



Prem Shanker Goel

Making of a Satellite Centre

The Genesis of ISRO's URSC



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Prolog

Indian Space Research Organisation (ISRO) is a unique organisation. It has a culture which is unique, and there is no other way to describe it except to say it is the ISRO culture. The Satellite Program of ISRO has done wonderful things, like providing confidence to the country with the launch of Aryabhata satellite on 19 April 1975, that we can do complex technology, when even safety pins were being imported into the country. It was a simple satellite by today's standard, but a big technology leap for the country in the seventies. Pokaran-1 in 1974 and Aryabhata in 1975 were two technology events that gave Indian scientists and engineers confidence to venture into new areas, which were not so far pursued in India.

The satellite technology growth has been slow but consistent, towards complexity, modernisation and professionalism. While URSC has built 104 satellites (as on Dec 31, 2019), a few missions have been landmark missions that opened the pathway for the future. Aryabhata, Bhaskara-1, APPLE, IRS-1A, INSAT-2A, IRS-P3, MetSat (Kalpana), INSAT-2E, CARTO-1, SRE, TES and IRNSS are some of those landmarks. Each one raised the bar in technology development and mission management. Chandrayaan-1, which attracted the imagination of the country, was another great achievement of mission management. Mangalyaan further raised the capability to manage a mission beyond the earth's gravity. Now we have a robust technology base and operational space systems for Remote Sensing, Communication and space-based navigation and space science. Chandrayaan-2 is yet another advanced technology and mission management demonstration. Though the Lander Vikram had hard landing very near to the pre-designated spot on the Moon, it was a remarkable mission in technology development and mission management. Gaganyaan (The Manned Mission) on its way is another technology challenge and dream of an aspiring nation.

This book is the story of people behind satellites, narrated through Satellite Centre (ISAC or URSC), which represents satellite activity as a living organism. It is the story of remarkable people, a few named and many unnamed, who created and nurtured this body, which I believe has conscious of its own. Like any other living body, it has gone through its ups and downs but has always bounced back with full energy after every hiccup.

As this story is of people, narrated by an individual who was one amongst them, it is likely to be biased in impressions and interpretations. I have, however, tried to

be as fair as possible towards my colleagues, each one of whom has contributed to the growth of ISAC. But there may be some omissions, largely because of fading memories or lack of my exposure to certain instances. I sincerely apologise for any such omission.

Bengaluru, India

Prem Shanker Goel

Acknowledgements

The inspiration to write this book came from Dr. B. N. Suresh, a colleague and a friend who had completed his book on design of launch vehicles and wanted me to write a book related to the evolution of satellites in India. I thank him for his continued persistence. Writing this book on Making of the Satellite Centre gave me an opportunity to recall my association with Prof U. R. Rao and live those moments again. I am grateful to him for those wonderful memories. There are hundreds of persons who have made their contributions in this journey, some alive and many passed away; each deserves a big *thank you*, whether captured in the book or not.

Dr. Surendra Pal and Mr. V. R. Katti reviewed the manuscript and made numerous suggestions, particularly in recalling the names and specific contributions of some of the persons that I missed in my first draft. I thank both of my colleagues for their patience and contributions. Mr. Guruprasad helped me with the chronology of events and in capturing photos of important milestones.

Indian National Academy of Engineering (INAE) decided to make this book a part of their publication and it was a big morale booster. I thank the engineering academy for all the support.

Prem Shanker Goel

About This Book

This book is all about the people who made ISRO Satellite Centre (ISAC), what is U R Rao Satellite Centre (URSC) today, as seen by one who lived through initial years of the “Centre in the making” and watched things happening, in addition to making his own humble contributions.

It was a dream of one man, shared by many and contributed by many more, Prof U R Rao will live as long as the Satellite Centre exists. The landmark journey from a small Division (Satellite Systems Division, SSD) of the then Space Science and Technology Centre, SSTC (now Vikram Sarabhai Space Centre, VSSC), with a staff of fewer than 10 in 1970 has grown to more than two hundred times as the second biggest Centre of ISRO. Professor Rao is to URSC what Prof Sarabhai is to ISRO. Professor Rao not only gave the vision but also inculcated the work culture of ISAC and built the organisation. His passion for space, concern for Indian science and love for ISAC are difficult to describe in words. It is remarkable that he transferred that spirit and commitment to dozens of youngsters, who helped in making the Centre and preserving those values for decades to come.

It is all about wonderful work of wonderful people, where passion drives and nation thrives.

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About the Author



Dr. Prem Shanker Goel pursued his B.E. in Electrical Engineering from University of Jodhpur, M.E. in Applied Electronics and Servomechanism from Indian Institute of Science (IISc), Bangalore, and Ph.D. from Bangalore University, India. He developed spin axis orientation system Bhaskara I & II satellites, magnetic control for spinning Rohini series satellites, momentum biased 3-axis control system for APPLE, zero momentum biased 3-axis control system for IRS, and V configuration momentum biased attitude control system for highly stabilized INSAT-2. He developed very agile control system with step and stare capability for spot imaging mission TES and guided the evolution of reentry capability through SRE mission. He was President of Indian National Academy of Engineering (INAE) and Vice President, Aeronautical Society of India, Dr. Vikram Sarabhai Distinguished Professor at ISRO. Dr. Goel was awarded the prestigious Indian civilian Award Padma Shree in 2001. He received several other awards including Distinguished Scientist Award of ISRO and lifetime achievement award of INAE. He is Fellow of Indian Academy of Sciences, Bangalore; National Academy of Sciences, Allahabad; Indian National Science Academy (INSA), New Delhi, among others. Currently, Dr. Goel is Honorary Distinguished Professor at ISRO HQ, Chairman, Comprehensive Technical Review Committee, GEOSAT Program, and Chairing Apex Committee for planning Communication, Remote Sensing and Navigation satellites of ISRO. Dr. Goel has contributed significantly to mission planning for remote sensing, communication, and scientific missions and authored over hundred research papers in referred journals and conferences.