CENTRE FOR LAND WARFARE STUDIES (CLAWS) AND

DIRECTORATE GENERAL OF EME

JOINT SEMINAR ON

SELF RELIANCE IN LAND SYSTEMS THROUGH INDIGENISATION THE FUTURE PERSPECTIVE

30 APRIL 2014

SEMINAR REPORT

Introduction

The Centre for Land Warfare Studies (CLAWS) and Directorate General of EME organised a joint seminar on "***Self Reliance in Land Systems through Indigenisation – the Future Perspective***" at the Manekshaw Centre on 30th April 2013. At this forum, experts from India's private defence industry engaged with serving defence personnel. The aim was to highlight the current capability of India's public and private sector in defence indigenisation, the challenges faced and to formulate effective policy recommendations bearing in mind the long term perspective.

Inaugural Session

Welcome Address by Maj Gen Dhruv Katoch, SM, VSM (Retd), Director CLAWS

It is my proud privilege to welcome you all to our seminar on Self Reliance in Land Systems through Indigenisation. This subject has great bearing on India's defence capability and it is a key focus area for us here at CLAWS. The first half of this year, the Defence Expo 2014 was held at Pragati Maidan, New Delhi. Those of you who would have visited the Expo would have seen what Indian companies such as TATA, L&T, Bharat Forge and the Mahindras are capable of. ***Despite limited support from the government, stifling red tape and difficult market conditions, the private sector has shown what it is capable of in production related to the defence sector. This underlines the fact that India has the requisite scales to manufacture sophisticated equipment***.

In the public sector too, the success of DRDO stands testament to the Indian capability. Why than have we not been able to manufacture even basic equipment like a world class assault rifle for the Indian Army? In 1995 the government introduced an ambitious plan to reduce the share of defence imports from the then prevailing 70% down to 30%. Two decades down the line, the situation has not

changed. Over the last ten years India has been able to attract just about five million USD in FDI in the defence sector. In this period deeds for the receipt of foreign military equipment exceed USD 50 million. Clearly something is wrong.

What we need today are not incremental changes but a major overhaul in our thought processes and the way we function. We need to ask ourselves the question – 'What can we do to alter the structure of the defence industry in India on a global scale'? We have today in this hall, key personnel representing the users, the decision makers and the manufacturers of defence equipment. I do hope that the deliberations that take place today, will throw up if not answers, at least the right questions which need to be asked if India is to achieve a substantial level of self reliance in defence production capability.

Opening Address by Lt Gen NB Singh, PVSM, AVSM, VSM, DG EME

The Indian Armed Forces today have the ownership of a vast array of weapons and equipment. The inventory consists of a mix of vintage equipment as well as state -of – the - art systems, incorporating the current generation of technologies. Such a diverse range demands ingenuity and foresight to address operational sustainment issues. Technological obsolescence has impacted our sustainment efforts, effecting mission capability of legacy weapon systems. Over the years operational sustainment of these weapon systems, has thrown up a great challenge in the face of rapidly diminishing product support from the OEM.

New inductions have also posed fresh challenges due to lack of timely supply of critical spares and ammunitions. This scenario has led to an inescapable necessity of self -help. The Army needs to take on these challenges head on, so that our vast array of weapons and equipment can be converted into a combat capability. Indigenisation efforts in the armed forces have been vigorously pursued for over a decade now. However, today we have reached a stage, where we need to focus beyond the low technology - high volume spare parts type of indigenisation. Development of complete systems and sub-systems through the indigenisation route would not only provide the necessary boost for self - reliance but also address the issue of future product support and upgrades.

A focussed approach towards maximising indigenisation is the only way we can achieve our aim of total self - reliance in defence technology or what can be termed as Technological Security. The Indian Army needs state -of – the- art weapons and equipment to win tactical encounters in combat. Advanced technologies with regards to defence equipment are mostly available ex import. In the present environment it is possible to obtain transfer of technology alongwith the procurement of latest weapon systems. However, certain crucial technologies are always denied.

