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Indian space effort poised for takeoff

Ramtanu Maitra reports from New Delhi on the government's determination to develop a complete national space program by the 1990s.

Among the first acts of Prime Minister Rajiv Gandhi in forming the new Congress government in January was the establishment of a separate Ministry of Space. It was a timely boost to a program that has been one of the country's most effective, and one that will prove an increasingly visible factor in the country's development over the next 10 years.

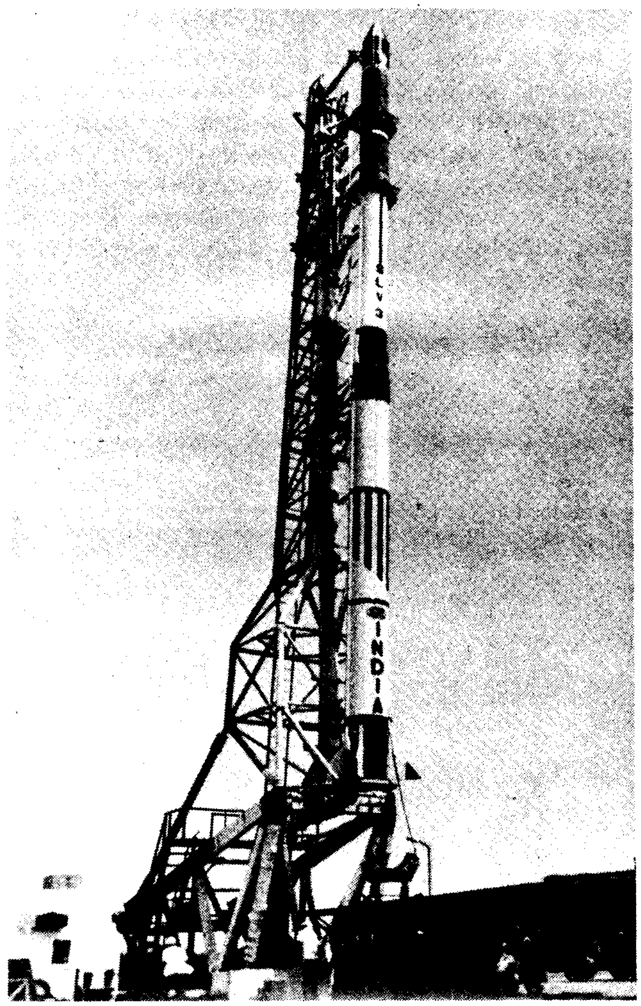
Not only are the space program's own requirements providing a direct spur to industry these days, but the program's applications in communications and remote sensing are coming to fruition—and this translates into an explosion of demand for user systems and technologies to provide the educational programming, handle the data flows, and so forth.

Within the next two years, the Indian National Satellite System (INSAT), which became operational in 1983 with the commissioning of the INSAT-1B, will be completed with the deployment of a second satellite, INSAT-1C, by the U.S. shuttle spacecraft. INSAT is a unique, multi-purpose satellite encompassing telecommunications and metereological observation functions with a nationwide direct broadcasting capability within a single system.

In 1986, India's remote sensing program (IRS) will be made operational. The country's first remote sensing satellite, the ingenuously designed and built IRS-1A, will be put into a polar orbit by the Soviet Union. As in the case of INSAT, the ground systems and user technologies have been systematically developed over the past 10 years for this far-flung system.

By the early 1990s, India will have the capability to launch its own remote sensing satellites into polar orbits with the Polar Satellite Launch Vehicle (PSLV) now under development and scheduled for testing in 1988. In the early 1990s, India's next generation launch vehicle, the Geosynchronous Satellite Launch Vehicle (GSLV), capable of placing 1,000-kg-class satellites into the distant geosynchronous orbit, will be ready for use. The GSLV's development is timed to coincide with completion of the ISAT-II series of replacement satellites for INSAT to be designed and, this time, build indigenously. Achievement of self-reliance

By the end of the 1990s, a fully self-reliant capability will have been established in all components of the space program. The achievement is the product of dedicated work by teams of scientists and engineers inspired by the vision of the space program's architect, Dr. Vikram Sarabhai.



