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The Outperforming Company in Aerospace Technology

Dr. Sudhir K Mishra, DS & DG (BrahMos), DRDO, MoD and CEO&MD, BrahMos Aerospace, has contributed immensely in India's quest to achieve excellence in Missile technologies and is currently spearheading the BRAHMOS supersonic cruise missile programme through his management skills, technical expertise, hard work, sincerity and outstanding leadership capabilities.

A true academician, Fellow and member of numerous professional societies, true disciple of father of India's missile program Dr APJ Abdul Kalam, an ardent scientist who has guided "Team BrahMos" in modernising and upgrading BRAHMOS missile to achieve newer capabilities and versions including several first time achievements in the world, has been awarded with numerous prestigious national and international accolades.





DR. SUDHIR K MISHRA (BrahMos)

Aiming for **ACCURATE, DEADLY STRIKES**

From BrahMos to Hypersonics – a race towards excellence

BrahMos Aerospace is one of the most outperforming companies in India's Defence & Aerospace Sector. Dr. Sudhir K Mishra, CEO & MD of the India-Russia JV entity, in an interview, shares the vision and incredible achievements of the company in its quest to improve the strike capability of India's armed forces whether on sea, from underwater, in air or on land.

How has BrahMos Aerospace's journey been so far and are you on track with the company objectives?

BrahMos Aerospace is a Joint Venture (JV) between India and Russia. The Company was set up in 1998 as part of an Inter-Government Agreement between India and Russia. Our Russian partner is NPO Mashinostroyeniya and in India it is DRDO. We decided in the very beginning that if we wanted to develop a high technology product, then we would have to follow a completely different path and undertake a different journey. Through a normal path, we would not be able to develop something which would be unique and unparalleled in the world. So, we decided that both Governments would hold an equity share distributed in such a manner to benefit both the partners. As a result, Indian Government held 50.5% share and Russian Government held the remaining 49.5%.

To be precise, the very basis of BrahMos JV is not "Transfer of Technology", but joint design, development, production and integration of the world's fastest and deadliest cruise missile BRAHMOS. Indian scientists and engineers since the very beginning have been closely involved in its design, development, manufacturing, integration, product support, and we are coming out with newer versions (of the weapon) almost every 3-4 years. BRAHMOS is now integrated on almost all platforms – ships, aircraft, and on mobile land platforms. On land, we intend to further widen the scope of its deployability and operationality. We have conducted successful flight tests from all these platforms and are able to neutralise almost every target in the sea or on the land.

What advantage does DRDO bring to the company?

BrahMos Aerospace is owned by DRDO and that allows us to access and generate a wealth of knowledge which we can always increase and enhance that would make a difference to the users. DRDO has done an

excellent job in the field of missiles and other engineering domains. They have contributed immensely in the development of BRAHMOS. The culture of achieving excellence has thus flowed down from DRDO to BrahMos.

For example, initially we planned that ship would be our main carrier platform and we developed our missile for that particular role (anti-ship) and demonstrated it. The missile was configured to be launched from an inclined launcher, but then we realized that if a ship is under construction, then we should go for a vertical launcher so that we can integrate it inside the ship to avoid the weapons' visibility from outside. And we completely automated the launch in such a manner that you just have to press a button, the hatch door would open, and the missile would go straight towards the target. That was the first integration. Then Indian Army realized that BRAHMOS has great potential for use against land targets also. So, we developed the land platform – a complete ground system and a vehicle-mounted device with a Command & Control centre on the vehicle. Everything had to be integrated so as to be able to communicate with the outside command centre or headquarters. All those things were developed. Now, the mobile launchers can be deployed anywhere along the borders and controlled from several places. After the land system, we realised there may be a requirement to integrate the missile with submarine. So, we have created a launcher for the submarine in the form of a cartridge which can be loaded on any submarine, giving Indian Navy the option to source the submarine from any country.

The Indian Air Force subsequently realised that the missile is very capable given its enormous destructive power and that they can use it against land or ship targets. That's how we started integrating the missile onto the Sukhoi-30MKI platform and that has completely changed the way wars will be fought in future.

This has been the kind of business model as far as the technology is concerned. And when it comes to financial aspect, you have to generate

wealth and that's the bottom line. You want to come out with a product which is economical, which is technologically superior or rather, which is the best. It also has to be user-friendly to make you feel empowered. The fourth important thing is we should be able to create the required knowledge base in the country so that we can use it for other missile systems too.

BrahMos is now integrated on almost all the platforms – it's integrated on ships, on aircraft, while on land we intend to further widen the scope of deployability. We have conducted the flight test from all these platforms and are able to engage with almost everything which sails in the sea or on the land.

BrahMos JV had an initial equity capital of Rs. 1,300 crore. So far, we have generated business worth around Rs. 40,000 crore, which is huge. We have also created employment because 100% ground system and approximately 65% of the missile system is produced in the country today. We have over 200 industries and around 20,000 people directly or indirectly (in India) involved in the programme. Besides, we have paid some Rs. 4,000 crore back to our Government as direct or indirect taxes. The success of BrahMos has convinced everybody that in this country, the private sector, although the Government is equity holder, can create the best product in the world. And it can financially survive, thrive, and deliver.

Integration and successful flight tests of BrahMos-Air version has created



in the world to possess such long range and annihilating power on their fighter aircrafts.

