AEROSPACE POLICY

Program contributes to nation-building

by Paul Zykofsky

The following report was dispatched from Bangalore, India.

While parts of India are still in the bullock cart age, a small group of scientists and technicians have propelled it into the space age, ever since July 18, 1980, when India launched a 35-kilogram satellite into an elliptical orbit around the Earth using the indigenously developed SLV-3 rocket. With the success of SLV-3, India became the sixth nation in the world—and the first developing nation aside from China—to possess its own satellite-launching capability.

As in other countries, India has begun to use satellites for communications and to survey and monitor the nation's resources and weather. But aside from these applications of space for development, the Director of the program, Dr. Satish Dhawan, highlights the importance of space research for what he calls "nation-building." In a recent discussion with foreign journalists visiting the space facilities in the city of Bangalore, Dhawan explained why India has insisted on developing its own satellites and rockets instead of simply purchasing them from abroad: "We are at a stage of development . . . where we have to build our own country and use our best talents in manpower. How do you use them if you go on buying somewhere else? If you buy an airplane, you buy machines or you buy bicycles, you can do that. But [this] is not a commercial proposition; development of a nation we regard as somewhat different. We don't ignore the commercial element, but there are many examples around the world which tell you that, if you don't build your nation yourself, nobody else is going to come and build it for you. You can't buy a new nation from somewhere.

"At a given point of time you can buy a lathe," Dhawan said. "But pretty soon you have to ask the question that it's not the lathes which develop a country but the minds which design the lathes, the machines which build other machines. . . . India is passing through a phase where we do not think that opening it entirely to the commercial element is the way to develop the country. You will not have self-reliance, you will not have the strength to become so, you cannot influence world markets, you are merely the recipient of the result of world marketing. And raw materials are all that we have been exporting in our past history in colonial times. We have a large experience of *that*. . . . You convert the raw materials to finished goods. *That's* human labor which does that, *that's* value added, that's what you pay for when you go abroad. We would like to have an exchange for it," Dhawan concluded.

Dhawan explained that "for the cost of the total program—in which 10,000 bright Indians have worked—we could hardly have bought two satellites."

A six-year buildup

Since the establishment of a Committee for Space Research in 1962 within the Department of Atomic Energy, work in this area has made significant progress. In 1963 the first rocket launching facility was established for conducting upper atmospheric studies with the help of the U.S., the Soviet Union and France. This was followed in 1967 with the setting up of an Experimental Satellite Communications Earth Station which helped train Indian personnel, and in 1972 with the establishment of an independent Department of Space.

The program's greatest achievements have been reached during the past six years based on a set of targets set in 1970 by its first director, Dr. Vikram Sarabhai, who also headed up the Atomic Energy Department until his deth in 1971.

In addition to developing the SLV-3 rocket, in this period India assembled the know-how to build its own satellites. The small Rohini satellite launched by SLV-3 was only used to monitor the performance of the rocket, but India has built four larger satellites for earth observations and communications which are still in orbit. The first three satellites, Aryabhata (at 358 kilograms) and Bhaskara I and II (444 kilograms)—named after two great mathematicians and astronomers who lived in the Indian subcontinent in the fifth and twelfth centuries A.D.—were launched in 1975, 1979 and 1981 by the Soviet Union. They were used, respectively, for scientific experiments and earth observations. Satellite technology was developed further with APPLE (Ariane Passenger Payload Experiment), the first three-axis stabilized geosynchronous satellite built by India. It was launched by the European Space Agency's Ariane rocket in June 1981, and has successfully performed a number of communication experiments.

The next decade

Having built up the necessary infrastructure, expertise, and manpower, India is planning to focus the efforts of the space program on three principal goals: 1) construction and launch by 1985 of a new Indian Remote Sensing satellite with emphasis on agriculture, water management, forestry, mineral geology and oil

exploration; 2) replacement of the INSAT spacecraft being built in the U.S. with an indigenously designed and manufactured second generation satellite by 1985; and 3) development of a Polar Satellite Launch Vehicle with the capability of launching 600-kilogram satellites into sun-synchronous polar orbits by 1986.

In addition, two complex multi-purpose geosynchronous satellites for telecommunications and meteorology—INSAT-1A and 1B—are being built in the United States by Ford Aerospace. Both will be launched by NASA; the first with a Delta rocket in 1982 and the second from the Space Shuttle in 1983. The INSAT satellites, built to Indian specifications and requirements, will reportedly be one of the most complex satellites ever developed for civilian purposes and is serving as the model for other multi-purpose satellites especially appropriate for developing countries.

The Indian space program is expected to play a growing role in accelerating the country's development by rapidly disseminating new technologies to industry. This process was clearly demonstrated in the construction of the SLV-3 rocket, in which over 100 small and large firms were involved. Dr. Y. S. Rajan, the scientific secretary of the Space Research Organization, noted that, as a matter of policy "we will not do something in-house if we can get industry outside to do it."

Although a few new products have been invented as a result of the space program, there is little doubt that India's most important groundbreaking work in this field has been in devising new applications of space for developing countries. The best example of this was an experimental program carried out from August 1975 to August 1976 which demonstrated some of the potential uses of space for education and development of rural communities. The program, known as SITE (Satellite Instructional Television Experiment), was carried out in collaboration with NASA, which provided free of cost a satellite with high transmission power to beam educational programs to 2,400 small villages throughout India. Each village was fitted with televisions and low-cost dish antennae made of wire mesh for reception purposes. It was the first time ever that direct transmission from a satellite to an individual TV set was carried out. The program, which was carefully monitored on the ground, made it possible to provide specially made instructional television programs relating to agriculture, health care, family planning, animal husbandry, and dairying to people who had never seen a television before.

While Dr. Dhawan cautioned that television could in no way replace the role of the teacher in education, the SITE program, he said, showed that "enhancement of education *can* be done effectively." For example, Dhawan added, television could be used to demonstrate experiments which might not otherwise be accessible to small village schools.