India's first domestically designed and manufactured rocket launch vehicle, the SL-3, shown here at its first launch on July 18, 1980.

As early as 1968, when the program was nascent, Dr. Sarabhai emphasized the direct benefits that space technology could provide in meteorology, geodesy, and communications, pointing out in particular that opting for satellite communications would involve only one-third the capital cost of conventional communications and allow India to "leap frog" into a position of dealing on equal terms with more developed nations.

From the beginning, the space effort had the full support of Prime Minister Jawaharlal Nehru, committed as he was to the use of science and technology to solve India's problems of poverty. But the individual whose indefatigable support during the critical period of the 1970s set the program on its present footing, was the late Prime Minister Indira Gandhi. It was by no means an accident that a major portion of the last speech she gave, on the night before her assassination, was devoted to a discussion of the significance of the space program and how it would help peasants, farmers, and villagers.

From the outset, the basic principle of India's program was self-reliance. Not in the sense of "reinventing the wheel," ISRO scientists explain, but in the sense that India must master all the essential technologies involved in being in space. India's space planners thus started work on all four of the basic fronts at once—applications, satellites, launch vehicles, and mission support. It was a carefully orchestrated process, projected over three decades.

Three-phase process

The first 10 years, during the 1960s, were a learning process. Under the leadership of Dr. Homi Bhabha, then chairman and the guiding spirit of the atomic energy program, and Dr. Sarabhai, the space program was conceptualized and the people and expertise assembled. The Experimental Satellite Communication Earth Station (ESCES) was established at Ahmedabad in 1963 to develop ground support and applications know-how. The Thumba Equatorial Rocket Launching Station (TERLS) came up at the same time, to give impetus to work with sounding rockets.

Both projects involved international assistance: Given strict resource constraints, it was imperative to take maximum advantage of opportunities for international cooperation at each step consistent with achieving self- reliance. As the pace of activities accelerated, the Department of Atomic Energy established the Indian Space Research Organization (ISRO) to deal with all matters relating to space, and by 1972, an independent government Department of Space was set up to encompass ISRO.

During the 1970s, a series of time-bound projects and goals was defined. The key was to undertake a series of projects which would give crucial hands-on experience at minimal investment risk. The 1975-76 Satellite Instruction Television Experiment (SITE), using the U.S. geosynchronous satellite ATS-6, is a good example, as in the 1977-79 Satellite Telecommunications Experiments Project (STEP), using the Franco-German satellite Symphonie. All ground systems for these experiments were built and managed indigenously. The projects proved the need and feasibility of a satellite-based communications system in the country.

Similar, parallel steps were taken in satellite technology, beginning with India's first satellite, Aryabhata, in 1975. Work on launch vehicle technology also proceeded from the beginning in 1962 at the "test-tube" level. This area, where the technological complexity of the job is even greater than the cost considerations, undoubtedly presented the greatest challenge. With worldwide development tied so closely to military applications, the details of the technology are less readily available.

It is the project phase of the 1970s that shaped ISRO into the dynamic functioning team—managed by scientists and engineers, and with a consistent ratio of scientific and technical staff to administrators of more than two to one—that we know today. Besides building up capabilities in all the four basic areas, by the end of the decade ISRO had also developed a concrete notion of what users want and need. ISRO officials rightly look confidently toward the 1980s as the "operationalization" phase of India's space program.

Multiplier effect

Starting with a modest annual budget of $20 million in 1962, the space program has jumped to what will be $300 million annually under the Seventh Plan beginning in 1985-86. While not large in absolute terms in an annual budget of some $60 billion, this 15-fold jump in the space budget gives an indication of the program's growing impact on the economy. But what the numbers cannot show is the fact that in India the space program has had to develop the sophisticated industrial base it required. Whereas in Europe, the United States, or the Soviet Union a sophisticated industrial base had already been built up as a result of defense programs by the time of the postwar period, in India the program was launched in conditions of extremely weak economic infrastructure.

