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India's year of expansive space programs

India has developed one of the world's most advanced satellite-based telemedicine networks, connecting patients in remote communities with doctors in urban areas via high-speed Internet and telecommunications systems. The country has also relied heavily on its Earth-observation satellites to track hurricanes, cyclones and patterns of environmental degradation. It also has used communications satellites to link medical specialists to patients in far-flung rural areas and to educate students.

But now, India is making a major push to use satellites to expand its military capabilities, as part of the next stage of what many experts see as a possible arms race with China.

In May the Indian Navy began linking all its ships via a satellite-based video-conferencing network to enable on-board medical teams treating wounded sailors at sea to consult medical specialists throughout India. That has been made possible by the August 2013 launch, on an Ariane 5, of the multi-band 2,650 kilogram GSAT-7 Rukimi, the first exclusive military satellite from the Indian Space Research Organization, or ISRO.

In addition, the space organization has a new range of heavy launchers — the Mark 3 version of the geosynchronous satellite launch vehicle, GSLV — about to enter the market. It also has new communications and Earth-observation satellites in development, a global navigation satellite system which will be operational by the end of 2015, and an ambitious scientific program that



India's Geosynchronous Satellite Launch Vehicle Mark 3 lifts off carrying the Crew Module Atmospheric Re-entry Experiment.

includes a mission to the moon with a lunar rover within three years.

In July, the ISRO is scheduled to launch the next in the series of military communications satellites — the 2,200 kilogram GSAT-6 on a Mark 2 Indian geosynchronous satellite launch vehicle from its spaceport at Sriharikota in Andhra Pradesh. This can carry a payload of up to 2.15 metric tons into a geosynchronous transfer orbit. Previously in December 2014 the ISRO made the first successful test flight of the Mark 3 version of the GSLV, built to take 4 metric tons

into a geosynchronous transfer orbit or 10 metric tons into a low earth orbit.

The Mark 3, with a third-stage cryogenic engine developed and built in India, will make the ISRO self-sufficient in the launch of heavier satellites, such as those required for future military communications and observation spacecraft, say industry experts. On its first flight the Mark 3 carried an unmanned astronaut crew module, an experimental version of ISRO's future three-person Orbital Vehicle.

Later this year military and civil customers will be able to start using position location services with India's version of the U.S. global positioning system. The fourth of seven Indian Regional Satellite Navigation System spacecraft was launched in March on an ISRO polar satellite launch vehicle. The constellation will eventually comprise four satellites, with three spares, to triangulate a user's position within an area encompassing India, its surrounding seas and neighboring countries.

Also later this year will be the launch of the Reusable Launch Vehicle-Technology Demonstration Program, a scaled down, test-bed version of a space shuttle which the ISRO wants to operate within the next decade. The mission will include a hypersonic flight test.

Meanwhile the ISRO's Mangalyaan ("Mars craft" in Hindi) Mars orbiter mission, launched in November 2013 on top of an ISRO polar satellite launch vehicle, is circling Mars looking for methane, as part of the search for life on the planet.

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