The other concern about technology is the speed of its change. Therefore there is a need for ***speedy absorption of technologies*** to avoid the problem of obsolescence. Defence indigenisation can be categorised into four stages or levels. The first stage pertains to spare parts i.e., Weapons Replacement Assemblies (WRA) and Soft Shop Replacement Assemblies (SRA). Since over 70% of our weapons systems are imported, the equipment readiness levels are affected due to product support not being available, vacancy in supply chain and high cost. The stories are the same for equipment from any country in the world because today it is becoming the marketing strategy of foreign vendors to raise the cost of lifecycle support, once the main equipment has been procured.

We have to look at large scale indigenisation of spares because they determine readiness and are not available either due to unaffordable costs or the onset of obsolescence. The second stage of indigenisation pertains to upgrades. Most systems import technologies that are a generation or two older, by the time we acquire them. These are fit enough to meet a certain operational requirement at the time of acquisition. To ensure that these remain operationally effective, there may be a need to insert new technologies to upscale performance. These are carried out through what are called ***system enhancement programs or upgrades***. These could be operability or technology upgrades and they have to be done for the system to remain mission capable. Examples are part-part upgrades, part-supply upgrades, electronic upgrades of systems etc.

Next in line is the ***procurement of new weapons or systems***. These are replacement systems that are required to be developed to replace existing systems or when a new requirement is identified. For these a product is required and herein the development and evaluation timeframes need to be compressed. Lastly is the ***incubation of new technologies*** to meet futuristic requirements such as precision guidance munitions, seekers, SDRs, cellular technologies, electro-optical sensors, UAVs, ring laser gyros etc. As is evident there is a huge amount of scientific and engineering work that the small, medium and big enterprises as also the academia and R&D establishments could take on. The work is challenging, satisfying and gives one a great feeling of serving the country. The Directorate of Indigenisation has effectively geared itself to address the first and second levels of indigenisation. This would bring in large amounts of savings in lifecycle costs besides guaranteeing greater performance and readiness levels.

The tempo in the next two levels needs a positive spin through appropriate policies and programs. Sixty years post independence, our nation has come of age in terms of her capable civil industrial complex and a home grown military industrial complex. There have been several achievements in terms of graduating from assembling knock down kits to building systems from scratch. All these have been part of a big learning process and experience. The Services too have set up considerable technology infrastructure in the form of base repair depots of the Air Force, Army

Base Workshops and the Naval Dockyards for operational sustainment and indigenisation. These organisations possess a large knowledge cache on systems engineering which needs to be shared with the defence industry. The foundation of our defence technology infrastructure is sturdy and robust. Rapid advances in all fields of science and technology point towards the advantages of adopting a strategy of technological leapfrog. Re-inventing the wheel is no longer required. Indigenisation perspective planning must be factored in the armed forces long term integrated perspective plans. ***A common management information grid raising all individual MIS domains in defence technology is the need of the hour***. ***We have to accept that the road to self - reliance starts from interdependence and collaboration between the services, public sector and the private enterprise***s.

The private sector posses the requisite skills and infrastructure for undertaking defence production. The industry must be encouraged to make suitable investments to guarantee buy-back of products. Firms of national repute that are willing to participate in the development model must be encouraged to come forward and take on system and sub-systems development, testing and evaluation, sustenance and re-set of systems for its entire life cycle. In the case of high technology complex systems, high levels of R&D and investment is required. Projects can progress in conjunction with the DRDO and other R&D establishment. The Ordnance Factories and DPSUs have been instrumental in developing ancillaries on major and minor aggregates in sufficiently large orders, thereby incentivising participation of small manufacturing enterprises (SMEs). ***Disaggregating systems into sub-systems and components can facilitate manufacturing by companies having the requisite know-how and expertise within the country. This way, indigenisation can be achieved much more easily. BrahMos is a case in point***.

