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PROPELLING HEALTHCARE IN MISSION MODE

"***We have indigenously developed state-of-the-art missile technology, making India self-reliant in the production of combat missiles and missile interceptors. It got realized through mission mode activity with a strong leadership and well managed workforce. The missile technology mission could be taken as a model for addressing the challenges in healthcare for the benefit of all citizens***".

Dr.Vijay Kumar Saraswat, Hon'ble President of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum, shares his experiences in missile development mission and suggests the lessons therein for the healthcare sector. Here are excerpts from his informal conversation with **Dr.Srinivas Gopala** and **Dr.Manoj Komath**.

Sir, we see that your professional career has been devoted to missile development. How did you get introduced to this exotic field ?

That happened in the Indian Institute of Science (IISc) Campus, when I enrolled for ME in 1970. I joined the Aeronautics Department for a course on Internal Combustion Engine. I did my Bachelors in Science and B Tech in Mechanical Engineering in my hometown, Gwalior, before coming down South to Bangalore. IISc is a different world where a student gets the rare exposure to exotic, state-of-the-art subjects. I studied 'Rocketry' as an elective.

Sir, can you tell us about your entry into defence research ?

That was through Campus selection in 1972 for the newly formed Defence Research and Development Laboratory in Hyderabad. It was set up under a special fund from the government for missile technology development. Only a few countries had that knowhow at that time and India was dependent on them for such weapons. Land for DRDL was acquired in the erstwhile Nizam's army barracks. We young engineers were taken to this huge but closed campus and deputed for the setting up of facilities from scratch. However, the real purpose was not disclosed for strategic reasons. We were working under strict surveillance to ensure secrecy of the activity.

Akin to captivity, Sir ?!

Sort of; but we were not at all bothered by that because it was a 'mission mode'. All were 'young blood' committed to work for the country. Our project leaders were strict disciplinarians and great managers. We learnt missile technology by dismantling the missiles procured from countries like Russia and tried back-engineering of the components.

There were two projects envisaged for developing liquid fuelled missiles – Project Devil for short range surface-to-air missiles and Project Valiant for long range ballistic missiles.

What were your roles in the mission ?

My interest was in Liquid Propulsion Engines, because of my M.E. background. The structure and working of engines for missiles were closely-guarded secrets. Practically there was no information available. It was really a complicated thing and posed a great challenge to me. Along with developing engines, the test facility also had to be made. We had to make advanced set ups like vacuum brazing and spinning. Our project in charge was Squadron Leader R. Gopalaswamy, Chairman of the Bharat Dynamics Limited in DRDL. The next task was to integrate with the missile.

How was that achieved ?

Project Devil team had gained sufficient knowledge about missile design by studying the Russian make surface-to-air missile (SAM). Reverse engineering phase was followed by indigenisation of the components and improving the performance. This part of the project was led by Dr. B. D. Nagchaudhuri. The SAM designed and assembled by the team was a ballistic missile of 1000 km range with a nuclear warhead of 30 tons. About 40 personnel, graduated from various Institutes, were in the team and they achieved the target in a short span of two and a half years. Flight of SAM-2 was tested in the Sriharikkotta range on 10th June 1974, just after the first nuclear experiment in Pokhran.

What was the future trajectory following the initial success ?

Despite the successful testing of SAM-2, the level of technology generated by the projects was not attractive for the Army. The Valiant Project, therefore, was terminated. Army suggested 150 km range Battle Field Support System. I tried to improve the engine by making a 2-propellent system instead of the existing 3-propellent system. This served as the prototype of the forthcoming model 'Prithvi'. Project Devil came to a formal end in 1980.

How did the Indian missile technology come to its present level ?

The fate of the missile technology mission was uncertain in the late 1970s. We had to wait until a strong political and scientific leadership came up. A high level review of the earlier projects revealed that several useful component technologies had been generated and the committee recommended their consolidation for further application. It led to the Integrated Guided Missile Development Program (IGMDP), with 5 component projects – (1) “Prithvi”, the short range surface-to-surface missile, (2) “Agni”, the long range re-entry missile, (3)“Trishul”, the short range low-level surface-to-air missile, (4) “Akash”, the medium range surface-to-air missile (5) “Nag”, the third-generation anti-tank missile. Dr. APJ Abdul Kalam was placed at the helm for his unparalleled leadership in the SLV project. This ambitious program IGMDP received a funding of 350 crores and was flagged off in 1982.

Sir, you led the “Prithvi” project

Yes. I had been involved as the Deputy Project Director at the beginning, under the leadership of Lt. Gen. Dr.V.J. Sundaram. We tried to revamp the technology with bootstrap engine and sophisticated navigation. The design was for 150km range with 1 ton warhead. We had 200 personnel in the team and achieved the target within 5 years. By that time, I became the Project Director. The first version of “Prithvi” was tested in Sriharikkotta on 25th February 1988. That is one of the memorable days of my life.

What about the other projects - and what were the challenges ?

“Agni” project also went at the same pace, with test firing in 1989. However, these early successes invited sharp adverse responses from other countries owning the missile technology – Canada, France, Germany, Italy, Japan, the United Kingdom and the United States of America. The Missile Technology Control Regime (MTCR) restricted the access of our Country to any technology that would help in its missile development program. We were deprived of phase shifters for radar, magnesium metal for wings, servo-valves for electro-hydraulic control systems, gyroscopes and accelerators and processors for computers. These were only the crucial components. The actual list extended to hundreds that had put us in crisis.

How did IGMDP survive that situation ?

Under the able leadership of Dr. APJ Abdul Kalam, we made a concerted effort to combat MTCR. A consortium was made involving DRDO laboratories, academic institutions and industries. All the needed technologies were developed domestically on warfooting and transferred to industrial counterparts for production. Though this delayed the programs a bit, it helped to prove our capability and made us self-reliant. The pressure on us was tremendous in the beginning but it laid a robust foundation for research.

