

ISRO achieves another milestone with *two-orbit mission*

India's workhorse PSLV completes a record fifth mission in a calendar year as it successfully launches eight satellites, including five from other nations

text | Dr Ajey Lele



On September 26, 2016, Indian Space Research Organisation (ISRO) successfully launched eight satellites into the Low Earth Orbit. This PSLV C-35 mission is unique in many ways. It once again proved the reliability of India's most dependable workhorse, the Polar Satellite Launch Vehicle (PSLV). This was PSLV's 36th successive, successful launch. Also, this mission has send a key Indian weather satellite into the space. With this mission, ISRO for the first time placed satellites in different orbits in a single attempt. Few in the world have the capability to launch satellites into two different orbits in a single mission. Recently, European Union's Vega launch vehicle demonstrated this capability.

PSLV C-35 launched a 371-kg weather satellite (SCATSAT-1) into the Polar Sun Synchronous Orbit (Polar SSO) at an altitude of 720 km. As per the standard PSLV configuration, this satellite was delivered in the orbit approximately within 17 minutes after the launch. Here the real technical challenge for ISRO scientists was to ensure the correct placement of the remaining seven satellites into a different orbit. This has been one of the longest missions ever undertaken by ISRO and it lasted for 2 hours and 15 minutes. The last and the fourth stage of the PSLV launcher was to perform the required maneuvers and the main challenge was to switch on and off the engine twice during a period of approximately two hours. With the cut-off of the fourth stage, SCATSAT-1 satellite was placed in the orbit. Later, after

1 hour and 5 minutes, two engines of PSLV fourth stage were reignited and fired for 20 seconds. This allowed the craft to enter into an elliptical orbit, and subsequently 50 minutes later the PSLV's fourth stage fired its engines again for another 20 seconds. This second firing ensured the entry into a correct orbit for remaining seven satellites.

SCATSAT-1 is an important addition to the Indian inventory of meteorological satellites. The satellite would assist India's weather forecasting services and also contribute in improving the existing cyclone detection and tracking services. SCATSAT-1 can also

be considered as a replacement satellite for Oceansat-2, which was launched in 2009 with a five years of designed life. Because of the enhanced application potential of SCATSAT-1, the new replacement unit is expected to provide data inputs with greater accuracy.

In this mission, apart from the weather satellite, there are

two other satellites with an Indian stamp on them. These are PISAT and PRATHAM – the satellites developed by educational institutions. The remaining satellites include three commercial payloads from Algeria (ALSAT-1B, 2B and 1N) and a payload each from Canada (NLS-19) and the United States (Pathfinder-1).

The important aspect of this mission that should not go unnoticed is that India is encouraging university students to develop satellites. ISRO has been promoting the participation of students in its space programme for the last few years. Since 2009, ISRO has launched nine student

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satellites. ISRO provides technical guidance in designing, fabrication and testing to the student community. And it is the students who have to do the actual planning, designing and construction of the satellites.

One such 'product' is PRATHAM which is a result of almost one decade of convincing, conceptualisation, planning, learning, experimentation, designing and production by the students of Indian Institute of Technology-Bombay (IIT-B). The 10-kg microsatellite has been designed to measure the Total Electron Count (TEC) in the ionosphere with a resolution of 1km x 1km location grid. This satellite has been developed

