

PROCEEDINGS OF SEMINAR : **COMBAT VEHICLES INDIA 2019 INTERNATIONAL SEMINAR**

BY

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Introduction

1. A Seminar on “**Combat Vehicle India 2019**” was organized at the Manekshaw Centre on 07 and 08 Nov 2019 under the aegis of CENJOWS, HQ IDS and OFB. The seminar focused on futuristic requirements of Armoured Fighting Vehicles (AFVs) in the developing battlefield environment, global trends and technologies. Also, it covered the upgradation requirements of existing fleet of AFVs to meet the challenges of emerging battlefields, public–private partnership, technology enhancement affecting training philosophy and training aggregates, etc. The Programme of the seminar is attached as Appendix “Ä”. The deliberations and discussions were conducted with interaction amongst the panelists and audience drawn from the fraternity of Veteran Soldiers, Mechanised Forces Directorate, and Serving Officers from the field formations, DRDO, OFB, Think Tanks and the Industry Representatives. Hon’ble Shri Shripad Yesso Naik, Minister of State for the Defence, Government of India was the Chief Guest.

Introductory Remarks

2. Lt Gen Vinod Bhatia, PVSM, AVSM, SM (Retd), Director of CENJOWS commenced the proceedings with the introductory address. He welcomed all the delegates and speakers to the seminar and highlighted that a large number of Defence Equipment including Armoured Fighting Vehicles are under procurement. He explained that the Combat vehicles have come a long way from the inception to the present state and need to be modernized further. He emphasized that this two day workshop will be bringing all stake holders together and would provide an opportunity to domestic industry to learn about the Combat Vehicle Sector.

Welcome Address

3. Sh Saurabh Kumar, Chairman Ordnance Factory Board (OFB) in his welcoming address brought out that Ordnance Factories - a family of 41 Ordnance Factories possesses the unique distinction of many years experience in defence production. He stated that OFB was the Prime Mover as the Government has set up the first factory for making of Armoured Vehicles in India in Dec 1961 and the production started from December 1965. OFB always worked for the modernization and as of now India is number four in building Armoured Fighting Vehicles after US, Russia and China. He highlighted that there is a paradigm shift in requirement of present and future Armoured Fighting Vehicles. Production of the latest Armoured Fighting Vehicles and increase Defence capability has always been the priority of the OFB. He emphasized that OFB with its state-of-the-art production facilities, experience and skills as well as domestic industry with its access to cutting-edge technologies, efficiency and entrepreneurship will provide the best win-win solutions. He also stated that OFB has already planning and designing the components of Combat vehicles which were being imported earlier.

Inaugural Address

4. In his inaugural address, Hon’ble Shri Shripad Yesso Naik, Minister of State for the Defence, Government of India congratulated the organiser for the seminar and praised their efforts

for bringing all stake holders together for meeting up the requirements of Armoured Vehicles. He appreciated the dedication and production output of various Ordnance Factories. He praised the Defence Research and Development Organisation (DRDO) for its achievements in the last few decades and said India is making great strides in research and development. He also congratulated private industries on their role in developing Defence Equipment. He emphasized on Indigenization and self reliance of all defence equipment. He further stated that Make in India, Digital India and Start up India is the first priority of the present Government and all stake holders should work for the same. He informed that financial powers of Ordnance Factories have been enhanced and the procurement process is simplified for fast procurement of spares. At the end once again he congratulated CENJOWS for organising this seminar and asked to share the report of this seminar with Government.

Special Address

5. Sh Praveen Kumar Mehta, DS&DG-Armament & Combat Engineering System (ACE), DRDO in his Special Address congratulated the organisers for the seminar on Combat Vehicles 2019. In beginning of his address he quoted the remarks of General Bipin Rawat, the Chief of Army Staff during recently held 41st Defence Research and Development Organisation (DRDO) Director's Conference that "We are confident that we will fight and win the next war with indigenous weapon system". Sh Praveen Kumar Mehta brought out achievements of DRDO's in the last few decades and said that DRDO is making great efforts in research and development. He gave a detailed presentation on Arjun MBT Mk-1A. He stated that presently India is the seventh in world to make tanks like Arjun MBT Mk-1A and would stride harder to become the first in future. He informed that indigenization solution for all ammunition and spares are under way and shown positive results. At the end he again congratulated CENJOWS and OFB for inviting him for the seminar and bringing all stake holders together first time to discuss and plan design, development of the new Combat Vehicles.