How did the Integrated Guided Missile Development Program end ?

Within a span of 25 years, the design objectives of IGMDP were achieved. Most of the missiles in the program were developed according to requirement. They were manufactured and inducted by the Indian Armed Forces. In the case of Prithvi, manufacturing started in

1994 by Bharat Dynamics Limited. We had 21 flight trials before it was approved for manufacture. The imported components were less than 10 percent.

On 8 January 2008, the DRDO formally announced the successful completion of the IGMDP.

We find this story of the missile development program highly inspirational

Exactly. I described it passionately because this story should motivate the younger generation to take up mission mode activity for social cause. The whole missile technology of our country, as you have seen, was developed by 'doing and learning'. We created our success model for achieving something next-to-impossible.

You are at the centre point in the 'Prithvi' story, standing as a role model for the younger generation

I must say, the credit goes to my mentor Dr. APJ Abdul Kalam. He was a role model for me and many others in the missile mission. A real mentor creates mentors for the coming generations, and Dr. Kalam was a typical one. He had the extraordinary capability of carrying people for the mission and driving it forward. He had the rare capacity to make the North Pole talk to the South Pole !

The success of the IGMDP mission as a whole is dedicated to something we call 'Kalam's Management Technique'.

You were in DRDO in various capacities, including as its Director General. There were several parallel projects and, in each of them, so many component programs. What was your style of management ?

I appreciate this question because that is really a crucial aspect. There were hundreds of programs to be managed, which were running in parallel. Each one needed funding, manpower, machines, materials, work space and work environment. For the governance of the Organisation, we needed the Department-Division-Lab hierarchy. Yet, to operate the project, we needed a lateral collaboration of people from this structure. Therefore, we had essentially implemented a 'matrix mode' in which hierarchy went vertical and work flow went across.

Can healthcare learn from the missile development mission?

Of course. This is exactly the point I am coming to.

India is the country that used scientific knowledge, meticulous planning and systematic management to demonstrate spectacular success in the area of agriculture, milk production and space technology. However, healthcare sector has not witnessed a revolution, failing to integrate major part of the population in mainstream health programs. We have shortage of fund allocation as well as workforce there. The reach to rural area is very limited and proper medical care today is skewed towards the urban population, amounting to 28%.

We have demonstrated the capability of developing a missile that uses more than 10000 sensitive parts, of which 90% is manufactured indigenously. That made India self-reliant in the combat missile and missile interceptors. It can be seen as a model for cracking the long-standing problem affecting the health scenario in the country.

Could you please give an outline of the programs you have in your mind ?

Collective activities in healthcare sector happened in the past, for example, the programs to control infectious diseases which recorded success in eradicating many dreaded diseases from the Country. We have to emulate the strategy for the new challenges like drug resistant TB and novel infectious agents. Non-communicable diseases and cancers are equally important. While pursuing these modern medical innovations, a relook into the alternative medical systems existing in India should also be made.

There is great promise for healthcare offered by the latest technological developments. We have to go for their effective use for disease diagnosis and management, like making mobile diagnostic systems, designing point of care diagnostics, effective use of information technology in telemedicine and incorporating artificial intelligence.

A mission mode healthcare requires a large consortium of institutions with different areas of expertise in biomedical technology, clinical management, health technology assessment and the like. Academic institutions and industries should come together to work jointly, but with clear individual goals for each partner. Matrix management is the way forward.

What about the technology ecosystem in the country for medical device development ?

The technology ecosystem of the country, in the industrial sector, should be such that it supports the entrepreneur to survive the 'valley of death' and hand hold to transform and take it on the upward slope of commercialization. In the valley of death, the entrepreneur, though technically sound, needs clinical support, financial support and moral support. In the Indian scenario, we have not created a strong system of pulling our innovators out of the valley of death. Once out of the valley of death, the industry should be helping the technology all the way to commercialization.

Industry has to get involved as soon as the basic research has completed the demonstration phase. In the translational phase, Industry should be able to put nearly 10-20 % investment. When the technology maturity reaches the pre-clinical level, Industry should start supporting it and carrying it to commercialization. In the scale up stage, Industry needs to raise at least 50 %, the rest shared by the Government.

How can we tackle the issues in medical device development, like costs of conducting clinical trials and meeting the regulatory stipulations ?

The gestation time to take the medical technology 'from bench to bedside' is currently too large. Clinical trials involving human subjects is again time consuming and pose huge costs, which deter Industry from taking part in such activities. NITI Ayog is now working on a modus operandi to streamline the process and funding the human clinical trials, working hand-in-hand with the DCGI, and efforts are being made with all stakeholders to make it happen.

You are visiting SCTIMST as its President. Based on the long experience in the fields of Science and Technology, how do you view this Institute ?

I am very happy that, despite a lot of limitations and constraints, SCTIMST has done wonderful work and established itself as a premier Institute of the country in Medical, Biomedical and Public Health Research spheres. I see a lot of enthusiasm and dynamism among faculty members and the young scientists who happily devote their time and work passionately. Such an institution should be supported in a big way by all concerned, by all stakeholders, State Government, Central Government and industries, so that the output from here continues to be useful to the Country.

The products and human resource generated here should serve our society to the fullest extent. In this connection, SCTIMST can form a nucleus for increasing the reach of the services to a larger portion of the country. I understand that very good engineering and medical science work is being done at the Institute toward product development. I congratulate you for the wonderful work and strongly urge you to keep up the pace. As the President of the Institute, I will try to do my best to support you to take your dreams and vision higher and higher.