The way ahead now is to identify self - reliance goals through perspective planning and establishing technology transfer paradigms and policy directives. The DPP needs to spell out a charter of inclusiveness that gives all stakeholders a sense of security in their particular expertise. The present buy Indian and made in India policies must become expansive and not mutually limiting. Military's technical infrastructure must be institutionalised. The DPSUs, PSUs and private enterprise can have a force multiplier effect and can enable Indian industry to gain valuable defence technology insight. There is also a need to adopt the *Special Forces* concept here. Small mission oriented teams of experts from diverse fields have to be rigged up for short durations to get cracking on basic and applied research to deliver breakthrough innovations.

The other imperative must be to see how existing technologies should advance to develop more capable systems for the future. This involves the following steps :-

(a) Set up a small and flexible organisation which is agile and adaptable. Do not put it under a committee if you want results.

(b) Give it the freedom to select projects to meet an operational need based on existing technology or to meet a user need that the existing technology cannot meet.

(c) Give it a multi-year budget, a high compensation package.

(d) Recruit the best scientific and engineering minds from all segments that will solve the difficult problems.

(e) Give it the independence to perform and do not link it to present user needs.

(f) The cell technology would not have seen the light of the day because the US Air Force was completely against it when the concept was debated. It is only by the support provided by the then Secretary of Defence that this technology has evolved into the form which we see today.

The Corps of Electronics and Mechanical Engineering has tried to propagate this concept in the Arjun ARV project and the Gun development project of the Artillery. We are certain that both these projects will come to fruition and in a pragmatic timeframes, setting course for other projects to emulate.

A technology base is the need of the hour. This can be accomplished with selective government funding and a collaborative process between the academia, military and the industry. We have to become a breakout nation and grow faster than others in that class, despite the slowing global growth. A self re-enforcing title of national development and technology security will be the outcome if defence indigenisation is pursued as a long term aim to create a strategic surprise for our adversaries.

Theme Address by Lt Gen AS Chabbewal, PVSM, AVSM, YSM, MGO

I speak with the experience of interacting at the highest echelons of decision making in our government and also from my experience of two giants of the Indian defence industry i.e., the Ordinance Factory Board and HAL. Why we are not moving the way we ought to? The intensions are very much there. When we interact at the highest levels, the intention to indigenize and get products manufactured by the industry is very much there. The problem arises in the actualising of it. We are not able to move fast enough in decision making. The industry is also not able to respond on the scale and in terms of the state- of -the - art products that we need.

As far as the armed forces are concerned, our requirements are absolutely straight forward. We want state- of –the- art equipment to the extent that our finances can meet. We want high reliability from the products and lifecycle sustenance from the providers. This is either from imports or even from our own captive defence industry which is controlled by the Government of India.

A foremost problem of our defence industry is that we do not have enough money. ***There is very little being spent on R&D, with the result that the focus of our industry is more on collaboration which is understandable at the beginning***. This is apparent from the fact that even in our make procedures; we permit very high import content. This is something that the industry will have to address over the long haul. There is no short term solution to this. A realization has to come in the industry that what they invest today will probably yield dividends 10-20 years down the line and with a reasonable chance that some in the industry may not get what they seek. That risk factor as it stands today, very much exists.

But that I suppose is the acumen of the dealers of our industry sliding to enter the defence sphere to steer their projects in the direction that they are able to fructify and provide products. Today even the so called top-end people who deal with the defence industry are very low on research. Unless we graduate towards greater research, using the collaboration route initially, things are going to languish. The other issue, which can be observed in both the government controlled and private sectors of the defence industries, is the extreme frustration with our procedures. The long delays from the time that an RFP is put out to EoI are done to the time it is ultimately nearing fructification, takes at best a decade. This is by no means an acceptable thing, for both government and the industry.

There are things which are being attempted to put in place, but it would be advisable for the leaders of our industry to keep up the pressure on the government to adopt policies and procedures that are friendly towards them. The services give a nudge to the extent that we can. There is a lot of scope for the potential of the defence industry, both in terms of money and profits. For e.g., in our Bofors gun there is a very elementary component, like a torch to give red, green and amber kind of colours. The cost from Bofors of this torch was INR 87,000. When our people indigenised it, the cost of the torch was INR 21,000. Otherwise if anyone were to have a look at it, you will see that it should not cost more than a few hundred rupees. These are the kind of frustrations that we people run in to everyday.