Keynote Address

6. Lt Gen RK Jagga, AVSM, VSM, Director General Mechanised Forces conveyed that the topic of the seminar is close to his heart, him being working in Mechanised Forces and he complimented the CENJOWS and OFB for jointly organizing this seminar and stated that this seminar is a good start and going to be a great help for Armed Forces. He stated that Indian Armed Forces are looking forward for the Indigenised Equipment and he is sure that in future the best Tanks and Combat Vehicles will be of Indian Make. He stated that after meeting the stake holder he is confident that the day is not far that India is Number One in Making Combat Vehicles. He brought out that the face of the war is changing and in present scenario it is emerging as multi domain concept operations. He stated that in modern battlefields, all Combat Vehicles will be equipped with Artificial Intelligence capabilities and have Robotic Operations. Artificial Intelligence and Robotics required to be added in the development of all future Indian Tanks and Combat Vehicles. He also stated that human life is important and there is a need of the hour to immediately build the special Combat Vehicles which can defend the UAV attacks. He emphasized that Indian Mechanised Forces being the nucleus of Armed Forces need to be transformed and modernized in the fast track. He insisted that India need more agile, lighter, reliable and modern weapons which will be effective in all terrains. He urged all stake holders like OFB, DRDO, Industries, Academia and Think Tanks to come together and plan a strong strategy to achieve this goal. At the end he appreciated the CENJOWS and OFB for planning this seminar.

Theme Address

7. Lt Gen AB Shivane, PVSM, AVSM, VSM (Retd), Consultant Combat Vehicles, OFB in his theme address stated that India in manufacturing of Tanks and Combat Vehicles has come up to a

good level. As per the latest Global Fire Power Index-2019, which has taken into consideration of 137 countries over 55 parameters to judge status of the Military Powers of the Nations, India is Number four after USA, Russia and China. Pakistan is 15 as per this Global Fire Power Index-2019. In this Index, if we compare the status of Tanks from 2018 and now, China and Pakistan are elevated to Number two and thirteen respectively, however India has slipped down to Number 6 from 4. It is an alarming situation and India should strategically plan and start building the next generation Tanks and Combat Vehicles at the earliest. He emphasized that to fight the future wars, more technical capabilities are needed to be incorporated at the earliest. He further stated that in today's scenario, the Mechanised Forces are the forerunners in any war and needs to be modernized. He insisted on standardization, fleet sustenance, risk analyses and life cycle management of all Combat Vehicles. He strongly recommended that Industries have to play an important role in all projects and they must be kept in a loop from the start of the project till completion of the project.

Release of EY-IMR Knowledge Paper on Combat Vehicles and IMR Paper on AFV Technology for India.

8. After the theme address, the Chief Guest Hon'ble Sh Shripad Yesso Naik, Minister of State for the Defence, Government of India released the EY-IMR Knowledge paper on Combat Vehicles and IMR Paper on AFV Technology for India.

Industry Perspective.

9. Mr Sukaran Singh, MD & CEO, Tata Advanced Systems Ltd brought out that Tata Motors has made a strategic shift from the Logistic vehicles space to the Combat vehicle space by focusing on development of contemporary state-of-the-art combat vehicle platforms (Tracked & Wheeled) with the dual purpose of empowering India's Defence Forces with breakthrough technologies and increasing the nation's self-reliance in this critical area. He stated that the idea is to ensure high mobility, fire power and protection to the forces for their various missions by developing world-class armored fighting vehicles in India. He also informed that Tata Motors is the first private sector OEM in India which has developed WhAP (Wheeled Armored Amphibious Platform), an Infantry Combat Vehicle, designed for optimized survivability, all-terrain performance and increased lethality jointly with the Indian Defence Research and Development Organisation (DRDO). Also, Tata Motors developed the Light Armored Multi-role Vehicle (LAMV), a reconnaissance vehicle that combines vital operational prerequisites of mobility, protection and firepower in association with the Ordnance Factory Board.

