DISPATCHES (HTTPS://FRONTLINE.THEHINDU.COM/DISPATCHES/)


The PAGD calls the Centre's report on...
(https://frontline.thehindu.com/dispatches/the-pagd-)


Defence workers' unions observing Black Day toda...
(https://frontline.thehindu.com/dispatches/defence-workers-)

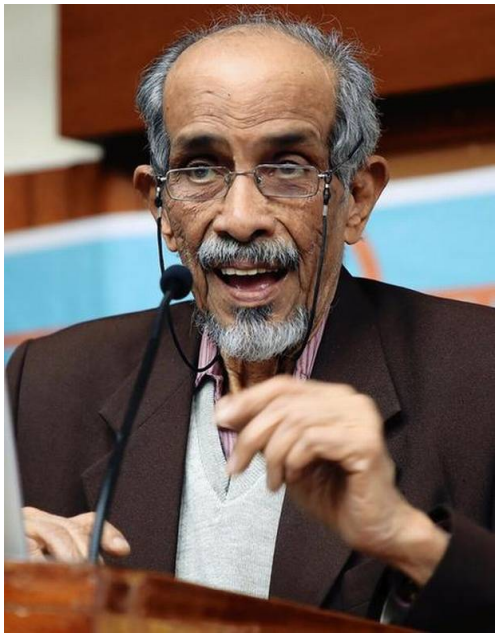

Telangana, Andhra Pradesh oppose...
(https://frontline.thehindu.com/dispatches/telangana-andhra-pradesh-to-)

TRIBUTE

The disappearance of Roddam Narasimha

U.N. SINHA
SRINIVAS BHOGLE

Print edition : January 15, 2021



Prof. Roddam Narasimha. Photo: CREDIT

Prof. Roddam Naras in New Delhi on Apri Innovation Policy-2

Roddam Narasimha (1933-2020), a great scientist and scholar, will be remembered in India for his contributions to the development of computing, aerospace technology as the initiator of the LCA programme, the space programme as the longest-serving member of the Space Commission, and in drafting the country's nuclear doctrine.

It is hard to accept that Professor Roddam Narasimha has gone away. We have known him, admired him, and venerated him for almost half a century.

Year 2020 had been rough; there was the lockdown, and then there were illnesses and hospitalisations. Our regular Saturday morning chats at Professor Narasimha's place practically stopped. But one Saturday, this November, after confirming that he was at home, we decided to make an impromptu call. Narasimha was pleased to see us; although decidedly frail, the eyes still had the familiar warm glint. And, when it was time to leave, he walked with us to the door to say goodbye.

Narasimha was not just a legendary scientist and an intellectual colossus; he was also incredibly caring and affectionate. As a researcher, leader or thinker, Narasimha's top three traits were optimism, curiosity and courage. All his life Narasimha was the intrepid adventurer in science and technology; and, when required, he could also be the most committed crusader.

Champion of parallel computing

Consider, for instance, parallel computing. It was the year 1985, Narasimha had just taken over as the Director of National Aerospace Laboratories (NAL), and scientists in NAL's Fluid Mechanics Division were livid at the poor number-crunching power of NAL's Univac computer. They met Narasimha to ask for more computing power. Narasimha bounced the problem straight back: "If you are unhappy with Univac, why don't you build your own fast *parallel* computer? They've built one at Caltech in the U.S. and I am sure we could put together one within a year ourselves."

The big surprise was that NAL actually built India's first parallel computer, Flosolver, within a year. Flosolver was faster than the existing Univac by at least a factor of three. Funding for Flosolver could have been tricky, but a 10-minute conversation was enough for Narasimha to convince Dr S. Varadarajan, the Director-General of the Council of Scientific and Industrial Research (CSIR), to sanction the Rs.20 lakh needed for the project.

The story does not end here. In 1986, at a meeting of the Science Advisory Council to the Prime Minister (SAC-PM), Rajiv Gandhi asked every member to give a 10-minute brief on what their pet project might be. Narasimha chose to talk about parallel computing. "The Prime Minister was so taken up by the idea that 10 minutes became nearly 90

minutes!", Narasimha later told us. And as word filtered out of the Prime Minister's interest in parallel computing, every national establishment quickly announced their parallel projects; indeed, the creation of C-DACT, now C-DAC, was almost certainly the outcome of that meeting.