There can be no greater supporter of indigenisation and buying products from India because of the way we interact with some of these fly by night State Trading Corporations from abroad. When we do not get what we need from Russia, we straight away approach others such as Ukraine and Bulgaria. We are really paying through our noses. Let me assure you that the biggest supporters of indigenisation are the Indian Armed Forces. We are trying to do our bit. As regards to the say that

we have with the decision makers, we try to be upfront to the extent that our forms, traditions and rules may permit us. As emphasised earlier, ***a nudge from the private defence industry will help immensely***.

Key Address by Lt Gen Anil Chait, PVSM, AVSM, VSM, ADC, CISC

While I am from the Army, today I hold the post of Chief of the Integrated Defence Staff and look at force planning in a substantive manner. The issues that I cull out reflect my understanding of the issue and may not represent that of the organisation. They may also have certain overtones of a purple perspective instead of a blue or green perspective. The other day, the Naval Chief mentioned that ***there are three categories that the Navy undertakes indigenisation in. In the category of Float, they are 90% indigenous. In the category of Protection they are close to 50% and in the ability to Fight they are at 30% indigenous. They are a good model to consider as far as the land power is concerned***.

Post- independence we were in search of self sufficiency. This resulted in the setting up of a large number of ordinance factories. Some of those were pre-existing from before the nation's independence. For e.g., DRDO, PSUs etc. The first shift towards indigenisation came under severe attack as far as the process of globalisation is concerned. What was indigenisation? This term started to come about which is self-reliance. Today when we speak of self-reliance, it is measured more in terms of cost rather than the core technologies. How does a young nation on the cusp of technological change get into manufacturing in the core areas? Will it remain in the fringes?

When we look at the LTIPP, I saw a figure purely as regards to the perspective plans, which is as astronomical as INR 30, 00, 000 Crores. If you re-visit this figure adding exchange rate variations and inflation then one arrives at as much as 15,00,000 Crores. India spends 12% on defence i.e., INR 2,00,000 Crores annually. This is not sufficient to make purchases. That is the kind of funds we have at our disposal. We adhere to a ratio of 60-40 with 40% going towards capital, of which 93% are allotted to purchases that have already been made. There is only a limited amount of money which is available and this beckons us to be very wise on our expenditures.

The Prime Minister himself said in the last Combined Command Conference, that we will have to cut the coat based on the cloth that we have. Therefore, we the military land power has to accept that there is not going to be adequate amount of money. We will have to pay audit tax. What is it that we need from the defence industry to create self-reliance? The industry here refers to the Ordnance Factories, PSUs, DRDO with regards to the core technologies and the civil sector. Should we be talking about everything? Or should we prioritise only what we need? Even within our requirements we need to address what our industry can produce given their limited resources with regards to R&D.

Let us look at land power. If we look at the annual acquisition plan, we are talking about the expenditure that is on priority of INR 300,000 Crores. That money is not going to be available. Should we be asking the government to spend instead on R&D and developing the technology and capabilities to produce that equipment for which we will not have the money? Or should we be through an interactive process refining internally the TPCR, to say that yes we have listed out what we require but in priority terms this is what we will need. If we are in a position to say that with reasonable amount of assurance then the industry too will come along and say listen, there is business to be had. There is the probability that this scheme will come about and hence we'll need to develop.

We within the military should be certain as to where we need to be spending. For that we require a vision that is not limited to land, air or naval power but a comprehensive military vision. We need to build up the basic common denominator of defence first before indulging in peripherals which would give us limited amount of advantages.

People in decision making are fully cognizant of the fact that the defence industrial base needs to improve. ***A large number of steps have taken place recently. In particular these include facilitating interactions between the users, industry and the scientists at the National Defence University to ensure formulation of a coherent vision for India's defence industry***. Such a forum would be key for building self reliance. Decision makers are also fully cognisant of the fact that the industry needs to come along. If one looks at the open source figures from 2010-11 and what the Ordnance Factories and production agencies have produced, it is a very limited percentage. Therefore the ***civil industry will have to contribute in a significant manner. To that end certain amount of policy changes are taking place. We need to continue to reform the civil military partnership so that people start to get enthused and work towards our dream of self-reliance***.

Special Address by Shri Sameer Gupta, Confederation of Indian Industry (CII)

It is a pleasure and privilege to be part of this august gathering today. On behalf of CII and myself, I would like to thank CLAWS and Corps of EME for giving me the opportunity to share my views and the industry perspective on this important subject of self-reliance. We all may be aware that we have the third largest military in the world. Since independence, policies relating to strategic defence production have been evolving. There has been a clear desire to achieve self-reliance but we were limited by constraints on account of technology and resources.

Since independence the production of defence equipment has remained under the purview of the government due to reasons of heavy investments and strong R&D

requirements. As a consequence, a large infrastructure consisting of 39 ordinance factories, eight defence PSUs and 50 R&D labs were created in India. Interestingly, the private sector has been playing a role in the capacity of being sub-contractors or ancillary for this large infrastructure created by the GoI. ***In recent years high-tech equipment have also been designed and manufactured by our private sector in the quest for self-reliance in this crucial sector of defence***.

In 2014 there was a defence expo and we did see key participation of Indian giants like L&T, Mahindra, TATA and Bharat Forge. This shows that our private sector is now very keen to participate. Over the last decade the GoI capital spending has been increasing on defence. This has positioned India as the sixth biggest spender worldwide. While most of the purchases are through inter-governmental agreement or are strategic deals, the creation of defence procurement procedure for making standard capital purchases has been a significant step. This has certainly boosted the confidence of the Indian industry and intent of the military to indigenise and move towards the direction of self-reliance.

As a matter of fact in recent years, even inter-governmental purchases there has been a shift towards DPP led competitive process. Evidently, India's domestic demand in this segment is likely to grow for reasons such as geopolitical scenarios, replacement of obsolete equipment, internal security requirements, economic growth that India is bound to witness in the coming years and increased innovation in this sector. It is estimated that by year 2017, offset obligation would offer close to USD 10 million for the domestic industry. ***The basic intent of the offset policy is to build a domestic manufacturing base. The most recent amendment to DPP offers opportunity to large private enterprises but also to SMEs and MSMEs to work closely with defence***. Indian industry is positioned to cater to domestic defence needs for reasons that are very evident such as:

- Cost efficiency.
- Availability of engineering talent in India.
- Increased focus on R&D in India.
- Improved productivity.
- Shorter lead times.

These drivers would lead to creation of export opportunities for the Indian defence industry potentially for nations where there are defence supplier nations such as Bhutan, Nepal and Sri Lanka apart from other emerging markets. As I understand, for a small country like Ecuador, an order for helicopters for defence was placed to an Indian company which is a big win for the Indian defence industry. Indian industry has demonstrated its quality and cost efficiency in the auto-sector over the last 15-20 years. This convincingly makes us believe that Indian SMEs and MSMEs are already well positioned for products like aero-structure components, complex castings and

fabricated components. Thus, the infrastructure already exists and we need to figure out best ways to make use of it. We as a country do posses the talent, capability and resources to produce world class equipment. India has the advantage of demographics and it is up to us to make the best use of it.

While DPP has built confidence across the industry, we would request GoI and defence to provide a level playing field to the Indian players. There are three basic parameters. These are competence, polity and competitive pricing. It is equally important to review existing product specifications so that we invest in futuristic products having much higher obsolescence cycle. This is already on the radar. The military can play a significant role in the growth and future of the Indian defence industry. To build the industry it would be extremely important to identify areas of core capabilities and put focused efforts towards strengthening these core areas of competence. Additionally, concentrated efforts on improving talent, building skills and ensuring open and inclusive access to defence markets would be required. Through proper planning and collaboration with GoI, we can make the best use of this opportunity which can contribute significantly to the growth of the Indian industry.

