

Vikram Sarabhai – Visionary motivator

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Vikram Sarabhai has been referred to as the ‘Founder’ or ‘Architect’ of the Indian Space Program. When such labels are used, people tend to forget or ignore many other significant contributions made by a multifaceted person like Sarabhai. More than forty-eight years ago Vikram Sarabhai passed away on 30 December 1971 at a young age of fifty-two. Last year in 2019 a large number of programmes were organized to mark the birth centenary of Vikram Sarabhai and these will be continued till August 2020. I was very fortunate to have met him in 1960, when I was very young, and had an opportunity to work with him during my association with him for eleven years.

He was not only a visionary scientist but was also an inspiring educator and motivator. He certainly had a vision for the self-reliant development of our country. He did not keep his ideas and vision to himself. He communicated the same to his colleagues and that motivated us. As a person he was warm and compassionate with an infectious smile. We used to track satellites at the Physical Research Laboratory. Many a times in the middle of the night, he would visit our tracking station to see what work was on going. His unannounced visits were very motivating for students, technical assistants and others. He remembered every person’s name and enquired about their families as well. For many of us he was not just the head of the institution; he was our teacher and mentor.

Today when we remember or think about what Sarabhai had said or what he had written, we must try to understand the same in the context of the ‘Socio Economic Situation’ or ‘Political Policy’ prevalent at that time. Many people have questioned the relevance and expenses involved in the recent activities of ISRO concerning *Chandrayaan 1*, *Mangalyaan*, *Astrosat*, *Chandrayaan 2* and *Gaganyaan*. They consider these activities as a departure from the path charted by Sarabhai.

At the time of dedication of the Thumba Equatorial Rocket Launching Station to the United Nations on 2 February 1968, Sarabhai had said, ‘There are some who question the relevance of space activities in a developing nation. To us there is no ambiguity of purpose. We do not have the fantasy of competing with the economically advanced nations in exploration of the moon or planets or manned spaceflight. But we are convinced that if we are to play a meaningful role nationally and in the community of nations, we must be second to none in the applications of advanced technologies to the real problems of man and society, which we find in our country.’ These words and thoughts had defined the goals for the space programme

of our country. Our space programme is driven by the space applications.

Sarabhai was convinced that no nation could afford to neglect scientific research while concentrating on economic, social and technological development. While establishing the rocket launching station at Thumba in 1963, the ionospheric research facilities were also simultaneously established there. It was clear that while rocket observations could give specific information, continuous ground-based observations were very much necessary. The work that was started then has resulted in an excellent Space Physics Laboratory as part of the Vikram Sarabhai Space Centre.

In the national programme of talks series – ‘Exploration in space’, Sarabhai had talked about ‘Sources of man’s knowledge’ on 12 August 1966 and he had said, ‘There is an active debate in the world today on the value of space exploration in the context of the many immediate problems of human existence. Why does man wish to go to the moon when he has sophisticated instruments including television cameras, which can be sent in spacecraft under command and can communicate information from millions of miles. It is because nothing that has been developed with the most sophisticated technology so far approaches anywhere near the capability of man who possesses the facility of receiving information simultaneously from a number of channels and to synthesise it to create an image of the environment as a whole. Let us note here that our present day computers and systems for analysis operate only serially, i.e. taking one bit of information after another. It is unlikely that man will restrain his urge to see, to feel and to listen, himself if he can possibly accomplish all these. I do not expect that the debate on the merit or otherwise of putting man into space would ever be settled. If we are to rely on historical experience, man will surely push ahead with adventures of this type backed by motives which will inevitably be mixed.’

We must also remember that Sarabhai had said the following at the United Nations Conference on ‘Peaceful uses of outer space’ in Vienna, August 1968, ‘A third important scientific objective has been to view the universe, the galaxy and the solar system through a wide window. The blanket of the atmosphere under which we live eliminates all but a tiny fraction of the broad spectrum of electro-magnetic radiations and particles which impinge on the earth carrying with them information about the sources where they originated and the properties of the media through which they have traversed. Depending merely on observations made with earth bound instruments to picture the universe, and understand cosmology

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is like the attempt of a blindfolded man to describe an elephant by touching the trunk and the legs of the animal.’