SESSION 1 - EMERGING TECHNOLOGIES AND CAPABILITIES

10. This session was chaired by Lt Gen Vinod Bhatia, PVSM, AVSM, SM (Retd), Director of CENJOWS. In this session he was assisted by representatives from the OFB, DRDO and Army HQ. He stated that our modernization policy must also factor in upgrades to the existing fleet of Infantry Combat Vehicle and Tanks. He informed that since the gestation period of new equipment is 10-12 years and the service life is 40-50 years, there is a need to plan for timely upgrades to retain it in the state-of-the-art category. He emphasized that replacement of obsolete equipment, sustenance of the fleet, mitigation of equipment voids is a need for Infantry Combat Vehicle and Tanks.

First Speaker : Overview of Manufacturing Process by Tata Motors.

11. Dr Ajit Jundal, Vice President Tata Motors gave an overview of manufacturing process and production of Combat Vehicles under Make in India and services. He informed that Tata Motors have been associated with country's Defence Forces since 1958 and over 100,000 vehicles have been supplied to Indian Military and Para-Military forces so far. Tata Motors Defence Solutions cover the complete range of logistics and tactical vehicles. He informed that their manufacturing unit is digitized; engineering and requirement driven. The production is digitally supervised from one place. The project governance is an inbuilt process and works as per project time lines. The quality matrix and timelines are strictly adhered. Product is delivered per requirements.

Second Speaker : Prospects for Aerospace & Defence.

12. Mr Praveen Mysore from Industry Leader-Aerospace & Defence, Dassault Systems spoke on the Prospects for Aerospace & Defence. He informed that Accessing applications on the cloud gives companies the flexibility needed to maximize time and innovate more. Leveraging resources such as the latest software tools, whenever you want, from wherever you are, allows you to adjust capacity and add new capabilities based on changing business needs. Using apps via the cloud saves time and money without procurement delays or hardware costs. Designed and optimized for cloud and mobile use, the 3DEXPERIENCE® platform by Dassault Systems connects people, data and resources. It offers powerful cloud-based solutions for the full development cycle, from concept to prototype; to get your product to market faster. Miniaturization, cutting edge electronics and Nano technology has effectively reduced the weight, dimension and mean time before failure of products. Technology development like 3D printing has reduced the design, development, trial and manufacturing process in terms of time, cost and resulted in cost cutting and reduced inventories.

Third Speaker : Insight on Strategic Independence.

13. Col KV Kuber (Retd), Director Defence & Aerospace, Ernst and Young gave an insight on Strategic Independence. He emphasized that to get Strategic Independence; the import has to be brought down to zero. He brought out that India is proud of the industries like Tata Motors role in Indigenisation of Combat Vehicles. He stated that there are many projects which are grossly delayed due to procedural processes at different level. India have the capability and potential to transform the Indian Defence Industries. But we are not able to maintain that pace and now it's time for modernization at the earliest. If delayed, then the Western Countries will be far ahead of us. He further suggested that in future all revenue procurements may be in Indian Rupees, which will boost the Indigenisation. He suggested to review the DPP as it has lot of flaws and needed to be corrected. He recommended that in Make-2 process the Government should give some compensation to encourage the industries.

14. The first session ended with short questions and answer session and then mementoes as token of appreciation were given to all speakers by Lt Gen Vinod Bhatia PVSM, AVSM, SM (Retd), Director of CENJOWS.