By 2020, the Indian defence industry can meet its domestic requirement as well as the needs of some other nations. The substantial job creation and stronger trade balance will further contribute towards self-reliance. On behalf of CII, I would reiterate that Indian industry would be committed to ensuring that right efforts are made on both the points. To sum up, ***it is the need of the hour to indigenise the potential by developing a sustainable model with a long term perspective. This is needed to translate our vision of self-reliance into reality***.

Inaugural Address by Dr Rajgopal Chidambaram, Principal Scientific Advisor to Govt of India

The discussion on indigenisation of defence procurement in India should not be a onetime occurrence but a continuing process. India today is not the same country as it was 50 or 20 years ago. At that time we were afraid of being overwhelmed by foreign technology. We have to interpret the goal of indigenisation and self reliance in the context of India of today and the developments that are taking place across an increasingly connected world.

Today's India should either play in the global arena or it will find that it has no arena to play on. It is no more the time where you can isolate yourself from what is happening around the world. The important issue is who controls the core technologies. When you are building a nuclear reactor, you will find a non-nuclear alignment cost more than 50%. You may say that I have indigenised a nuclear reactor more than 50% but you do not have the design of the reactor. Without the

core technologies these percentages are of little value. In other words, the ***Technology Security*** must relate to the core technologies.

Imports are costly. We have to make sure to include their sustenance requirements in the costing. Their availability should not be doubtful in critical times. The supplier should be reliable. Importing technologies will make you addicted to them and indeed prevent indigenisation. There is the issue of foreign origin manufacturers, not willing to part with critical technologies. A lot depends on your negotiating capability. Our negotiating stance should improve given the market size and also if we can integrate, get together and make the orders fragmentally. ***The DARPA model of the US is relevant in this regard. Small and medium enterprises should be important in any country particularly for component systems***. ***Often times these industries tend to be a lot more innovative than the big ones***.

Ofcourse the ***role of academic institutions needs to be enhanced*** as well. National labs are extremely important for the DRDO as is the larger university system. They are all pools of knowledge but you must know exactly what you want from them. You cannot expect a professor whose main job is transferring knowledge to the next generation to be aware of the bigger picture of where their knowledge fits into the defence system. If you are able to identify and pick their research then you can get what you want.

There have been references made to reverse and frugal engineering. I do not like this word, '*jugaad*'. ***Self-reliance today must be able to appropriate knowledge generated by the country***. Currently, every step of the acquisition program has to be accelerated. Sometimes the total process takes four to seven years. Many steps indeed every step can be accelerated. The 'Buy' process involves identification of requirement (2-3 years for clearance by an apex body) and delivery of equipment after the order is placed (2-4 years) i.e., a total of 4-7 years. The 'Make' process involves R&D, technology transfer, user trials, acceptance by the user, productionization and finally full-scale production. The total time taken can be 5-10 years including delays in the DRDO.

