

Sitaram Rao Valluri (1924–2019)

On 23 January 2019, the Indian scientific community lost Dr S. R. Valluri, former Director of the (then) National Aeronautical Laboratory (NAL) and Director-General (DG) of the Aeronautical Development Agency (ADA), Bengaluru. Seldom does an outstanding young researcher morph into an institution-builder, manager and formulator of administrative policy, whose legacy will continue to be cherished and admired by future generations. Most would agree that Valluri was indeed an exceptional leader. The few who may hesitate, would have to admire the resoluteness of a young engineering student who decided he would 'go to the US for further studies, and return to head a research institution here'. As mentioned in his memoirs, that is precisely what young Valluri resolved to do into his third year as an engineering student of Banaras Hindu University (BHU), Varanasi.

Rao, as Valluri was fondly called by friends, was born on 25 June 1924, in Eluru, West Godavari district, Andhra Pradesh, in a doctor's family of moderate means with nine siblings. After obtaining B Sc (Engg) degree in 1946 from BHU, he went on to pursue postgraduate studies on a Madras Government scholarship at the newly formed Engineering Department of Aeronautical Engineering, Indian Institute of Science (IISc), Bengaluru. Later, he was to become the Founder-President of the IISc Alumni Association. In 1949, Valluri proceeded on a Pauley Scholarship to the California Institute of Technology (Caltech), USA, for further studies leading to a Ph D in Aeronautical Engineering. His doctoral thesis submitted in 1954 related to metal fatigue, and involved intricate and cumbersome measurements of internal friction and its correlation with the fatigue process under cyclic loading. This work and its potential applications to aeronautical fatigue made Valluri a sought-after consultant for the US aerospace companies as well as the US Air Force Laboratories.

After a brief stint from late 1963 as Professor and Head of the Department of Aeronautics and Applied Mechanics at the Indian Institute of Technology-Madras, Chennai, Valluri took charge as Director of NAL on 23 November 1965, after Dr Nilakantan, NAL's founding Director, unexpectedly passed away in

1964. Valluri's vision of building a world-class engineering laboratory had several key elements: selection of applied research areas based on requirements of next-generation aircraft, building industrial-scale test facilities, nurturing development of new materials and advanced manufacturing technologies, developing excellent supporting infrastructure and, last but not the least, recruiting the best available scientific and technical talent.

Over the next 19 years, Valluri proceeded to literally 'script, sculpt, paint and conduct' what was to emerge as the 'crown jewel' of the Council for Scientific and Industrial Research (CSIR). His long association with Caltech and with senior personnel in the US aerospace industry may have moulded his perception of what drives the success of R&D in high-technology fields such as aerospace. But to translate this perception into reality demanded the requisite infra-

structure, more importantly the required people, and most importantly the resources to support them and the skills to manage them. Valluri realized right away that this meant setting aside his personal research interests. Indeed, one is unlikely to find any original research publications by Valluri on metal fatigue from work at NAL. Not even in co-authorship, because he was against attaching his name to someone else's work. He did not need to. What he did achieve is monumental.

The first half of Valluri's 19-year tenure at NAL was devoted to institution-building, with a focus on laying the foundation for developing essential technologies that go into an aircraft, technologies that did not exist at the time in India. Nilakantan had already set the ball rolling with a wind tunnel facility. Valluri first saw his predecessor's project to successful closure as a world-class facility, which has now been used during the last five decades for over 50,000 blowdowns



