



PSLV-C39: AN OPPORTUNITY FOR PERFECTION IN LAUNCH CAPABILITIES



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The Indian Space programme faced a setback, with the failure of its most trusted rocket - the Polar Satellite launch Vehicle (PSLV), to put a satellite into orbit. The PSLV C39 had a perfect launch at 7:00 pm on August 31, 2017. It was carrying the eighth satellite of the Indian Regional Navigation Satellite System (IRNSS), the IRNSS-1H. Indian Space Research Organisation's (ISRO) attempt to commission the country's indigenous navigation and positioning services became unsuccessful as the heat shield of the PSLV rocket did not separate, carrying the IRNSS-1H satellite enclosed in the fourth stage into sub-geosynchronous transfer orbit. It is now just a piece of junk in Low Earth Orbit which will eventually decay and burnout as it re-enters the atmosphere.

IRNSS is an independent Indian Satellite based navigation and positioning system for critical national applications. The main objective is to provide reliable Position, Navigation and Timing services over India and its neighbourhood with a fairly good accuracy. It consists of seven satellites, three satellites in Geo-stationary orbit (GEO) and four satellites in Geo-Synchronous Orbit (GSO). This constellation of seven satellites was named as "NavIC" (Navigation with Indian Constellation). All the satellites will be visible at all times in the Indian region. All the seven Satellites of NavIC, namely, IRNSS-1A, 1B, 1C, 1D, 1E, 1F and 1G were successfully launched by PSLV rockets on July 02, 2013, Apr 04, 2014, Oct 16, 2014, Mar 28, 2015, Jan 20, 2016, Mar 10, 2016 and Apr 28, 2016 respectively and all were functioning satisfactorily from their designated orbital positions.¹ However, IRNSS-1A, the first to be launched, developed a snag with all its three on-board atomic clocks malfunctioning. The clocks are a critical component in providing accurate locational data. IRNSS-1H was a replacement satellite which would have made the NavIC system operational.

1 | www.capsindia.org

The PSLV has played a key role in ISRO's success over the years and has had record launches, including putting into orbit 104 satellites in one go earlier this year. This is only the second time in its history that the PSLV had failed. The only failure of the launch vehicle was when the rocket (PSLV-D1) had failed to ignite after the second stage separated on September 20, 1993, while attempting to launch IRS-1E, a remote sensing satellite. Since the 1993 setback, different versions of the PSLV have had 39 successful launches putting into space all the spacecraft it was integrated with- the first being on October 15, 1994 and the last one on June 23, 2017.²

While the exact reasons for this failure will be known after an investigation, which is being conducted by a committee of experts, the setback raises questions on the technology used and the level of perfection achieved. ISRO is banking heavily on PSLV for indigenous and foreign satellite launches and at least two important future projects - the second mission to Mars and Chandrayaan-2. While the second mission to Mars is still in the planning stage, work on Chandrayaan-2 has reached advanced stages with the development of the lander complete.³

The failure of the mission is particularly disheartening as the IRNSS-1H satellite was jointly assembled and tested by ISRO and a Bengaluru-based private company, the first time a single private company was involved in building a satellite. The satellite though is very unlikely to be the cause for failure of the mission. The space organisation has opened up to private companies for building satellites. What would hurt most is the dented reputation of ISRO and the consequent loss of revenue from the commercial launch business. Between May 1999 and Jun 2017, ISRO launched 209 satellites for 28 countries on co-rideshare basis, all on PSLV. The annual revenue through foreign satellite launches grew from Rs 1051 Cr in 2011-12 to Rs. 1795 Cr in 2015-16, and the number of launches per year has been steadily increasing.⁴It may take many more perfect launches to get the reputation back on track.

With an enviable track record, the failure of the mission this time almost comes as a surprise. This is especially so as the lift-off and the stage separation of the first and second stages, which are the most challenging parts of the mission, went off smoothly. In comparison, the heat-shield separation is a relatively minor operation which takes place once the rocket crosses an altitude of 100-110 km, and the temperature in the absence of the heat-shield will no longer damage the satellite. The failed mission serves as a reminder that utmost care and scrutiny are required before every single launch. The exact cause of failure of heat shields to separate has to be studied with the greatest attention given to even the minutest detail. Herein lies the opportunity for ISRO to prove that 'Failure is a stepping stone for success'. Though ISRO is confident that there is no structural or design flaw, it is

critical for the analysis to be completed and remedial actions implemented before the next launch of PSLV or GSLV. The criticality is also in view of the 'Human Spaceflight Programme' for which no glitches can be afforded.

The failure of PSLV C39 has to be seen as an opportunity for perfection in launch capabilities. ISRO would do well by revisiting the rocket manufacture and assembly procedures and putting in more checks and balances in the operating procedures. A technology upgrade could be considered. The next launch of the PSLV will be very significant. ISRO's customers and millions of Indians would be looking up to it to be a success, and so will be the space organisation. A lot depends on it. The failure of the heat shield of PSLV-C-39 could well be a blessing in disguise for achieving perfection and precision in launch capabilities. With the ongoing efforts of ISRO in pinpointing the cause of failure and implementing remedial measures, the silver lining is clearly visible.

(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])

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Notes

¹ 'Satellite navigation, at <http://www.isro.gov.in/spacecraft/satellite-navigation>, accessed on September 01, 2017.

² Chethan Kumar, "Isro's workhorse PSLV: 24 years, 39 successful launches, only 2 failures", August 31, 2017, at <http://timesofindia.indiatimes.com/india/isros-workhorse-pslv-24-years-40-successful-launches-only-2-failures/articleshow/60312099.cms>

³ Ibid, n-2.

⁴ Chethan Kumar, "Defying Gravity, Staying Grounded", *Times of India*, July 05, 2017, Times Nation, New Delhi edition.