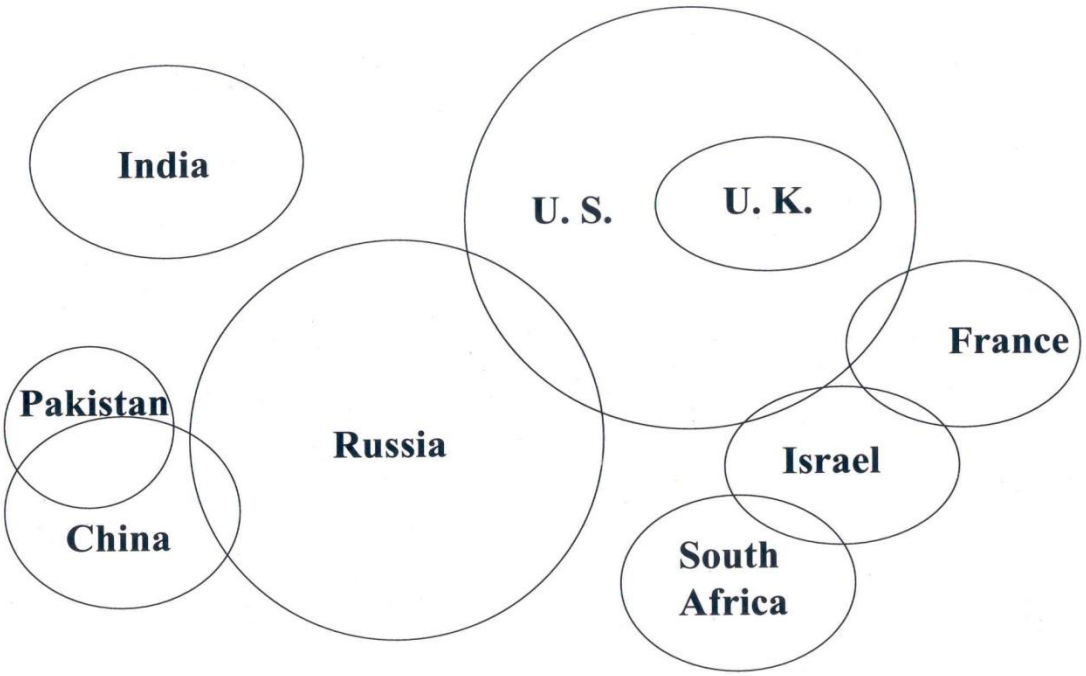
The GSQR (General Staff Qualitative Requirements) of the Army are often based on acquisitions by other countries (particularly by our potential enemies) and on market availability rather than only on operational requirements. ***Indigenisation and speedy acquisition will need careful introspection and corrective measures on each of these aspects***. When I was Director BARC, I used to ***define self-reliance as 'immunity against technology denial***'. There are two methods of indigenisation which the Department of Atomic Energy (DAE) has used:-

(a) ***Progressive indigenisation***: For e.g. - the import of 220 MW PHWRs. The system supply was cut off, halfway through construction by the Canadian collaborators in 1974. It was completed with help of Indian companies. This

was followed by indigenous 220MW, 540 MW and now 700 MW PHWRs. Similarly, the Fast Breeder Test Reactor in Kalpakkam was built through French collaboration but the 500 MW Prototypes are of indigenous design and construction.

(b) ***Ab- Initio Indigenisation***: For e.g. - the reactor in the nuclear submarine ARIHANT, which went critical on 10th August, 2013. It is a Pressurized Water Reactor (PWR). Based on this experience, India has taken up design of an indigenous power-producing PWR, whose construction is expected to be started within five years.

Of course in the design of nuclear weapons, there is no other option. A 1998 Paine and Mackenzie Venn diagram illustrates the sharing of nuclear knowledge between various countries. In the post cold war era, the Russians were handing over their technology when they started cutting down from their astronomical figure of 30,000 weapons to the less absurd but equally astronomical figure of 10,000 weapons. They were handing over the core of their nuclear weapons without re-melding. That meant the design recognition was there. That is what the overlap in knowledge between USA and Russia is about.



Historical sharing of Nuclear Weapons knowledge (from Paine & Mckenzie, 1998)

UK is now considered buried as far as nuclear technology is concerned within USA. There has also been a linear transfer of knowledge from USA to France to Israel to South Africa. Similarly, knowledge has been shared from Russia to China to Pakistan. One can see that India stands alone. We have shown that no knowledge as far as nuclear weapons programme came from USA.

The **Chinese** have an interesting model of indigenisation. They call it ***introduction from outside*** and the basic approach that they have used is low cost manufacturing. The steps include:

- Introduction.
- Absorption.
- Digestion.
- Re-Innovation (Intellectual Property Rights issues are involved here).

India needs to do more of this. In particular there is the interesting mechanism of the offset. How well are we using it? Are we using it effectively enough? Some discussion is required on this matter. ***Multiple agencies importing the same system in India (e.g. UAVs) must come together to get the best technology transfer advantage out of the offset mechanism***. This will help indigenisation.