S. R. Valluri with S. Chandrasekhar and S. Ramaseshan in 1966.



S. R. Valluri with S. Dhawan.

PERSONAL NEWS

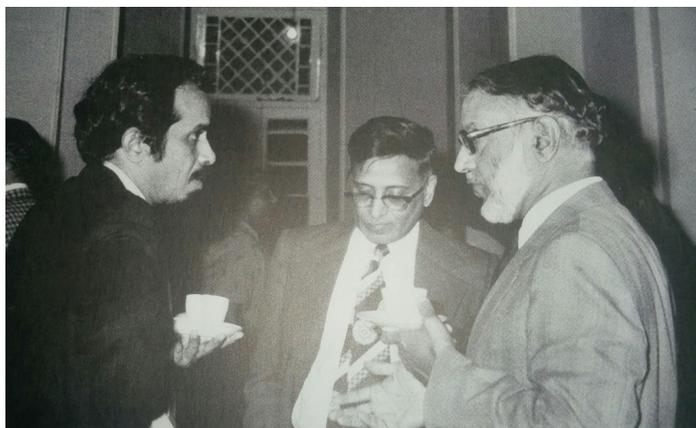
generating aerodynamic data in subsonic, transonic and supersonic range for indigenously designed aircraft, rockets and missiles. The key to its success was a high-level committee that was established by Valluri, with representation of user agencies to run the tunnel as a national facility with an agreed scheme for sharing tunnel time as well as fixed and variable costs of its operation and its continued development.

A state-of-the-art aircraft represents the best of technologies emerging from a variety of disciplines. These include high-grade materials with the best properties, light but strong structures, propulsion systems, and controls that serve as the brain of an aircraft. So Valluri went on to create the infrastructure around the Propulsion, Materials, Structures and Systems Divisions of NAL, in addition to the Aerodynamics Division. Over this period, the two campuses of NAL (respectively at Kodihalli and Belur) emerged as a closely knit network of full-fledged operational facilities that would address most of the critical elements associated with an aircraft as a system. Valluri realized that people determine the success of any endeavour. He set about recruiting the best talent to make this possible, and at one point, around 90 Ph Ds formed the core of the NAL team, arguably the largest across national laboratories. This included scientists in a wide variety of disciplines ranging from basic research right up to the level of technologists ready to exercise science in industrial application. Never mind how unrelated the activity was to the core discipline of aeronautics, he strove to get only the best involved. Thus, the Graphic Arts Department of NAL was headed by C. Rajagopal, a renowned photographer and Honorary Fellow of the Photography Societies of several countries, including the US, Britain and France. Apart from state-of-the-art equipment for research, workshops, pilot plants and test rigs also came up at NAL, many of in-house design that were later to serve as an insurance against the consequences of technology denials from foreign sources; and some of them actually made it to the global market.

Valluri created a system of management in which research activities of the Divisions at NAL were organized in projects with identified title, objectives, rationale, schedule, project leader and project team, and budget. Each Division

had its Scientific Advisory Committee, with members from academia and industry. These committees would meet twice a year to review existing in-house and sponsored projects and proposals for starting new projects. Their recommen-

dations formed an input to the agenda of the highest laboratory committee, which was the Research Council in later years. Tracking of the progress of the projects and related documentation was handled by a Project Monitoring Cell. Valluri



S. R. Valluri with M. G. K. Menon and R. Narasimha.



S. R. Valluri with Air Marshal I. H. Latif in 1979.



S. R. Valluri with Vikram Sarabhai around 1967.

also held periodical meetings of senior staff, which included the Heads of the Divisions and senior scientists. These meetings discussed formulation of policies and delicate matters. The meetings were known for free and frank discussions. Valluri was fond of saying that he believed in collegiate management, and scientists did not fear persecution for expressing their views. However, Valluri had strong views on discipline. If a staff member was found to have misused or abused facilities or his position, he would be almost invariably taken to task.

Valluri attached paramount importance to honesty and ethics in the practice and management of science. He used every opportunity to illustrate through meetings, circulars and spot discussions the importance of integrity in research. This obviously played an important role in the elevation of the quality of research and development at NAL as perceived by its partners and customers alike.