He not only discussed with us the future programmes for space research, space applications and space technology, but also simultaneously discussed about science and mathematics education for young students as well as the community. Based on his ideas, the first Community Science Centre was established in our country. This was the first place that I had seen where students at any age could carry out science experiments and learn through experimentation. He knew the value of encouraging the ability of asking questions and finding answers. He had always encouraged students in developing their own ideas.

His style of working, his way of communicating and the breadth of his thinking have been aptly summed up by the writer of his obituary that appeared in *Nature*, 1972, **236**; ‘In his style of working, “hurry” had a charming leisurely quality about it, even though every minute of his time was claimed by one or the other of his self-created projects. Within the space of an hour he could go from cosmic-ray modulation, to rocket propellants at Thumba, to power reactors at Kalpakam, to the television satellite experiment, to community science education, to antenna systems for communication links, to infrared devices for surveillance of crop disease, to the administrative details of setting up a new public corporation and back perhaps to cosmic rays. And each of these transitions was deep, involving decision making, unwasteful of words, and outwardly done with a naturalness and charm which always overwhelmed his friends. Vikram Sarabhai will be missed on the Indian scene, as a scientist, as a scientific visionary, as a doer of things and as a remarkable human being.’

In 1963, the first geosynchronous satellite that was launched by NASA had generated large interest. The utilization of such a satellite for television broadcasting and telecommunications was envisaged by Arthur Clark as early as 1945. In our country, development of a national network for television was considered to be on a low priority due to the absence of a wideband microwave line of sight telecommunication network.

Internationally, discussions had already started regarding the formation of the International Telecommunication Satellite Organization – INTELSAT. India was one of the early signatories for the same. INCOSPAR had taken the required steps for the establishment of the Experimental Satellite Communication Earth Station at Ahmedabad. The station became operational in 1967 and is still fully operational. At that station, educational courses in space communications were started for people from our country as well as other developing countries. The facility continues to be used as a training facility for the United Nations sponsored programme CSSTEAP.

After the launch of INTELSAT III satellite, discussions had started on the subject of definitive arrangements for INTELSAT. Vikram Sarabhai had thought about developing communication satellites not just only for India but also for other developing nations. He was looking for an international agency acceptable to all the nations. Since a

large number of countries were members of INTELSAT, Sarabhai had thought through the possibility of including the activity of getting domestic communication satellites developed by INTELSAT, in the definitive arrangements. As I was already deputed to work at Goddard Space Flight Centre, NASA, USA, I was asked by Sarabhai to assist our delegation in making certain that this was included in the definitive arrangements. I had asked for the supporting papers and after reading those, I realized how far sighted Sarabhai was. In his address at the United Nations conference on ‘Peaceful uses of outer space’ in Vienna, August 1968, he had said, ‘One of the hardest questions to be faced in adopting a synchronous satellite for national needs, arises from the fact that many interested countries would not expect in the near future to have an independent capability for placing such a satellite in orbit. The nations advanced in space research have done much to extend the benefits of the peaceful uses of outer space to all countries, and one can reasonably count on their continued support. But the political implications of a national system dependent on foreign agencies for launching a satellite are complex. They are not negative in the present day world only in the context of the coming together of the national interest of the launcher and the user nations. As long as there is no effective mutuality or interdependence between the two, many nations left only with the ground segment would probably feel the need for some measure of redundant capability under complete national jurisdiction. There is great scope today to explore this structure of possible international systems which could provide credibility in increasing measure that the space segment could be relied upon even in the context of political and ideological differences amongst nations. Perhaps collaborative participation of nations in the construction and operation of a launching system for the peaceful uses of outer space would be realised in the long run.’ I was able to use these thoughts during discussions and then after a long discussion we were able to get Sarabhai’s idea incorporated in the definitive arrangements.

Sarabhai was convinced that television systems in our country could be developed by using space communications. Sarabhai always took a holistic view of any system that he studied and wanted to be developed and deployed in our country. He was convinced that education and instruction was the key to social and economic development. He was convinced that imparting education and instruction through use of television in our country was possible. In order to realize such a system, experimentation was necessary and for that purpose the Satellite Instructional Television Experiment was planned to be conducted using the NASA Applications Technology Satellite – *ATS F*. At that time, we had only one television station functioning in our country at New Delhi. To get the necessary experience, a programme named ‘Krishi Darshan’ was established. This involved development of the necessary ‘software’ or television programmes based on the information available with the Indian Agricultural Research Institute (IARI). These programmes were

transmitted using the New Delhi television station. In about 80 villages around Delhi, in the TV coverage area of the Delhi TV station, television sets were deployed by ISRO/DAE.

