Human Spaceflight – the Indian way

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Although not nearly as sophisticated or ambitious as the Orion capsule, India's very own crew capsule was flight tested just days after its U.S. counterpart. As a result, the Indian Space Research Organisation (ISRO) is hitting the headlines and in developing a crew module adapted to its new launch vehicle in only a year at a cost of some €20 million, it has confirmed the merit of its methods.

On 18 December, when the GSLV-III launcher, the most powerful India has ever built, loomed large out of the dawn mist on its Sriharikota launch pad, its silhouette reminiscent of Ariane 5 left no doubt that India was about to take a great step forward. Even though there were no astronauts on board and qualification for human spaceflight is still some way off, the launch vehicle stood proud in the eyes of a people who, since the sensation created by the Mars Orbiter Mission (MOM), never miss an episode of their nation's space adventures. A few hours later, ISRO would at the same time bring off the maiden flight of India's heavy-lift launcher and clear the path for crewed spaceflight.

Conceived in record time and at record cost

The CARE capsule (Crew module Atmospheric Re-entry Experiment), a pathfinder for India's future crewed spaceflight missions, accomplished a flawless suborbital flight after riding on the first qualification flight of the new GSLV-III launcher. Tipping the scales at 3.6 tonnes, it separated from the launcher at an altitude of 125 kilometres. The data acquired during its atmospheric re-entry will supplement the results of the smaller-scale experiment flown in 2007. Three pairs of parachutes opened in succession from an altitude of 15 kilometres to slow the capsule's descent before it splashed down off the Andaman Islands in the Bay of Bengal, where it was retrieved by an Indian coast guard vessel. Not for the first time, ISRO executed this programme in record time and at a record cost of just €2 million to develop and manufacture the capsule and €18 million to adapt the launcher. Inspired by India's frugal engineering concept, the capsule launched is more than just a demonstrator as it is structurally identical to future operational flight models. For its very first flight the the GSLV-III launcher flew without its future upper stage cryogenic engine, still in development. Its main stage is powered by two liquid-propulsion Vikas engines, derived from Ariane's Viking. At full capacity, the new launcher will be able starting in 2017 to boost 4 tonnes into geostationary transfer orbit and 8 tonnes to low-Earth orbit. This performance could ultimately lead to a future upgraded spacecraft with a service module able to accommodate three 'vyomanauts' (the term ISRO favoured over 'gaganauts').

Reconciling space exploration and development

India reveres its astronauts. The first in space was Rakesh Sharma, flying on a Soviet mission in 1984. Kalpana Chawla, truly an icon for the sub-continent, lost her life in the Columbia space shuttle tragedy in 2003. And American-born astronaut Sunita Williams, whose videos of life on the International Space Station (ISS) have been seen around the world on YouTube, has maintained close ties with her father's country of origin. But despite these ambassadors adored by an entire nation, human spaceflight is not part of its space policy DNA. India initiated its space programme in the 1960s under the guidance of Vikram Sarabhai, who expressly steered away from planetary exploration and crewed missions, focusing instead on technologies to help foster the country's socio-economic development. In the decades that followed, ISRO stood out through its ability to develop mature space applications, from telecommunications and Earth observation to its navigation programme currently being deployed, and through its successful distribution of space services directly accessible to Indian citizens. The diversification undertaken with missions to the Moon and Mars and the launch of a crew module should not be overestimated, as the human spaceflight ambitions announced in the wake of the 2008 lunar mission were put on standby after the two successive launch failures of GSLV in 2010. The latest five-year plan (2012-2017) does not include crewed spaceflight and has reduced exploration to a bare minimum, covering only the first Mars mission and preliminary studies for a second lunar mission. India's budget choices clearly favour space applications and the entry into operational service of the GSLV-II and GSLV-III launchers. The cost of the current Mars mission—€59 million over two years out of an annual budget of around € 1 billion—accommodates the Sarabhai doctrine. As Dr. K. Radakrishnan, ISRO's former Chairman, often points out, the hope the space programme gives to the nation and its impact in motivating younger generations amply justify the investment, which amounts to about one-tenth of what Indians spend on fireworks during Diwali, the traditional Hindu 'festival of lights'.

Vyomanauts waiting for government green light

A study dating back to 2007 puts the total cost for India of human spaceflight at around €1.6 billion.
According to ISRO, the costs would be spread over seven years up to the launch of the first vyomanaut.
Only €19 million have been released so far to develop and build the first capsules (€8 million), human-rate the launcher (€3.5 million), outsource contracts for certain critical technologies (€5 million) and conduct preliminary engineering studies (€2.5 million). The go-ahead for a human spaceflight programme now hinges on a decision from Prime Minister Narendra Modi, but India has already shown its interest in the past in joining the ISS programme.
Currently, ISRO rather advocates the need to position the country as a key partner in a future crewed mission to Mars, which he believes is bound to be international.

Adapting the Indian model to crewed missions

The support promised by Russia in 2008—India's crew module was initially to be derived from the Soyuz capsule—finally did not materialize. As with the development of cryogenic technology, ISRO ended up going it alone and applying its famously shrewd methods. But doing things differently does not mean having to compromise on quality, as the reliability of the PSLV launcher attests. However, due notably to the fact that it relies on a single test model, the Indian method theoretically comprises a greater degree of risk than western space manufacturing methods. If funding is cleared for a human spaceflight programme, it will be interesting to see how ISRO squares its methods with the level of risk management that goes with sending humans into space. For now, India's response is eminently empirical; as the launcher will be human-rated once it has achieved 6 consecutive successful flights. Until then, a vyomanaut training centre is expected to be set up near Bangalore's Kempegowda international airport. Initially, it would train just four vyomanauts selected from a group of 200 military pilots and should cost around €130 million. The third launch pad at the Sriharikota launch base, yet to be built, would subsequently be adapted for crewed flights. Dedicated to GSLV and designed chiefly to accommodate the base's increased launch rate, this new pad will have retractable launch towers and is scheduled to be operational in 2016 at a cost of €60 million. Like the Indian people whose fervour for space is unprecedented and possibly unrivalled anywhere in the world, the Prime Minister is not afraid to show his enthusiasm for space and can very often be seen in the control rooms. If the human spaceflight programme eventually gets the green light, the date of the announcement will no doubt be carefully chosen.

**source : http://www.cnes-multimedia.fr/cnesmag/CNESMAG64.pdf*