

## About Prof. Satish Dhawan

*K Kasturirangan*



K Kasturirangan is currently a nominated member of the Rajya Sabha after having served in the ISRO establishment for over three decades. His main interests are high energy astronomy, optical astronomy, satellite technology, and remote sensing.

Rare is the combination of academic degrees that Satish Dhawan had – BA in Mathematics and Physics, MA in English Literature, BE in Mechanical Engineering, MS in Aeronautical Engineering and PhD in Aeronautics and Mathematics – but rarer is a human being of his kind – a loveable teacher, an intense researcher, an innovative technologist, an able institution builder and an excellent academic administrator, all at the same time but distinctly visible.

Dhawan took over the reins of the Indian space programme at a very crucial stage of its infancy when Vikram Sarabhai passed away in December 1971. He could efficiently consolidate the efforts of Sarabhai and gave a concrete shape to his dreams by nurturing the space programme through the most critical phase and making it to mature to a stage of yielding several benefits to the country. He had a great foresight for managing a multi-disciplinary and technologically complex space programme in a governmental set-up. His strategy of organizing the programme was unique. He carefully worded, perhaps, bringing to bear his deep knowledge of English, the resolution setting up the Space Commission and Department of Space, which read: “In order to promote a rapid development of activities connected with the Space Science, Space Technology and Space Applications, the Government of India consider it necessary to set up an organization, *free from all non-essential restrictions or needlessly inelastic rules*, which will have responsibility in the entire field of Science and Technology of Outer Space and their Applications”. Being a researcher, a technologist and having led a reputed academic institution like Indian Institute of Science for several years, he knew the importance of insulating the professionals from the drudgery of bureaucracy.

Dhawan had a very intense feeling of technology and, more

### Keywords

Satish Dhawan, ISRO Aryabhata, satellites.

significantly, an exceptional depth of understanding of its relation with the society. His concern was to make space technologies like remote sensing and communication relevant to the society. He knew that if this had to become a reality, he had to institutionalise their implementation. He created the INSAT Coordination Committee, a unique inter-ministerial forum with participation of end users like the Department of Telecommunication, Information and Broadcasting, Department of Science and Technology for evolving and implementing the INSAT system. By the time INSAT system was commissioned in 1983, the users had been prepared to use the system that brought a revolution in communication, broadcasting and meteorological services in India. He created the National Natural Resources Management System (NNRMS) and a Planning Committee of NNRMS under the Chairmanship of Member, Science, Planning Commission, to evolve and implement Indian Remote Sensing (IRS) satellite system and its application to various fields. He did not overlook space science, which was always dear to his heart. He made sure that the space capability and space science go together by setting up an Advisory Committee on Space Sciences (ADCOS) with multi-institutional participation.

If the Indian space programme has great relevance to the country today and its sustainability no more in doubt, it is because of the close interfaces that he established with the users. It was a Herculean task, which only he could achieve, considering that he had to deal with a large and complex country, bring an awareness among an even more complex governmental system and a bureaucracy managed by those who are not necessarily technically oriented and, ultimately, integrate the space system into the conventional systems. It is easy to say that space can provide communication and timely information on resources, but it was Dhawan who addressed the questions like who will use it and how they will use it and how it will reach the society at the grassroots.

Dhawan was a person who could think well ahead. It was his strategic decision that kept the Headquarters of Indian space

programme in Bangalore, not because he wanted to run the space programme even as he continued his academic administrator's role as Director of the Indian Institute of Science but because he knew that Bangalore had several advantages. The city could accelerate satellite building activities, which had just been taken up, using the institutions like IISc, National Aeronautical Laboratories (now called National Aerospace Laboratories) and industries like Hindustan Aeronautics and Bharath Electronics. Besides its salubrious climate that facilitated the fabrication of satellite systems, the academic, industrial and research ambience of the city were decidedly advantageous.

Personally, I came in contact with Dhawan when the project to develop the first Indian satellite, Aryabhata, was initiated. I was fortunate to work with him very closely and learn from him the nuances of space programme management, which has brought to bear in my leading the programme later for nearly a decade. When we started the Aryabhata project, with U R Rao as the Project Director, there was no time to put up buildings and other infrastructure and, in order to meet the international commitment of readying the satellite in time for launch on board the Soviet Union's Inter Cosmos rocket, we selected a few industrial sheds in Peenya, on the outskirts of Bangalore to design, develop and test the satellite. It is interesting to recall the events that preceded the approval of the Aryabhata project itself. When the offer came from the erstwhile USSR for launching an Indian satellite, the then Prime Minister, Smt Indira Gandhi, wanted the decision on accepting the offer within 48 hours and also the details of the terms and budget outlay. We worked through the night to come out with a budget figure Rs. 50–60 lakh that looked ridiculously low. We decided to multiply all our estimates by 6 and the total outlay came to a respectable Rs. 3 Crore. M G K Menon, who was leading the Space Programme temporarily at that time, submitted the same to the Prime Minister. After Dhawan took over as Chairman, ISRO, he asked us about the logic behind the budget figures and he even asked how we decided to multiply the estimates by 6 and



not any other number! He would not let anything unanswered and would convince himself before decisions were taken.

Being the first major space project of India with an international commitment, Dhawan decided to be the Chairman of the Aryabhata Project Management Board, the only project board for which he was the Chairman. He always believed that he should not be directly in charge of major activities himself but make sure that works and responsibilities are delegated. As secretary to Aryabhata Project Board, I can vividly recall the meticulous way in which he looked at the issues – technical, programmatic, financial, schedule or infrastructure – and the follow-up actions. He was deeply concerned about the success of Aryabhata because, as he told several of his close colleagues, it was the first opportunity for India to prove that it could build a space system and if it failed, the credibility would be lost. I used to admire the way he conducted the meetings meticulously every three months, coming to the Peenya sheds with other members like Brahm Prakash. He would not only check the technical details but also, as a true English Professor, look at the language – every comma, hyphen and semicolon. Once I had written a paragraph on our assessment of a technical issue and concluded that there was no problem on that issue. He had remarked in his own beautiful handwriting against this paragraph “there is no problem? – I am worried”. As a technical administrator, he could not believe that there could be no issues in a project that was being executed for the first time in the country.

After the successful experimental project, Aryabhata, it was Dhawan’s initiative to proceed directly to an application-oriented experiment, the Bhaskara-1 project. Bhaskara-1 had to be of low cost of about Rs 4-5 Crore, technologically feasible, realisable in 3-4 years and have some meaningful utility. He had more confidence in us than we had in ourselves. He made us realise this project, in time and within the budget. When the satellite’s television camera initially had a problem due to suspected high voltage corona, he made us simulate the problem on ground to understand it and decide on the remedy. The work

involved placing a similar system in the thermo-vac chamber, conducting off-line experiments and modeling. We concluded that there was some trapped gas in the satellite which could possibly escape if we wait for 5 to 6 months. Six months later, the camera was switched on and indeed, it worked and we were thrilled. Dhawan had bet his one-month salary with one of his junior colleagues who was very confident of the camera coming through and Dhawan lost the bet. He promptly handed over his one month's salary to his jubilant colleague. But the amount was unfortunately just one Rupee! Since Dhawan was also the Director of IISc and drawing salary there, he was taking only a token salary of one Rupee from ISRO. Perhaps he was so confident that the camera would work and did not want to stake more than a rupee! Dhawan was "seriously humorous" with his colleagues and this way he used to establish a long lasting personal rapport with them.

It was Dhawan, the original thinker, who decided the final configuration of Polar Satellite Launch Vehicle, PSLV, which is the work horse launch vehicle of ISRO today, with six successful flights so far. It was his judicious decision, based on a combination of factors including technical capabilities, infrastructure, schedule, financial and project management that resulted in the unique solid-liquid-solid-liquid configuration for PSLV. He configured it keeping in view the expertise and aspirations of highly committed and talented people. He was indeed an outstanding techno-economic administrator. When PSLV had its first successful flight in October 1994, he had a sense of satisfaction. But it was only its second success that assured him that PSLV had indeed come of age. He acknowledged this when he gave me a bear hug, which I cannot forget.

Dhawan's foresight came to my notice again when, as Project Director of Indian Remote Sensing satellite, IRS-1A, I was drafting the contract for its launch with the Russians. He made sure that all contingencies that could arise in the following six years, before the satellite's launch, were well thought of in drafting the contract. He jokingly remarked after going through



the document “I will hold you responsible if you make any changes on it later”. It was the first commercial agreement with Russia for launching a satellite and the first to be signed by Dhawan himself.

I had more intense interactions with Dhawan after I took over as chairman of ISRO in October 1994, which exposed me to his concern for the society and his view that space be never used as a technical bonanza but only as a tool to develop the society at the grassroots. He was deeply concerned about the lower strata of the society, always trying to see how they could be fruitfully employed even if they are unskilled or illiterate without displacing them or altering their pristine cultural heritage. His view of the impact of technology was very different than many professional technologists, economists, or sociologists. He expressed his views when ISRO took up the task of identifying and delineating 13 types of wastelands in the country using data from Indian remote sensing satellites. These maps are prepared and updated to help reclaim the lands for agricultural and other uses. When I took copies of these maps to Dhawan, he viewed the whole exercise from an entirely different aspect. He said “this is all very good and these maps are very useful to develop this country. But do you know that wastelands in our country are not a waste? There are tribals and others who depend on the produce of these so-called wastelands. If you start water recharging and improve the water availability in these lands to improve the vegetative cover, the whole place may look very promising to prospective developers. Then these tribals will be disturbed and there will be no system to protect them”. He even cited the example of aqua-culture, initiated to bring prosperity, which resulted in several traditional fishermen and others along the coast being displaced. Even though they were given some 10,000 rupees each, they did not know how to manage that money and, within months, they frittered it away and were left in the lurch. In a lecture delivered at the Indian Institute of Technology, Chennai in February 1976, Dhawan explained how a technology related to rocket propellant, developed by the Vikram Sarabhai

Space Centre, Thiruvananthapuram, could trigger developments that could benefit millions of unskilled, illiterate and predominantly tribal population. The technology related to developing polyols using naturally available oil seeds that could lead to production of other petroleum products. The project involved collection of seeds, both cultivated and uncultivated, from Castor, Mahua, Pisa, Neem, etc, de-hulling, transportation to oil extraction centres and transportation of oil. The capital investment estimated was Rs 190 crore and operating cost Rs 461 crore while the value of the product was estimated at Rs 487 crore per year. Further, it would have resulted in about 4 million tonne per year of non-polluting, non-toxic and biodegradable manure that would have significantly enhanced agriculture and food production. Dhawan was peeved when the project was shelved due to economic consideration. He felt that the feasibility study was purely an economic analysis and did not assess the sociological benefit that would have accrued to a million grassroots level population.

While most believe that development and progress means economic prosperity, Dhawan viewed it as that related to the very grassroots level people of the country and their lives. For him, the impact of information created by even the most sophisticated technology was of no use if it did not address the grassroots realities of the country. His views were revealing and were of great value to keep one's foot on the ground even while being enthusiastic about a new and promising technology.

Dhawan was a keen observer of Nature. He had great admiration and fascination about the phenomena in Nature and always curious to learn from it like a true scientist. His observation of birds' flight resulting in his research into the various aspects of their flight, including painstakingly collected photographs of birds in flight, is indeed an outstanding contribution to the aeronautics field. This is very characteristic of an intense researcher as evident from the lives of scientists like Archimedes who discovered the laws of buoyancy while taking bath or the greatest Briton, Isaac Newton, discovering the laws of gravita-



tion while observing a falling apple. Dhawan was also very innovative in designing his own research tools; he made the first precise direct measurement of skin friction on a flat plate by designing a special balance which was later widely adopted and used in many laboratories across the world. Further, he was responsible for setting up several aeronautical research facilities including wind tunnels for the first time in the country.

A great analyst and a man who could look at a problem from different angles, Dhawan was entrusted with the responsibility of reviewing the flight worthiness of the Indian Airlines' Avro aircraft after it met with a few mishaps in the sixties. He completed his assignment with high credibility and confidently proved their airworthiness and indeed Avro aircrafts were hovering over the Indian skies for a long time after their proven flight worthiness.

Dhawan's leadership came to the fore when ISRO had to face several setbacks like the failure of the first flight of SLV-3. Outwardly he told "we have stumbled but we have not fallen flat" but he was deeply upset. He never showed his feeling that he was disappointed with the team or any individual. Further, he never spared any effort to identify the problem and ensured that it was corrected. It was his encouragement and his deep interest to learn from failures that made ISRO recover fast and fly SLV-3 successfully in the very next flight. And today, ISRO has the resilience to face any challenge even in the face of a few setbacks here and there, thanks to the early culture and outlook.

ISRO has named its Launch Centre at Sriharikota as Satish Dhawan Space Centre – SHAR

A Shubhashita Sloka says

उदयेति सवितारक्ता रक्ताश्च अस्तमानेकता  
संपत्तेश्च विपत्तेश्च महत्तायः एकरूपता

(When the sun is rising it looks reddish when setting also it is reddish.  
Great men look alike in times of happiness or distress.)

Dhawan was indeed a great man to remember and to emulate.

*Address for Correspondence*  
K Kasturirangan  
Member of Parliament and  
Former Chairman, ISRO