SESSION 2 – FUTURE READY COMBAT VEHICLE CHALLENGES

15. This session was chaired by Maj Gen GD Bakshi, SM, VSM (Retd), Former GOC Romeo Force. He informed that Combat Vehicle and Tanks are going to play major roles in future warfare. He said that he is satisfied with the progress of the procurement of the Indian Combat Vehicles and Tanks and look forward for Future Ready Combat Vehicle (FRCV) induction into Indian Army. He insisted on opening of a Directorate of Design in Army Headquarter as available with Indian Navy for the designs of their Ship and Equipment. He suggested that Academia like IIT can be

also be approached for helping in designing India Army future Combat Vehicles and Tanks. He recommended that all stake holders should work jointly for Indigenisation of Indian Army Equipment. He stated that the future warfare is going to be Hybrid warfare and Indian Army has to be ready for the same at all times. Therefore, there is a need to prepare for the Modernized Mechanised Forces to deal with the Hybrid element like Israel and Russian Forces.

First Speaker: Challenges Faced in the Design and Development of MBTs.

16. Sh T Paneer Selvam, Sc G, CVRDE, DRDO gave an overview of Challenges faced in the design and development of MBTs. Initially he talked about the lab making MBTs design and development. He gave a detailed presentation on all challenges faced in in the design and development of MBTs. He informed that the first and major challenge faced in the design and development of MBTs is formation of QRs. The formation of QRs is taking time. He gave the classic example of FRCVs and IFCVs. The QRs were not in detail and they were changed often. Also, the time frame given for the project is also not realistic. He stated that the second challenge is designing and indigenisation of the ammunition for Combat Vehicles Guns/Tanks and this process is going on and is under final stages. He informed that DRDO is also developing stealth technology, lighter, agile, better armoured and modern protection tanks and vehicles. All these require a team effort of all stake holders including the attachment of the user from the time of inception till final product.

Second Speaker:Challenges Faced in the Production of MBTs.

17. Dr Sanjiv Kumar Saxena, AGM HVF Avadi, OFB spoke on the Challenges faced in the production of MBTs. He gave a detailed presentation on challenges faced in the production of MBTs. He stated that most of electronic and electrical systems are built using Russian power relays and logic relays - difficult to procure of current vintage and also when the level of indigenization is low. Most of the critical components and sub-assemblies are imported from foreign OEMs having complete manufacturing set up and technical expertise, which takes time. There is a challenge in R&D and Investment for limited numbers. He recommended that the proposed futuristic Tanks can reach goal post of success only if the development project is led by the user and supported by the DRDO & OFB with partnership of Private Industry. He suggested that the work centers with defined responsibility of each stakeholder can be identified. He emphasized on policy of long term orders and continual upgrades in phased manner to encourage gradual technological advancements in country.

Third Speaker : Insight on “MBT Design Philosophy”.

18. Brig Varun Sehgal, Brig Armoured Corps, Mech Forces Dte gave an insight on “MBT Design Philosophy”. He stated that the design has been made as per the future requirements. He began with mention of the design of ammunition and stated that the ammunition planned are simple and which are already being used in the country so that indigenization can be promoted and the country need not depend on imports. He further stated that after weighing the pros and cons of the system, the second aspects that is being insisted is of remote weapon system and planning a MBT without crew. The future MBTs will be capable of attacking multiple targets in Day and Night Operations. Also for the survivability, the modern MBTs will be capable of defending any type of attack from different directions. Future MBTs will have excellent communication system including IFF on them.

19. The second session ended with short questions and answer session and then mementoes as token of appreciation were presented to all speakers by Lt Gen Vinod Bhatia, PVSM, AVSM, SM (Retd), Director of CENJOWS.

SECOND DAY: INAUGURAL SESSION

20. Lt Gen AB Shivane, PVSM, AVSM, VSM (Retd), Consultant Combat Vehicles, OFB in his inaugural address brought out that OFB is already carrying out research and development of state of art future Combat Vehicles. He informed that soon OFB will be upgrading most of the Tanks and Combat Vehicles with collaboration with the Industries. The Tank and Infantry Fighting Vehicle will continue to remain pivotal for manoeuvre warfare. These will have deterrence capability, which will be a war-winning factor. He emphasized that future Combat Vehicles and Mechanized Forces must modernize to retain their cutting edge due to the dynamic nature of warfare as they required to operate in the full spectrum of future conflicts and must be equipped with mature state-of-the-art cutting edge technologies. He stated that Lethality, Survivability and Manoeuvrability have acquired greater significance but aspects like communications, affordability, modularity, etc, cannot be ignored. He stated that future Combat Vehicles should be capable of operating both along the Western & Northern borders.

Special Question & Answer Session

21. A special question & answer session was conducted by the panelist Lt Gen RK Jagga Director General Mechanised Forces, Lt Gen Vinod Bhatia, (Retd) Director of CENJOWS and Lt Gen AB Shivane (Retd) Consultant Combat Vehicles, OFB and . All relevant questions and answers asked have been framed into recommendations of the seminar and penned down at the last para of the proceedings.

SESSION 3 – INFANTRY COMBAT VEHICLE CHALLENGES

22. Maj Gen Devesh Agnihotri, VSM, Consultant OFB and former Head of Futuristic Infantry Combat Vehicle (FICV) chaired this session. He was assisted by representatives from the OFB, DRDO and Army HQ. He stated that the development of future Infantry Combat Vehicles offers immense opportunities and a challenge for the indigenous defence industrial base to grow. He emphasised that OFB with its state-of-the-art production facilities, experience and skills as well as domestic industry with its access to cutting-edge technologies, efficiency and entrepreneurship will face lot of challenges in production Infantry Combat Vehicles however he has no doubt that finally it will provide the best win-win solutions. He urged that government must address the genuine concern of the public and private sector for the benefit of all stake holders.

First Speaker: Overview of FICV Design Philosophy.

23. Brig Anurag Chibber, Brig Mechanised Infantry, Mech Forces Directorate gave an overview of FICV Design Philosophy. He stated that his being an infantry man this subject of Future Infantry Combat Vehicle (FICV) is very close to his heart. He covered the genesis of the Mechanised Infantry and stated that FICV project started in 2008. He praised the BMPs (Infantry Fighting Vehicle) and its operations in past, which transformed the infantry operations. He informed that the present, however the quality of the Combat Vehicle now required is different as per the present scenario that's why the FICV work started. The FICV designed to work in any terrain and any role. He stated that FICV is designed to carry of infantry generally 6 to 9 men and their equipment along with armament required. Also, it will provide direct fire support to the infantry and will have significant better and heavy armament. He stated that FICV is 30% state of the art equipment, 40% is the contemporary and 30% is obsolescence. He explained that the major design philosophy is to increase protection, mobility, carriage capacity and fire powers. At the end of his talk he stated that world over Armies are shifting to greater reliance on mob based on which

platforms and utilisation of variants like FICV will provides commonality of platforms, lesser logistics strain for maintenance support.

Second Speaker : Experience of Production and Improvement of BMP.

24. Sh Alok Prasad, General Manager, Ordnance Factory Medak gave presentation on Experience of Production and Improvement of BMP. He stated that when the FICV design and development was talked initially at MoD level, the OF Medak planned a locally developed FICV for the country. The PSQR received in 2015 and the same time work started on the same. FICV designed as modular with new technology. He praised the Indian Industries role in earlier projects like BMP-2, which is 98% indigenized now. He stated that he is sure that Indian Industries are again going to play an important role in FICV project. Further, he gave detailed insight on future plan for the production FICVs.

Third Speaker :Role of DGAQA in Production of Combat Vehicles and Challenges.

25. Brig SB Kodaru, Controller CQA (HV), Avadi spoke on Role of DGAQA in Production of Combat Vehicles and Challenges. He stated that CQA (HV) Avadi is looking after QA activities and provides technical and QA services to all Metallurgical & Explosive Stores manufactured at Ordnance Factory and their role starts at the start of the project till the completion of the production. Further he stated that his team is responsible for rendering efficient QA and Technical Services to users and Assists & participates in the developmental projects undertaken by Ordnance Factory. Quality Assurance is given the highest priority in all pedestals. He gave detailed presentation on Role and Challenges in production of the Combat Vehicles and the solutions to cover the challenges.

