on the moon is the ultimate challenge which combines both - the space science and technology, as well as space biology. While the Soviets were the first to send a human into space on April 12, 1961- Yuri Gagarin - the Americans were not far behind and achieved the feat three weeks later, the same year. Space science and technology has since grown by leaps and bounds, with many more humans being sent into space by these countries, and a permanently occupied space station in orbit. Yet, China is the only other country to have attempted this feat by putting a human in orbit in 2003.

The public reaction on hearing the Prime Minister's announcement of sending a human into space by 2022 during his Independence Day address from the ramparts of Red Fort on August 15, 2018 was that of jubilation and exhilaration, though some would contemplate - 'Why Now?'

The significance of a first human spaceflight cannot be underestimated. Optics aside, it is an essential morale booster for those associated with the space programme. It rejuvenates national pride. It re-kindles the aspirations of youth. It generates employment. It sharpens scientific temperament. Most important of all, it gives an opportunity for ISRO to develop many spin-off technologies and gives an opportunity for the new space phenomenon to find a place in the aerospace ecosystem.

It may appear a rather hasty decision, but ISRO has been on the job for many years to realise the vision - to send an Indian into space from Indian soil. ISRO has been working on developing the required technologies since 2004. One of the reasons for not realising this mission earlier was the non-availability of a suitable launch vehicle. With the orbital module weight of 7 tons - including a crew module mass of 3.7 tons¹ - it was beyond the capability of PSLV rocket. GSLV Mk-III has now been earmarked for

the mission, having flown two successful missions. Most of the indigenously developed technologies required for the mission have already been tested. These include crew module re-entry, reusable space vehicle, crew escape mechanism in case of a glitch during launch, a deep space network and even the astronaut's space suit. These technologies have been developed from ISRO's regular annual research and development budget, as claimed by the chairman of ISRO in a press conference at New Delhi on August 28, 2018.² Is this reason enough to take the leap? Is the timing right? The gains may sound impressive, and there is a reasonable chance for a successful mission, but any deviation would result in a setback for India's space programme. And hence the announcement of the mission (named Gaganyaan) should be seen as a bold decision by the Government.

The Americans were faced with a similar dilemma at the peak of the cold war in the aftermath of the Sputnik event of 1957. Worried of national condemnation on being beaten by the Soviets in putting a satellite in orbit, the US space establishment embarked on a mission under the newly created NASA to orbit a human around the earth under project 'Mercury' in 1959. Both the American and Soviet spaceflight programmes carried out space flight trials with animals on-board. The Americans suffered a setback again when the Russians beat them once more by sending a human into space on April 12, 1961. Though the Americans did succeed soon enough,

there were many setbacks on later missions in the prelude to the Apollo mission to the moon; the most gruesome disaster being the fire which erupted in the crew module during the Apollo-1 pre-flight test in 1967. Both, the Soviets and the Americans did embark on pioneering space missions which involved considerable risk financially as well as to the safety of the human element. They did encounter constraints of time for developing the technologies required for a human spaceflight mission from scratch. However, national pride and the urge to be supreme in a space race at the peak of a cold war was an overwhelming reason for doing so.

For India to embark on such a mission, sixty years after the pioneering event, it needs to have clearly stated objectives, and a well deliberated strategy for India's space outlook for the next two decades, lest it becomes just another feather in the cap for ISRO. Can the objectives be met through a robotic mission? Can India partner with the International Space Station (ISS) for getting the human spaceflight experience? Can India piggy back on China's open offer to participate in its space station programme? These alternatives may well be worth considering for future missions to gain experience prior to sending humans beyond earth orbit.

With the mission being slated for launch in 2022 – to mark India's 75th Independence Day celebrations – and with two trial unmanned missions planned before that, the time available

is rather short. ISRO, however, is upbeat for the task ahead and appears to be working with great zeal and enthusiasm. This was evident in the exclusive stall on Gaganyaan, put up by ISRO at the 6th Bengaluru Space Expo 2018. This stall, which displayed the crew capsule and astronaut suit developed by ISRO, saw a landfall in visitors, which explains the popular sentiment and public opinion.

Though a certain amount of distance has already been travelled and it's not going to be a new beginning, it's a beginning all the same, as putting all the required technologies together is the real task ahead. ISRO may have the competence, but doesn't have dedicated infrastructure, which includes the testing and training facilities. These facilities need to come up alongside, which will then be utilised for future manned space missions. It is also a known fact that though ISRO's capabilities are proven in multiple segments of space science and technology, the capacities are limited by infrastructure and skilled human resources and thus any additional task would see pooling in of resources from other ongoing projects. Therefore, much of the work related to ramping up of infrastructure and supply of hardware needs to be outsourced to industry in a major way. The chairman of ISRO has indicated an ongoing effort to outsource manufacturing of proven technologies with a transfer of technology to the private sector, which would enable ISRO to dedicate the spare capacity

towards the human spaceflight programme. Post the successful launch of PSLV C42 on September 16, 2018, the chairman also stated that future PSLVs will be manufactured by the private sector³. What needs to be ensured is that quality assurance standards are not compromised in a zero error technology sector and selection of the right partners from the private sector where there is very little expertise so far.

ISRO also does not have the experience in human physiology aspects and infrastructure for training astronauts. This is perhaps the most critical mission requirement, and all technology for the mission, including the human spaceflight capsule, is built around the physiological requirements for the astronauts. The Institute of Aerospace Medicine – an Indian Air Force establishment – is being relied upon for such expertise, though an agreement has also been entered into with the French Space Agency, CNES, which will share their expertise in astronaut health monitoring, space medicine, life support, radiation protection, space debris protection and personal hygiene systems⁴. Astronauts for the mission are yet to be selected. Training these talented men and women in a truncated timeframe will be a daunting task, considering the lack of expertise and facilities within the country. But the silver lining is the opportunity it provides for streamlining the astronaut selection procedure and training curriculum and create world class astronaut training infrastructure for future manned space

missions. The plan for two unmanned trial missions prior to the manned mission seems to be a brilliant strategy. It would ensure all anomalies and observed parameters are corrected and flight tested to recheck, before sending the astronauts into space. This will definitely enhance the safety factor of the mission.

There is no doubt that with the focus shifting towards a manned spaceflight and all energies diverted to make it happen within the deadline and with the best brains on the job, it will surely be a success. Such an enormous feat being achieved within a short timeframe and as an indigenous effort should become the spike required to take India to the next level of manned missions beyond earth orbit. This will propel India into the exclusive league of nations to have achieved this feat. India is at the threshold of a space renaissance and the opportunity to create history should not be lost to under preparedness. The project is a challenge, but India has the knowledge and expertise required to successfully complete this mission. The Gaganyaan mission should therefore be treated as a national mission rather than ISRO's alone. It should be the first in a series of manned space missions leading to a permanent Indian space station and eventually manned Moon and Mars missions. With the US already working on orbital gateways and moon stations, India should not allow the capability gap to increase any further. With 30 months to go for the first unmanned mission, the

countdown has begun. India is well on its way to becoming the fourth nation to put a human in earth orbit. The moon could be the next destination.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

Notes

¹ "Indian Manned Spacecraft", at <http://www.astronautix.com/i/indianmannedspacecraft.html>, accessed on September 22, 2018.

² Rekha Dixit, "Gaganyaan: ISRO ready for the daunting task", August 28, 2018, at <https://www.theweek.in/news/sci-tech/2018/08/28/gaganyaan-a-daunting-task-ahead-for-isro.html>, accessed on September 15, 2018.

³ "Launch of PSLV C-42 / NovaSAR & S1-4 Mission from Sriharikota - LIVE", DD National Streamed live on 16 Sep 2018, at <https://www.youtube.com/watch?v=Petx-I5VnwE>, accessed on September 20, 2018.

⁴ Rasheed kappan, "Isro strikes deal with French space agency on Gaganyaan", DH News service, September 06, 2018, at <https://www.deccanherald.com/state/isro-strikes-deal-french-space-691479.html>, accessed on September 16, 2018.