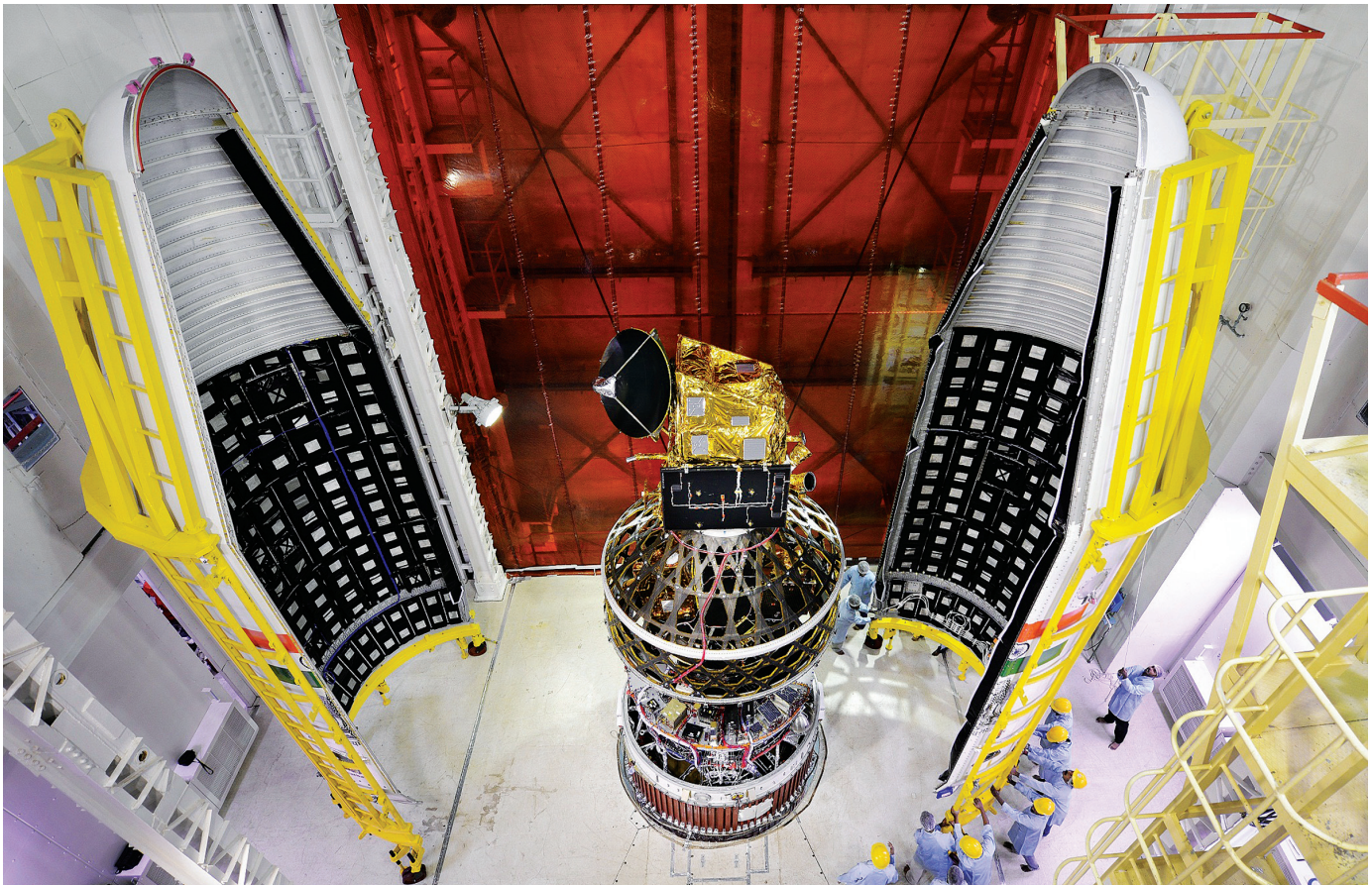
Since 2009, ISRO has launched nine student satellites

with an approximate budget of ₹1.5 crore. The students of IIT-B worked hard to make their dream a reality. Initially, the pioneers of this idea thought it would take them around two years to realise their dream. However,

from the drawing board to the actual launch, it took eight years and seven graduating batches to finish the job. With the student community being the Principal Investigator (PI), several batches of students ensured that when they pass out, the satellite's mantle was passed on systematically to the next.

As this IIT-B satellite would be measuring the electron count in the ionosphere, this information could assist in detecting tsunamis,

SCATSAT-1 spacecraft integrated with PSLV-C35 with two halves of the heat shield





Fully integrated PSLV-C35 with Mobile Service Tower withdrawn to parking end

reduce communication errors, and improve the accuracy of the Indian alternative to the GPS system.

Other co-passenger satellite carried by PSLV C-35 is PISAT, built with the involvement of students from PES University, Bengaluru and its consortium. The 5.25-kg remote sensing nanosatellite will take snapshots of Earth, with the focus on India. It has a three-axis image stabilising system and the telemetry and telecommand systems on board the satellite will help in tracking and maintaining the satellite post launch.

The PSLV C-35 launch has proved yet again the innovative character of ISRO, as the Indian space agency has always been a forward looking organisation ensuring maintenance of socio-economic focus of its space agenda. Now it is also increasingly engaging young minds in order to ensure that the existing group of rocket scientists pass on the mantle of leading all future missions to the young blood.

INDIAN STUDENT SATELLITES PLACED IN ORBIT BY ISRO

| SL. NO. | DATE | NAME | MASS (KG) | STUDENT GROUP |
|---------|--------------------|---------------|-------------|----------------------------------|
| 1 | APRIL 20, 2009 | ANUSAT | 40 | MIT CHENNAI |
| 2 | JULY 12, 2010 | STUDSAT | LESS THAN 1 | 7 ENGINEERING COLLEGE CONSORTIUM |
| 3 | APRIL 20, 2011 | YOUTHSAT | 92 | INDIAN AND RUSSIAN UNIVERSITIES |
| 4 | OCTOBER 12, 2011 | SRMSAT | 10.9 | SRM UNIVERSITY, CHENNAI |
| 5 | OCTOBER 12, 2011 | JUGNU | 3 | IIT-KANPUR |
| 6 | JUNE 22, 2016 | SATHYABAMASAT | 1.5 | SATHYABAMA UNIVERSITY, CHENNAI |
| 7 | JUNE 22, 2016 | SWAYAM | 1 | COLLEGE OF ENGINEERING, PUNE |
| 8 | SEPTEMBER 26, 2016 | PISAT | 5.25 | PESIT AND CONSORTIUM OF COLLEGES |
| 9 | SEPTEMBER 26, 2016 | PRATHAM | 10 | IIT-BOMBAY |