26. The third session ended with a short question and answer session and then mementoes as token of appreciation were presented to all speakers by Lt Gen Vinod Bhatia, PVSM, AVSM, SM (Retd), Director of CENJOWS.

Closing Remarks.

27. Sh CS Vishwakarma, Addl DG OF, AVHQ & Member Armoured Vehicles, OFB in his closing remarks highlighted that the event has succeeded in bringing together stake holders, the services, the industry and the academia in discussing issues of concern and generate synergy in suggesting solutions. He stated that overall, the seminar was well received, with each community be it the user, developer of the manufacturer participating whole hearted and putting forth their points of view in a candid manner. He thanked the CENJOWS for organizing the seminar, and the stake holders before closing the proceedings of the seminar.

Vote of Thanks.

28. Maj Gen Ravi Arora (Retd), Chief Editor, Indian Military Review gave vote of thanks. He conveyed special thanks to the Chief Guest, Hon'ble Sh Shripad Yesso Naik, Minister of State for the Defence, Government of India for his valuable time and consenting to be the Chief Guest for this seminar. He also thanked MoD Officials, Sh Saurabh Kumar, Chairman Ordnance Factory Board (OFB), Lt Gen RK Jagga, AVSM, VSM, ADC, Director General Mechanised Forces, CISC Headquarter IDS, Lt Gen AB Shivane, PVSM, AVSM, VSM (Retd), Consultant Combat Vehicles, OFB, Sh Praveen Kumar Mehta, DS&DG-Armament & Combat Engineering System (ACE) DRDO, Mr Sukaran Singh, MD & CEO of Tata Advanced Systems Ltd. He thanked the participants from Army, Air Force and Naval Headquarters, OFB, DRDO, Industries, Foreign Companies, various Embassies and Academia. He also thanked CENJOWS and OFB being the partner and organizers and conducting this seminar smoothly.

SUMMARY OF RECOMMENDATIONS

29. The seminar provided an opportunity to all the stake holders to discuss the relevant issues pertaining to Combat Vehicles with specific reference to the civil and military use in India. A number of important and relevant issues emerged which will provide the way forward in the growth of Combat Vehicles in the country. These are summarized as follows:-

(a) Phased introduction of equipment, each subsequent batch (size to be decided by DGMF in consultation with stake holders) of equipment to be improved versions of previous version through vibrant use of Operational Research Statistical Analyses (ORSA) approach, the view outcome analyses and the recommendation of alteration committee. Also, to have time bound deliveries on aspects of the Combat Vehicles it is proposed that all stake holders to adopt conscious speedy decision on Operational Research Statistical Analyses (ORSA) approach.

(b) Single window AHSP and QAS establishment with suitable representation of designer, manufacturer, user (DGMP), Logistics elements (i.e. EME, ASC and AOC) along with Standardisation and Indigenisation Cell to be formed for easy coordination and fast completion of the project.

(c) All Combat Vehicle issues, projects involving in service, under modernization and futuristic to be user Director General Mechanised Forces (DGMF) driven only. The user has to adorn the mantle of the lead agency and be the driver of the project, to ensure its fruition in the next decade or so. There is a need to incorporate the user in all iterations during design, development, trials and production cycles. Also, alteration Committee Platform to be galvanized to resolve in service Combat Vehicles updates and upgrade issues. The end users should be incorporated right from the inception stage for the development process for better comprehension and ownership.

(d) To foresee the technological requirements considering that the FRCV would remain in service for the next forty years post induction, it needs to have comparable capability to the present generation of AFVs, incorporate maturing technology, as also have certain futuristic capabilities that could be upgraded periodically to meet the future battle field challenges.

(e) The triad of firepower, protection and mobility remained the key tenets for the developmental philosophy, the aspect of network centric capability and soft kill measures assumed great importance and needed to be incorporated in the design parameters to offset weight penalties.

(f) Industries brought out that some of the major progress FICVs are ongoing service since 1990 without any tangible results and the industries are not kept in the loop. If collaborated approach is adopted by all stake holders including industry with innovative mindset ruggedize the Combat Vehicles is not rigidized the procedures, major positive outcomes will be achieved in time bound way for major dividends to all stake holders.

(g) The Future Combat Vehicles are likely to be deployed in a wide range of terrain and operational conditions i.e. from the deserts to super high altitude and span the complete spectrum of warfare from conventional to hybrid warfare.

(h) The Future Combat Vehicles should be compact, modular and of light weight category to enable speedy strategic, operational and battle field mobility. The modular design should enable upgradation, easy replacement and high commonality of parts, as also facilitate sharing of the chassis with a large family of support vehicles and variants.

(j) Presently, the 'Range of Engagement' has moved into the realms of 'Beyond Visual Range (BVR)'. Therefore, Tanks are required to carry a multitude of weapon systems including remotely operated weapons to operate over a wide range of terrain and operational conditions

(k) The induction of the Future Combat Vehicles may take another decade; the existing fleet would continue to remain the mainstay for approximately another decade before being phased out. Hence, the DRDO and OFB should be alive to the user requirement to refurbish and upgrade the combat vehicles with maturing technology, to keep the Combat Vehicles contemporary.

(l) Miniaturization, cutting edge electronics and Nano technology has effectively reduced the weight, dimension and mean time before failure of products. Technology development like 3D printing has reduced the design, development, trial and manufacturing process in terms of time, cost and resulted in cost cutting and reduced inventories.

(m) The aspect of battle field situational awareness and surveillance is required to be incorporated in the design philosophy to ensure seamless flow of information and tactical situational awareness of the fighting elements at all times. The aspect of technology superiority and sovereignty to be highlighted to ensure maintainability and sustainability aspects of the Future Combat Vehicles.

(n) In India the designer and developer so far had been the DRDO and the OFB put together, since it required large inflow of capital to set up assembly lines. It is recommended that IITs and the Users be the part of the team for better results.

(o) The cohesion between the vendors needs to be good and to be included in the developmental process. While there is a belief that transparency, multi-vendor and a collaborative approach will lead to cost cutting and competitive spirit, there was another section which argued that multi vendor is intrinsically fraught with problems of compatibility, duplication of effort leading to increase in cost and production becoming economically unviable due to reduced numbers.

(p) Transparency should be there in all projects. The projects are to be realistic and communicated to all stake holders for the best output. There is a definite requirement to ensure exacting QA/QC parameters. More often than not it is the poor quality spares provided by the L1 bidder which lead to premature failures and poor mission reliability.

(q) In Make-1 program the onus is on the Government since they take care of the finances, wherein Make-2 program the onus is with the private industries. It is suggested that even in Make-2 the Government should give some compensation to encourage the industries. Imported equipment will always be 4-5 times costlier than the indigenous equipment. The Industry requires a committed No of orders to break even and have a reasonable profit. ToT is not feasible if the numbers are low or in case there is no firm order for equipment in the future. In fact a repeat order after a protracted gap may result in the item costing exponentially higher due to winding up of the production chain by the OEM in the absence of orders.

(r) To ensure that the equipment is not already obsolescent when being inducted, we should have shorter 'concept to product' cycles due to reduced technology life cycles.

(s) For an MSME profitability over the short time is important for sustenance. Small numbers of demanded spares with no guarantee of subsequent order leads to the few MSMEs, who have invested in producing the spares, are non-profitable and very few industries are ready to invest further to take on the challenge of Import substitution. It is recommended that, the system of demand generation for spares be worked out and a consolidated demand be generated for any industry to supply in a given period of time, optimizing the warehousing capacity at the OFB and Army workshops.

(t) *The DPSUs/OFBs give their requirement of spares that are currently imported to be "Made in India". There are many Indian industries (especially in MSME sector), which have the capability or are ready acquire the capability to provide a substitute at affordable cost provided they pass the AHSP test.*