In 1978, the Department of Space took a policy decision that all space projects would make maximum use of Indian industry, but in the initial phase, ISRO was doing everything itself, in house. Gradually, capabilities were developed in industry such that an ISRO-made prototype could be reproduced in quantity on order, with close collaboration from ISRO. In the final phase, now beginning, ISRO will increasingly be giving only functional specifications to industry for a component or subsystem.

Where ISRO has not developed a needed technology itself, it has sought constructive technology transfer agreements. For instance, ISRO entered into an agreement with France to produce transducers where France agreed to give ISRO the technology on condition that the product would be exported to France for a stipulated time period. Now, under the terms of the agreement, the technology will be disseminated to industry and India will possess the capability to export transducers to the world market—not to mention the broader domestic market for control systems where lack of transducers has been a critical bottleneck.

ISRO has built a dynamic interface with Indian industry, which includes systematic technology transfer from ISRO to industry of technologies and systems for both space and non-space applications. So far more than 65 products and processes have been licensed to companies mainly in the areas of chemicals, electro-optics, electronics, and telecommunications, and another 25 are in the pipeline.

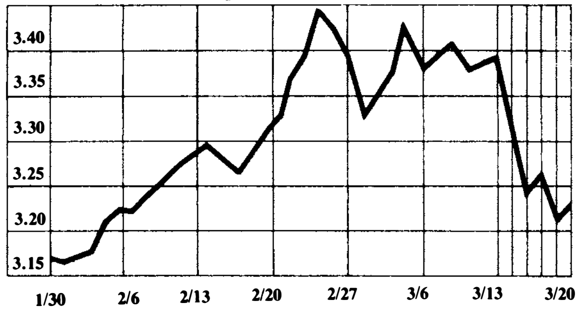
Moreover, within the past two to three years, the program's direct demands on industry have led to establishment of two complete chemical plants and new divisions within a number of private and public sector industrial corporations devoted exclusively to supplying the space program. An estimated 50-60 industries across the country are involved.

This "spinoff" effect will become increasingly visible, just as Dr. Sarabhai foresaw. Dedicating the Equatorial Launching Station in 1968, he emphasized the point: "I might illustrate this from experience which we are gaining in the development of rockets. This requires new disciplines and an understanding of materials and methods; of close tolerances and testing under extremes; the development of guidance and control and the use of advanced information techniques," said Dr. Sarabhai. "Indeed, I often feel that the discipline and the culture of the new world which emerges through the pursuit of activities of this type are among the most important from the standpoint of a developing nation."

Currency Rates

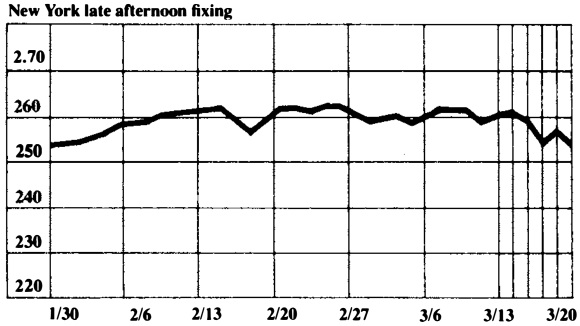
The dollar in deutschemarks

New York late afternoon fixing



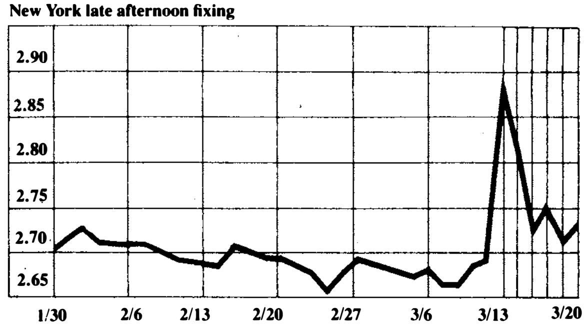
The dollar in yen

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing