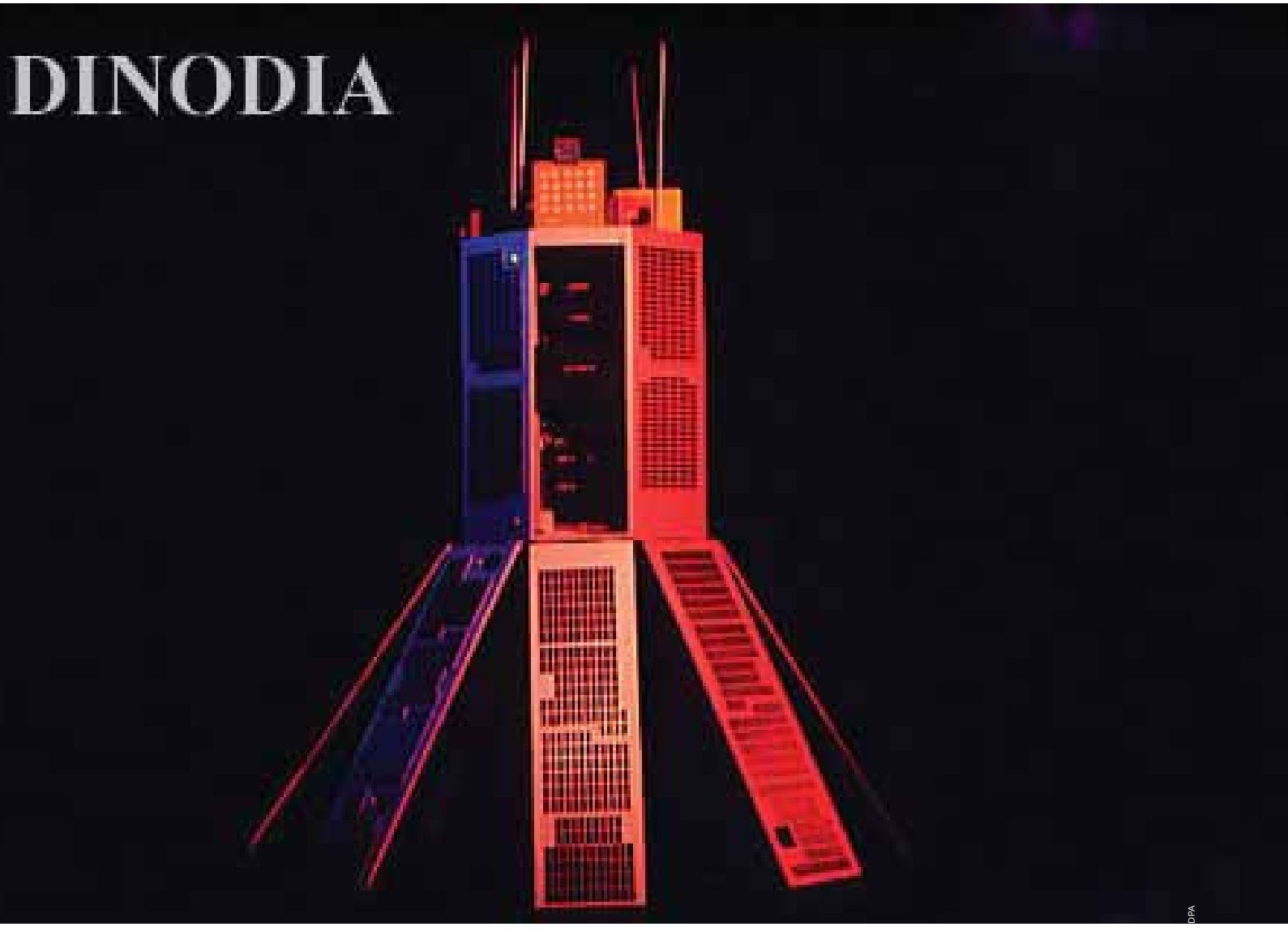
On a new Orbit

The space progamme in India started off modestly in the 1960s, but has taken off on an exciting journey of late. The recent launch of yet another satellite, writes **Roshesh. P,** establishes India's emergence as a significant space and satellite power



INDIA steps across the threshold of its 60th year of Independence, firmly securing another milestone in advancing its space technology. The September launch of the GSLV-F04 put into orbit the Insat 4CR satellite, not just taking India's satellite launching capabilities a notch higher in the world market, but also augmenting the country's booming television and telecommunication sectors.

The Insat 4CR satellite will for the next 10 years provide direct-to-home television broadcasting, video picture transmissions and digital satellite news-gathering services from its geo-stationary orbit. The launch is also a pointer to India's ambition to be a significant player in the race for the $2.5 billion global satellite launch business.

Even as it celebrates the success of the GSLV-F04, the premiere national space agency — the Indian Space Research Organisation (ISRO) — is preparing the launch of the first GSLV-Mark III series. Slated for launch in early 2009, it will arm ISRO with the competence to launch four-tonne payloads into geo-transfer orbit.

For ISRO, 2007 has been a resounding success in determining its capabilities in high end and critical technologies. "ISRO in fact has managed around two launches every year in the last five years. Now it will be more than four a year," explains G. Madhavan Nair, chairman of the premier space body.

The Space Capsule Recovery Experiment in 2007 was a triumph, marking the beginning of a new era for the Indian space programme. Scientists can now have experiments conducted in arduous micro gravity environments of space and be assured that the samples will land safely back on earth. It also bears testimony to the fact that India is now spearheading vital technologies like aerothermodynamics, recovery through deceleration and floatation systems, navigation, guidance and control. These technologies will further find applications in re-recoverable and reusable launch vehicles, as well as in future manned space missions.

The Indian space programme started modestly in the 1960s with the launching of small sounding rockets to investigate the ionosphere.

With its first successful launch of a domestic satellite by an indigenously built rocket in 1980, India has had an exciting journey into space over the last two decades. India aims at tripling its current five-year space budget to nearly $12 billion by 2012, in order to launch more satellites and rockets for local and foreign customers. The country is also busy preparing the ground to send an astronaut into space in the next decade.

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SCANNING THE SKIES: For ISRO, 2007 has been a resounding success in determining its capabilities in high-end technologies

Launched in the 1980s, Insat is the largest domestic communication satellite system in the Asia-Pacific region, providing services in telecommunications, television broadcasting, meteorology, and disaster warning. Meteorological data from Insat is used for weather forecasting and specially designed disaster warning receivers have been installed in vulnerable coastal areas for direct transmission of warnings against disasters like cyclones.

There have been several innovative applications of the Insat system in a country with an expansive demographic spread. ISRO has always stressed on shared community use of its advanced technologies. It is only in recent years that the commercial potential of its technologies are being tapped and enhanced.

Space-based telemedicine has enabled people in the remotest corners of the country to access super-specialty medical care. Around 230 hospitals are on this telemedicine network, bringing together 190 small clinics in remote rural areas in touch with medical experts in 40 super-specialty hospitals in major cities.

Edusat, launched in 2004, was the first thematic satellite dedicated to educational services. It took one-way TV broadcast, interactive TV, video conferencing, computer conferencing and web-based instructions to more than 10,000 classrooms all over the country.

With the moon being the most tantalising dream mission for any country, India has now embarked on its own — Chandrayaan-1, set for launch in early 2008. ISRO plans to carry out high-resolution mapping of the moon, creating a three-dimensional atlas of regions that are of scientific interest. The spacecraft will carry six Indian scientific instruments, besides two from America's National Aeronautics and Space Administration (NASA), three instruments from the European Space Agency and another from the Bulgarian Academy of Sciences.

A Deep Space Network (DSN) station is being completed about 40 km from Bangalore, consisting of fully steerable 18m and 32m diameter antennas, to

track Chandrayaan-1 as well as for future missions.

"There's global interest in exploring the moon," observed Roddam Narasimha, professor emeritus at the research body National Institute of Advanced Studies. "In the last few years, ISRO has built a robust launch capability. They can now afford to think of a lunar mission without looking at how much money is being spent."