The incredible success of BRAHMOS and its operationalisation in Indian Armed Forces has created a kind of confidence, technological maturity and manufacturing capability which is unique not only for India, but for entire world. In case of BRAHMOS, we conducted one flight test and we started delivering it against land target. We carried out yet another test, and we started the delivery for naval warships. The confidence that if we conduct one flight test and if we are successful... that kind of maturity is very important. Majority of our staff comprises of youngsters. We have many senior officials, but majority of the work has been done by young engineers and scientists.

We go to different NITs and recruit manpower. We train them for about 9 months, and 3 months they work on factory floor, after which they get to choose what exactly they are going to do. We are only 600 people creating the wealth of over Rs. 40,000 crore.

What sets apart BrahMos from other private companies and PSUs?

We have successfully oriented ourselves as “a future looking” company in the sense that we decided to exploit all platforms, all possible targets, and also “life extension” technologies. BRAHMOS, being an expensive piece of engineering, previously had a lifespan of

the real muscles for our Air Force. We conducted the first flight test of BRAHMOS-A on November 22, 2017 against a ship target and again on the May 22, 2019, we conducted the second flight test against a land target. They were the real game changers

How has BrahMos helped in developing indigenous technology? What sort of collaborations has it helped evolve in the quest to strengthen the missile programme?

About 8 years back, we were given the task to integrate BRAHMOS on Sukhoi-30MKI and at that time, the Russian designer of Sukhoi-30 had asked for a lot of money to carry out modifications in the aircraft. The reason is that the weight of original BRAHMOS was 2,900 kg (2.9 ton) which called for some changes in the aircraft as you need two points for integrating the airborne launcher on to the aircraft for holding such a heavy missile.

The options for us were: either we modify the aircraft to carry the 2.9 ton missile or try to reduce the missile's weight. We chose both options. We talked to Russians, the original equipment manufacturers. As the amount of work was huge, we decided to carry out all the work in India. Because HAL had a manufacturing ToT (transfer of technology), they had access to the drawings. We decided that HAL with the help of SDI (Software Development Institute of Indian Air

Force), plus, the certifying agencies like CEMILAC, MSQAA, DGAQA and other private companies, the National Aeronautic Laboratories (NAL) under DRDO, would carry out all necessary work on their own. So, we literally ripped apart the Sukhoi-30, strengthened the internal structure, welded it back and created one more additional hard point. And the airborne missile, with a reduced weight of around 2,500 kg (2.5 ton), was now ready to go. For electrical and software integration, IAF took the responsibility to modify the main software so that BrahMos could be integrated with the platform. The SDI carried out the electrical integration with the missile. ASTE, another institution of IAF played major role in planning and conducting flight test of newly developed missile.

Indian Air Force is the only air force



only 10 years. So, we decided to extend its shelf-life and created a complete framework of tests to ensure that the weapon worked for 5 more years. Secondly, we realised that our missile has some qualities like range, accuracy. Third is its destruction power, so we should focus more on these things. Earlier, the range was 290-kms, and India joined Missile Technology Control Regime (MTCR) after which we could have gone to any range. But India being a very responsible and MTCR-compliant state, we never breached the provisions of MTCR. Even without being a member of such treaties and regimes, we have followed all rules and regulations. Now we can go for longer ranges of 400 km, 500 km or even more, and those capability we are going to offer to our users. As for

accuracy, initially we used to think in terms of 10 meters, then we came to single digit, and now we are thinking of less than a meter of pin-point accuracy. That would give a lot of confidence to our users. The third is the annihilating power. Again, we had only the deep penetration and then explosion. So, we decided to go for some kind of air-burst capability plus deep penetration so that it can take care of both soft target and hard target. When it comes to speed, we realised that if we do some tinkering with the existing engine and go to higher altitude, we can go for higher speed – maybe up to Mach 3.5 or 3.8 or 4, which is also in the pipeline. As the future is of Hypersonics, which is a completely different ballgame, we are working on it. It's a very classified engineering. Many countries including

the US, France, China and surprisingly Australia, are working in the field of Hypersonics. We are at par with these countries. It will take some time as it's a new engineering. We need to develop new materials, plus new aerodynamics with new configuration, new chemicals, new fuel – so we have to work in all these aspects of engineering. It may take 3 to 5 years to create a new product.

Will the speed go beyond five Mach?

Hypersonics means it will go up to 7 or 8. We will not be pure hypersonic because we are improving the performance of the existing engine. Basically, its material has to withstand high temperature. So, we are creating and coating new materials which we feel could allow the missile to withstand high temperature. For higher speed, we feel that we should be able to reach it by using the existing engine. But for pure Hypersonics, where Scramjet Engine is deployed, we must reach at it within 5 to 7 years. However, improvements in the engine performance can happen in about 3-4 years.

How do you see the future of BrahMos Aerospace? What is the company aiming at?

When we created BRAHMOS, it was created to provide better strike capability to our Armed Forces. Now we aim to provide much stronger capabilities in future. For instance, the integration with Sukhoi-30 has provided the capability to strike at the adversary located thousands of kilometres away. As I mentioned, we are now aiming for better accuracy and longer range. When exports happen, we will earn more and add more to the exchequer. Defence exports need permission of Governments and we are guided by interests and vision of Indian Government. However, we have enough production capabilities to meet requirements of Indian and foreign customers. BrahMos Aerospace has been a profit-making company, and we will keep making profit because our product is unbeatable and the best in the world.