It is very important to remember that these television sets were regularly maintained by ISRO/DAE. Many people used to ask us about 'Why the Department of Atomic Energy was getting involved in deploying and maintaining TV sets around Delhi?' Sarabhai was convinced that this programme for farmers was the starting point for bringing television as a tool for development at the national level using space communications. In Sarabhai's view, the television programmes were to be utilized for education and instruction of the masses and at that time 80% of our population was residing in villages. To reach them, community reception sets were required to be established in each of 56,000 villages in our country.

In the headquarters of DAE, he had established the Program Analysis Group. This was a group that was responsible for bringing out interdisciplinary ideas about new projects and programmes. I was fortunate to be able to participate in this group. We had discussed many new ideas about the large system level projects. One of his important ideas was the development of 'Agro Industrial Complex' dealing with nuclear power production and linkages with agriculture and industry. It is unfortunate that this idea did not fructify.

We had concluded two system studies in 1969 on our national satellite for television and telecommunications and we were getting ready for the third definitive study to be jointly conducted with MIT, USA. The Memorandum of Understanding between the Department of Atomic Energy, Govt of India and NASA, USA, for conduct of the Satellite Instructional Television Experiment was signed in September 1969.

In his opening remarks at the National Conference on electronics on 24 March 1970, Sarabhai had said, 'We shall talk later in this Conference of the project proposed by the Indian Space Research Organisation of the Department of Atomic Energy for a national satellite for communication purposes. This is one major task which can provide, as the Apollo Project to the Moon did for the United States, a means for rallying engineers in a number of different directions to leap-frog from our state of technological and economic backwardness. It not only gives a most valuable input for national development through a powerful communication system reaching the remotest village or isolated community, but introduces us to the latest technology in space and electronics, offering employment to tens of thousands of engineers.'

These remarks by Sarabhai enlarged and transformed our own ideas regarding the task ahead. We were really motivated to realize the *INSAT* satellite system as an operational space communication system. Many of us had worked day and night to provide the material for Vikram Sarabhai for his paper 'INSAT-A National Satellite for Television and Telecommunications', which he had referred to in his opening remarks, however we had not

seen the final paper. At that time; we were considering television broadcasting using *INSAT* satellite for community reception as a social service not generating any revenue but the telecommunication was expected to be revenue earner. Thus we had to project realistic numbers. We were surprised to see that he had included our names as authors when the paper was presented by him at the National Conference on Electronics held in March 1970 at the Tata Institute of Fundamental Research, Mumbai.

During 1968 and 1969, the earth oriented applications of space technology were defined properly. By that time the meteorological earth observations and space communications were already being operationally utilized. Monitoring the earth resources using imaging from space was the new discipline that was emerging. Use of satellites for imaging for reconnaissance and surveillance by USA and USSR was already known. Images of the land and ocean brought back by the astronauts were generating interest in identifying land use, water resources and agriculture. NASA of USA was in the process of building the first Earth Resources Technology Satellite – *ERTS 1* for civilian use.

Sarabhai had clearly understood the implications of the emerging remote sensing technology and had constituted a team of scientists, tasked to familiarize themselves with the new technology. Pisharoty had retired as Director of Indian Institute of Tropical Meteorology and joined PRL. Pisharoty, Dakshinamurthy from IARI, Krishnamurthy from Atomic Minerals Division and I were asked to visit various places in USA where work was on going in the field of remote sensing and study remote sensing as a technology and its applications. Sarabhai was not looking at the technology alone, but he was also looking for the utilization of the data, information and knowledge by all government agencies. From the very beginning of the work concerning remote sensing, he had thought through the utilization of the information. We were in the middle of discussions regarding establishing a ground station in India for receiving the data from *ERTS 1*, when Sarabhai had passed away.