Valluri expected nothing short of excellence from this team in the pursuit of research. He tried hard to avoid the atmosphere of subordination and hierarchy typical of many government offices. He made sure his attention could be sought by any employee of NAL, even if it meant hearing a voice of dissent or protest. He constantly underscored the importance of this feedback loop as a necessary element for management, even if in the end the decision would always be his own and he would, of course, own responsibility for the consequences as Director. Obviously, office meetings would be lively, if not heated. Valluri's daily routine would involve unannounced random visits to individual divisional facilities, often with visitors, during which discussion and comments would get down to the last detail. He seemed to know the name of each of the 1500-odd employees at NAL. This was by no means micromanagement. It reflects Valluri's meticulousness and attention to detail in his pursuit of excellence across the institution, be it an experiment in progress, a research seminar, a selection interview, the next building under construction, or the landscaping and gardens across the campus. This was how an entire institution was groomed over almost two decades that now, even some 30 years later, serves as an operational monument to his tenacious efforts.

In this age of subcontracting, outsourcing and labour mobility in the tech-

nology sectors, nothing seems to matter more than the bottom line on a spreadsheet. Modern-day CEOs may wish to consider what was achieved by Valluri's determination that in the long term, it is not just human resources in terms of their qualifications that matter, but also the prospects of their growth, their welfare and that of their families. In ensuring these, Valluri strived to put in place processes that were not only fair in their definition, but equally so in their enforcement. He promoted the recruitment and fair treatment of women scientists long before this emerged as a subject of discussion in the country (many leading women scientists at NAL recruited during his time have actually long retired). Valluri went out of his way to ensure justice when cases were brought to his attention of scientists being unfairly treated, even if this had nothing to do with NAL. His contributions to reforms in the assessment and promotion process impacted the employees of the entire CSIR system. Valluri's initiatives resulted in the emergence of a Kendriya Vidyalaya on campus and even a Nursery School (whose operations were graciously overseen over many years by his wife, who, in spite of her position, would ride to work on her moped). These benefitted employees of both NAL as well as the neighbouring ISRO Satellite Centre. Valluri's legacy also includes a well-equipped and well-staffed modern Health Centre at NAL.

Valluri recognized from his experience in the US that the R&D process starting from applied research and technology development to final integration in a flying aircraft has large timescales. So he advocated vertical integration of research related to aeronautics with aircraft industry in the form of an Aeronautics Commission, similar to commissions in atomic energy and space. His relentless championing of the cause of self-reliance in aeronautics led to a vigorous coordinated proposal with HAL and IISc to develop a new family of aircraft designed for India's needs that builds on existing capacities. Thus, if as a third-year engineering student Valluri had resolved to one day head a research institution, it should not come as a surprise that upon assuming the Directorship of NAL, he was attracted to an even loftier goal. His perseverance in mustering the support of other leaders and officials ultimately led to the formation of ADA, of which he

assumed charge as Director-General in 1984. The agency was entrusted with the development of the Light Combat Aircraft (LCA) that has since entered service with the Indian Air Force. Thus, the LCA, which effectively signals the final coming of age of India's aircraft development programme, may serve as a flying legacy of Valluri. Indeed, this state-of-the-art aircraft reflects a number of technological achievements of the National Aerospace Laboratories. Its aerodynamics, controls and carbon fibre wing serve as stand-out examples of fruits from saplings that this outstanding scientist, manager and human being planted and nurtured over the two decades that he was associated with the country's aeronautical scene.

Valluri never sought personal recognition. At every opportunity, he would ask visitors for critical comments that would help improve the work at NAL. If compliments came instead, he would immediately attribute success to the effort of his 'brilliant colleagues'. Recognition was conferred on him on many occasions. Of note are the Wright Brothers Medal for his research on metal fatigue, the Vasvik Award and Padma Shri. Valluri's own description of his experiences can be found in his memoir written in 2006, which his family has now kindly agreed to release to the public (<http://www.instint.in/wp-content/uploads/2019/02/EventsInLifeSRValluri.pdf>). In this age of scams and 'fake news', its contents are, at the very least, likely to throw some light on why we are where we are. One can be sure it would also serve as an inspiration and guide for the new generation of scientists aspiring to reach the kind of heights that Valluri was able to conquer. In doing so, they may do well to follow his oft repeated aphorism 'if you don't get facts, facts will get you'.

Valluri is survived by his wife, a son and a daughter, and two grandchildren.

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