Father of the LCA idea

Narasimha was shy to talk of his role in the development of India's light combat aircraft (LCA, now Tejas), but there is no doubt that he set the ball rolling. In the late 1970s, Narasimha took time off as a professor at Indian Institute of Science (IISc) to spend a few years with aircraft design teams at Hindustan Aeronautics Limited (HAL). Based on these interactions, Narasimha argued that it was both feasible and desirable to build the LCA in large numbers. Narasimha's arguments achieved a rare resonance: the Indian Air Force (IAF) changed its perception, and Dr Raja Ramanna, the then Scientific Adviser to the Defence Minister, was sufficiently enthused to ask Narasimha to lead a team of experts from the IAF, the HAL and the Defence Research and Development Organisation (DRDO) to visit Germany, France, Sweden and England to obtain more insights and data. The team returned with a unanimous verdict endorsing the LCA concept. For the first time, all the principal actors in Indian aeronautics appeared to be on the same page.

Later, a high-level committee, headed by Dr S.R. Valluri, which included a bigger contingent of aeronautical players, and of course Narasimha, gave the formal 'can-go-ahead' verdict after a detailed feasibility exercise. It then took Defence Minister R. Venkataraman just two minutes to clear the LCA programme.

"I want you here!"

In 1984, NAL was looking for a new director to succeed S.R. Valluri. Narasimha was the best man to succeed Valluri, but he failed to show up for the interview. "I didn't want it; I liked being a teacher and a researcher more," he later told us. But when the Chairman, Prof. Satish Dhawan, found Narasimha missing he sent his own car to fetch Narasimha with a brief message: "I want you here!" Narasimha could not say no to Dhawan, who was both his teacher and mentor. He joined as NAL's third Director in July 1984, just as he turned 51. He would continue at the helm until he retired in July 1993.

This was the first big leadership opportunity for Narasimha. There were formidable challenges: money was in short supply, foreign exchange was meagre, computing power was dismal, the crippling self-reliance slogan still ruled, and the worrying disconnect between academia, R&D, industry and users of aerospace technologies persisted.

Also read: Roddam Narasimha, an illustrious master (https://frontline.thehindu.com/other/obituary/tribute-roddam-narasimha-illustrious-master/article33426112.ece)

Narasimha's prescription was a heady mix of 'hard' and 'soft' skills. The hard skills included innovative R&D, winning technology connections, and intelligent mathematical modelling. The soft skills included stronger networking, charismatic leadership, unbridled optimism, and his intense personal charm (it was always a great pleasure to interact with Narasimha).

Narasimha also brought in his other traits: of being a visionary (his crystal ball saw things that most others failed to see), of being a science and technology fanatic ("what would I have done in a world without science?," he once mused), of indomitable courage and confidence ("if there's a way to do something, we'll find that way," he used to say), and of being an inveterate dreamer (he was the first to dream of building India's own fighter aircraft).

The bigger canvas

As NAL Director, Narasimha made an impressive start; often a great painter simply needs a bigger canvas to show off his ability and repertoire. He entered NAL as the LCA development programme was acquiring greater steam. An early challenge in aircraft development is wind tunnel testing—where you place a scaled-down aircraft model in a narrow and enclosed tunnel, unleash a controlled blast of air from one end, and see how the model 'behaves'.

When the question arose about where the LCA models would be tested, Narasimha naturally assumed that the wind tunnel testing would happen at NAL; after all, NAL's wind tunnels were built in the late 1960s in preparation for such a challenge. He was horrified when a top decision-making committee in Delhi asked him to agree to the proposal to do the wind tunnel testing abroad, because this was a 'time-bound'

development programme. Narasimha later told us: "I was NAL's Director, and I was being asked to agree that NAL couldn't do this! Nothing could be more preposterous. So, right there, I gave an undertaking that we would complete all the wind tunnel testing ... and on schedule."

Eventually, NAL met every commitment; this involved a fundamental change in mindset, and the very style of administration. The wind tunnels worked for two shifts instead of one, and eventually round the clock. Narasimha won because he kindled everyone's hidden fires, pioneered outsourcing, and, most of all, because everyone wanted Narasimha to win. He had that kind of allure and luminescence.

The Satish Dhawan influence

While Narasimha's remarkable success as a researcher and academician was probably ordained, Satish Dhawan intervened at the key inflexion points to make sure that Narasimha successfully made the transition from good to great. After completing his "Masters" at IISc in the mid-1950s, Narasimha was not sure if he should look for a job or do research. That's when Dhawan suggested: "Why don't you stay here for two years and do some research, and we can have some fun?" And, after two years of fun, when Dhawan realised that he had nothing more to teach Narasimha, he told him: "Now you better go to Caltech."

Narasimha spent some of the best years of his life at Caltech. He recounted so many Caltech stories. Talking of the American reaction to the Sputnik satellite in 1957, he said: "Everyone thought the Soviets were lying, and crowded on terraces to check out. To their great dismay, the bright little speck was indeed seen in the sky at exactly the appointed time." This Soviet success completely changed the U.S. perspective, and the R&D focus shifted almost overnight from aeronautics to space.