The goals and outlines of our space programme were defined very clearly by Sarabhai in the 'Decade Profile of Space and Atomic Energy' issued in the period 1969/1970. It was clearly indicated in that profile, '*SLV-3* would be followed in the period 1975–79 by satellite launch vehicles using more powerful motors and it is the objective of the Space Science and Technology Centre to develop by the end of the 1970s a launch vehicle capable of putting a 1200 kg satellite into synchronous orbit at 40,000 km. This is the type of capability which is needed to fully exploit, on our own, the vast potential arising from the practical applications of space science and technology.' In these three short sentences, the tasks for the next ten years were described. In the decade profile he had also mentioned about the value of placing an imaging system in a geosynchronous satellite. While we knew that the primary goal for the *INSAT* satellite was provision of

communication capability for long distance telecommunication and television broadcasting, we had included the meteorological earth observation imaging system. This combination made the *INSAT* satellite a true 'multipurpose' satellite.

We did not achieve these goals as per the timeline projected by Sarabhai. There were international restrictions and 'embargos'. We have been able to overcome those difficulties in a self-reliant manner. We were delayed, but we did achieve the goals as set out then. Today we have a vibrant space program. We have assured 'access' to space. We have the ability to build our own satellites, our own launch vehicles and provide operational space systems and space services for our country. The necessary scientific disciplines and technological solutions are developed in our country. Sarabhai's vision was adopted and expanded by Satish Dhawan. The programmes started by Sarabhai were continued and grown by him. Under the leadership of A. P. J. Abdul Kalam and Satish Dhawan our launch vehicle programme was firmly established.

Kamla Chowdhry had written about him as follows: 'He created intellectual networks of natural and social scientists, of engineers, and architects and builders, of planners and management specialists and generated new ideas for innovative tasks in these interactive clusters. Wherever he went he created these overlapping clusters so that members of such clusters became "carriers" of new ideas and were able to perform leadership roles in their own professions.' She had further described him as, 'People can become bigger and stronger when they are wholly and totally accepted, and Vikram could make people feel bigger and stronger and wiser for he transferred to others a trust from his own trustworthiness.'

These words by Kamla Chowdhry clearly define how Sarabhai motivated people working with him by trusting their abilities. In a speech broadcast by the All India Radio in August 1965 on the topic, 'Leadership in Science', Sarabhai had expressed his thoughts about leadership as, 'Through experience we know that conditions of work in India within our own specialized scientific fields rarely match the facilities available in several other countries. Some of us get frustrated striving against heavy odds. Others leave the country. But those who can apply their insights to the problems of the community and of the nation discover an exciting area of activity where effort is rewarding even while the results come slowly. What should we do to provide opportunity for such leadership? I do not expect those attitudes which segregate scientists and intellectuals from the real world to change quickly. I do not believe that in the near future we are likely to provide to scientists and educationists job opportunities and service conditions which are on par with those enjoyed by administrators. But I have a dream; a fantasy maybe; that we can provide encouragement to those who will accept responsibilities for real tasks; big

and small; even while they continue to do their own work.'

When we say that Sarabhai was a visionary 'institution builder' it does not mean that he built very large or grand institutional buildings. Apart from the Physical Research Laboratory, he was responsible for establishing the Ahmedabad Textile Industries Research Association, The Indian Institute of Management, Ahmedabad, The Indian Space Research Organization, The Vikram Ambalal Sarabhai Community Science Centre, The Ahmedabad Management Association, Darpana Academy and many others. He was heading his industries till he was appointed Chairman, Atomic Energy Commission. He was responsible for introducing modern management methods in his industries. Sarabhai always insisted that 'institutions' should be built around 'persons'.

He made certain that people working with him should grow. He relied on people to take up responsibilities and deliver the results. He had always delegated the authority commensurate with responsibility. He trusted the people working with him and all the people responded to that. This enabled people to grow and this in turn enabled the institutions to grow and thrive.

In 1962/1963 the work for the establishment of the Thumba Equatorial Rocket Launching Station was started under the direction of Vikram Sarabhai by a handful of people. That group of people continued to provide the necessary leadership for the space program. Vikram Sarabhai's vision was not restricted to his ideas about space research or atomic energy. He was a multifaceted person with multiple interests. He was very much interested in performing arts and culture.

Recently, I came across a pdf entitled 'Sarabhai_V_Speeches' published by the Physical Research Laboratory. It is fascinating to read the speeches given by Sarabhai on various occasions in person and on radio. These speeches provide an insight into his concerns about education, management and development. In this birth centenary year of Sarabhai, we remember him as a person, we remember his contributions in the field of National Science Policy, atomic energy, space research, applications of space technology, education, management and many more.

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