ISRO is working to develop an indigenous manned space vehicle in about eight years. It will be designed to carry a two-member crew to low earth orbit. A manned mission is expected to cost more than $2.5 billion and will be undertaken once approved by the government, according to ISRO chairman Nair. The organisation ultimately hopes to develop a fully autonomous manned space vehicle, to be launched by the GSLV (geosynchronous satellite launch vehicle).

Manned space programme studies have been going on for the past few years at ISRO and an overview of the concept developed was presented to 80 senior scientists from across the country in November 2006, says Nair.

The space agency's major emphasis in the coming years will be to meet the growing demand for transponders, increasing the capacity to about 500, from the current 200.

Scientists at ISRO are also working to produce an Indian Regional Navigational Satellite System (IRNSS) – a constellation of seven satellites – to provide navigation and timing services over the Indian subcontinent, marking another step toward establishing an indigenous satellite navigation system.

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The space agency has also initiated a GPS and GEO Augmented Navigation system called Gagan with the Airport Authority of India to enhance accuracy of air navigation and therefore, safety, in the country.

Gagan is also expected to provide satellite-based navigation services in the Asia Pacific region. As part of advanced technology initiatives in the area of air-breathing propulsion, a stable supersonic combustion has been demonstrated for nearly seven seconds with inlet air at Mach-six. This takes the country on par with countries like Russia, China, Japan, and Australia that are in the ground test phase; the USA alone has conducted an in-flight demonstration of this technology so far.

ISRO is now planning to use this technology to flight test an integrated Scramjet propulsion system to demonstrate air intake combustion and nozzle, using its Rohini Sounding Rocket.

While the primary objective of ISRO has been to make sure that space technology finds applications that are beneficial to Indian society, it has evolved a step ahead. Tapping its technological know-how, it has of late begun to reap commercial benefits too. Antrix Corporation Ltd was expressly created in 1992 to market space services and hardware in the international market. In fact this commercial wing raked in revenues of over $100 million in 2005-06. These figures are expected to cross the $125 million mark this year.

India's Polar Satellite Launch Vehicle (PSLV-C8) successfully launched AGILE, a satellite of the Italian Space Agency, in April 2007 under a commercial agreement. Recently, ISRO inked a pact with a European company for joint development of communication satellites for the international market.

ISRO's launch contracts are competitively priced and with the launch of GSLV-MkIII, these rates could be slashed by half.

"Chandrayaan-1 will be followed by a multi-wavelength astronomy satellite, Astrosat, and a climatic research satellite Megha-Tropiques. These missions will be followed by Chandrayaan-2 and Astrosat-2 for pursuing scientific exploration," says Madhavan Nair, stressing on ISRO's goals toward further space discoveries.

A new generation of micro satellites that pack in a lot more in less than 100 kg is also part of the agency's plan toward making space systems more compact. With emphasis on understanding the origin and evolution of the solar system, technology development could be initiated in the coming years towards exploration of Mars, asteroids and comets.

EVOLVING INNOVATIVE APPLICATIONS

ISRO chairman G. Madhavan Nair says the most significant aspect of the Indian space programme has been to realise the vision of achieving self-reliant capability in building a variety of satellites, orbit them with indigenous rockets and evolve innovative applications to benefit society.

"Today, Indian space systems like Insat for communication, television broadcasting, meteorology and disaster warning and the Indian Remote Sensing satellite (IRS) for resources monitoring and management are playing a major role in the national developmental tasks," he explains. "The major emphasis in satellite ommunications will be towards meeting the growing demand for transponders, continuous improvement in technology. The thrust areas of applications will include expansion and growth of tele-education, telemedicine and village resource centres management with the involvement of other central and state ministries and NGOs."

In the longer run, over the next two decades, he also foresees that there could be a major thrust towards permanent habitation in space and on some of the nearest objects like moon and Mars. "Already, efforts towards these possibilities have begun and most of the space agencies (of various countries) have a framework developed to achieve this. Low cost access to space and more reliable platforms for space exploration could be realised," says the ISRO chief.