This also affected Narasimha's Caltech research plans. He had hoped to continue his work on turbulence, but research priorities shifted to outer space, where Navier-Stokes equations did not apply, and Narasimha therefore ended up working on rarefied gas dynamics and the Boltzmann equation.

But Narasimha was 24, at the prime of his powers, and everything seemed rather easy. His first paper, on rarefied gas dynamics, did not take too long to appear in print. A year later, Narasimha found himself at

an international meeting in Berkeley, where someone was talking about his paper and declaring that it was all wrong. "You can imagine my surprise, but my PhD adviser, Prof. Hans W. Liepmann, was supportive. We got chatting with other Caltech mathematicians, and I was reassured that my calculations were correct. It ended well; the speaker in Berkeley came down to Caltech, acknowledged his small error and withdrew the paper." Narasimha's confidence soared, and he started earning new respect in the U.S.; "I even earned a few lucrative consultancies while I was still a PhD student," he recalled.

Narasimha was such an engaging *raconteur* with so many interesting stories to tell. That periodic clearing of the throat, and the engaging smile that frequently broke into a somewhat ironic laugh; we are going to miss all those moments.

Back in India

Narasimha returned to India in 1962 to begin his Indian adventure starting as an assistant professor at IISc. Almost as soon as he returned, Dr Vikram Sarabhai invited him to Thumba to witness a rocket launch. That visit led to Narasimha doing some useful Monte Carlo calculations for ISRO.

At IISc, Narasimha quickly realised that he had to change track; serious computation was then not possible in India. Instead of grumbling about it, he cheerfully embraced theoretical mathematics, and proceeded to work on the "fascinating but neglected problem" of relaminarisation of turbulent flows, in collaboration with Prof. K.R. Sreenivasan "who was one of our brightest students". Many consider this to be among Narasimha's best works.

Multifaceted

How could we describe Roddam Narasimha? "Great scientist and scholar", "charismatic leader", "mighty patriot", "Sherlock Holmes of Indian S&T", "eminent essayist"? He was arguably all that, and much more.

As a young engineering student, Narasimha remembers reading as many Holmes stories as he could; his friend wanted the book back in 48 hours. In the late 1970s, he got to play Sherlock Holmes while assisting the

Satish Dhawan one-man committee. The pilots were refusing to fly the HS-748 (Avro) aircraft because they said its climb would be dangerously sluggish if one of the two engines failed. Narasimha enjoyed the adventure; a highlight of which was the IAF test pilot, Wg Cdr P. Ashoka, taking off with one of the Avro engines shut: "Just let my wife know if you see the plane crashing behind the bushes," he requested before getting airborne. These test flights enabled Narasimha to compile valuable flying data, use it to develop the theory of stochastic corrective processes, and eventually conclude that there was no significant airworthiness issue of concern with the Avro.

As he aged, Narasimha became more Mycroft than Sherlock. He once told us: "I have been the chairman of so many investigation teams in aerospace, that I'm not sure I can now recall all of them." But even he remembers the cloudy morning, sometime in July 1988, when a grim Prof. U.R. Rao, then Chairman, Indian Space Research Organisation (ISRO), walked in to meet him at the NAL Director's Office. There had been two successive failures of the Augmented Satellite Launch Vehicles ASLV-D1 and ASLV-D2, and U.R. Rao asked Narasimha to head the investigative team. After studies spanning almost a year, Narasimha's team determined that the failure was due to the brief instability after the first rocket burnt out and before the second rocket fired. "That was a good investigation," Narasimha recalled. "Since both failures were very similar, we knew that it had to be a design issue." Soon, thereafter, Narasimha was invited to be a member of the Space Commission; he went on to become the Commission's longest serving member (1989-2012).

Also read: Roddam Narasimha as scientist & mentor (https://frontline.thehindu.com/other/obituary/tribute-roddam-narasimha-scientist-mentor/article33424882.ece)

As for being an essayist, we recall Narasimha lending us a book about good English writing. It was a slender book, but Narasimha's 'learning notes' in the margins were as profuse as the number of words in the actual book. Good writing, and good scientific communication, was something that Narasimha deeply cared for. As President of the Indian Academy of Sciences (1992-94), he recommended the publication of a

journal of science education. The first issue of *Resonance* appeared on January 1, 1996, and, 25 years later, the journal is still marching ahead strongly.

Narasimha's knowledge of Sanskrit, acquired as a schoolboy ("although my father never considered this knowledge good enough") coupled with his amazing felicity in the English language, persuaded him to read (and eventually write a book titled *Verses for the Brave*) about the *Yoga Vasistha*, believed to span an 18-day dialogue between Rama and the sage Vasistha. "What attracted me the most," he told us, "was how strongly the verses rejected fate. I was struck by the articulation of such a different philosophy. It was also so forcefully expressed... there was such verve, force, humour, lyricism and logic in the verses that reading them actually became a minor obsession with me."

Hope and Despair in Civil Aviation

Narasimha always talked of the limitless options offered by civil aviation in India: "Civil aviation can be a net creator of wealth; not a consumer of wealth." During the 1980s and early 1990s, he showed projections to explain how India's air traffic would soar (at a time when Bangalore had just a dozen daily departures). He used to say: "If Brazil and Indonesia can do it, so can we!"

A lot of this enthusiasm got translated into the programme to design and develop the SARAS light transport aircraft. At the 2003 Bangalore air show, Narasimha's mood was buoyant. "Can it be boom-time for Indian aerospace?," he asked. And, with his eyes dancing, he said: "Although I'm posing this as a question, I strongly believe that the answer is yes."

When SARAS had a successful first flight on May 29, 2004, Narasimha could not stop smiling: "This is the day I was waiting for a long, long time!"

In some ways this was also the last hurrah. At a talk he delivered at NAL on his 73rd birthday in 2006, the optimism had diminished. "*Aeronautica is globalizing: Can India afford to keep out*?", Narasimha asked as he ruminated over an "apparent paradox": "When the basic fundamentals of Indian Aeronautica remain extremely strong, why isn't

that boom coming? We don't seem to know how to exploit our potential and talent," he went on, and wondered if the endgame would be a Western group "exploiting our talent the way we can't ourselves".

In 2010, there was another glimmer of hope with the creation of the National Civil Aircraft Development (NCAD) programme . "This is an extraordinary step in Indian aeronautics. We couldn't have asked for more!" Narasimha, now 77, and the 'wise old man' on NCAD exclaimed, during another lecture at NAL. "It's going to be an extraordinary challenge.... NAL must learn how to make and ride this approaching wave." He then proceeded to list the many formidable challenges ahead; it was a most remarkable enunciation.

Looking back, one is saddened. Narasimha still had the immense intelligence needed to wage a battle; he knew exactly how the war could be won. He still had abundant will, but was ruefully realising that there might be no way.

Insight and Erudition

Everyone who met Narasimha came away gushing how learned he was, and how charming. His handshake was warm and firm, and his handwriting was exquisite, and almost a work of art.

Conversations with him were immensely fulfilling. He was an excellent listener; he endeavoured to listen to every word you said, and if he did not catch the word, he would interrupt you and ask you to repeat. If he did not agree with you, he would start with an embarrassed "well ...", and then proceed to articulate his contrary point of view. He read voraciously, and was a prolific writer.

Narasimha was always influential, perhaps never more than during his years as Director, National Institute of Advanced Studies (NIAS; 1997–2004). His views were sought by individuals in the highest positions of power. He was often consulted on matters of national security. Following India's nuclear tests, there were many questions asked abroad about India's true intention. In response, the Indian government prepared its Nuclear Doctrine document; it was drafted almost entirely by Narasimha.

Narasimha invoked the alluring idea of 'computational positivism' to respond to Needham's poser: How did modern science come to birth in Pisa, instead of Peking or Patna? While the European method was based on hypotheses, generalisations, deductions and abstraction, Narasimha suggested that the Indian way was based on observation, examination and ingenious specific solutions or inferences; often called *yukti*. What was 'proof' for the Greeks was '*yukti*' to the Indians, but, somewhere along the way, proof completely overwhelmed and submerged *yukti*.

The Monsoon and the Clouds

If Dhawan's big love was birds, for Narasimha it was clouds. As a child, Narasimha admired clouds for their mystique and variety. As a scientist, he realised that India's well-being was inextricably linked to the monsoon, and the rain that these winds deliver across the country. An accurate rainfall prediction was therefore essential, and among the many actors that play roles in the enormous monsoon drama, the cloud was the prima donna. The best monsoon prediction model would be the one with the best cloud model within.

Understanding cloud behaviour therefore became Narasimha's enduring passion; what troubled him was that we saw clouds every day with our eyes, but yet failed to understand the fundamentals of the phenomenon. So, Narasimha lovingly set up a cloud lab to create cloud-like flows. He was sure that these flows had important and fascinating stories to tell. It did not bother him that he was now 87, and officially old. The *karmayogi* never wavered from his *karma* till the very end.

(This tribute draws heavily from G.S. Bhat and K.R. Sreenivasan's remarkable 2014 note in *Current Science*, the two wonderful interviews in *Bhavana* issues of April 2017 and April 2018, and the very exhaustive unpublished transcripts, archived by Dr Gopal M. Kamath, of our conversations with Narasimha in 2013 and 2014.)

U.N. Sinha and Srinivas Bhogle, former scientists of the National Aerospace Laboratories, Bengaluru, are Honorary Scientists at the Council of Scientific and Industrial Research-Fourth Paradigm Institute, Bengaluru.