Furthermore, ***India should not shy away from international scientific cooperation***. Even unique multi-billion dollar facilities like the Large Hadron Collider in Geneva (CERN) have needed international collaboration. India has contributed USD 40 million worth of precision-engineered equipment (superconducting sextupole and decapole magnets) and advanced grid software to this facility. This was estimated at European costs. Our actual cost was a little over half of this.

Actually we spent on USD 20 million but got credit for 40. Half of this went into a fund to support scientists from India not limited to the field of atomic energy. So now it is all funded and we decide when our scientists will go and do experiments with them. The advantage for us was that this is a very high-tech superconducting magnet. Since the design was created and tested by CERN, we as a result derived knowledge from this.

Similar is the case of the launch of foreign satellites on ISRO's Polar Satellite Launch Vehicle (PSLV). ISRO launches a lot of satellites for various countries. Till date 35 satellites from 19 countries have been launched through PSLV. Collaborating with them would have spin-off benefits for our own space technology.

The core advisory group for automotive research i.e. the CAR programme was initiated by my office ten years back. TATA, Mahindra and automotive groups in Chennai were involved in this venture. We also put in a programme for getting in international collaboration. Germany has a number of institutes called the *Fraunhofer* Institutes which are devoted to industrial oriented research. Each one of these institutes focuses on a very specific area. For e.g. there are institutes for machine tools & forming technology, machine & beam technology, manufacturing technology etc.

Our CAR programme was for pre-competitive applied research. Improvement in propriety products is not the business of the government but generic technology is. Our problem was of joining diverse materials such as aluminium, steel, plastic etc. The leaders are our International Advanced Research Centre for Powder Metallurgy & new Materials (ARCI), Indian Institute of Technology (IIT) Madras and Automotive Research Association of India (ARAI), Pune. Today's India is strong enough to not worry about not having international cooperation, so long as we continue to strengthen our own initiatives. To that end I have put forward a three point agenda, as under:

- Optimal utilization of visible capabilities.
- Identification and nurturing of latent capabilities (visible in one field, but sometimes latent for another).
- Leveraging of international cooperation to strengthen indigenous initiatives.

This applies for all science & technology and defence systems and sub-systems. We need to fully utilize the existing and potential capabilities in our national laboratories, universities and also Industry. DRDO should obviously be the fulcrum for this.

Another example of synergising exceptional internal component capabilities is an initiative from my office called the Advanced Ultra Super-Critical Thermal Plant. The higher the temperature of the coal burning that you produce from your plant, the higher is the efficiency. In practice this is not a zero carbon-emission but a relatively cleaner carbon based technology. If for the same mega watt that you produce, you emitted less carbon dioxide then it also becomes a contribution to ameliorating the climate change threat. So conserve your carbon reserves.

This is essentially a materials problem. A hostile environment for a material is a fast reactor. So our office brought together the Indira Gandhi Centre for Atomic Research (IGCAR) and Bharat Heavy Electricals Limited (BHEL) which has the big power producing equipment. Our aim is to eventually build 800 MW Advanced Ultra Critical Thermal Plant with steam temperatures at 700-750 degree Celsius. The IGCAR has already designed the materials with MIDHANI (Hyderabad) also participating in the preparation. The tubes have been drawn and are being tested by the Nuclear Fuel Complex. A test loop will be set up by BHEL/NTPC.

Our office is also funding projects for turbine blades; super heater header for the development, characterisation of dissimilar weld joints and for the design and development of bypass valve for high-pressure turbine. Thus, this is what can be accomplished if we identify the latent capabilities which are available.

It is important to facilitate academia-industry interactions through innovative interfaces for 'Pre-competitive Applied Research' and through what I have called 'Directed Basic Research', for Industrial Development. Examples: CAR (Automotive), CMAT (Machine Tools) and CAREL (Electronics Hardware) of PSA's Office. ***University Research Parks which are a "cluster of technology-based organizations that are located on or near a university campus in order to benefit from the university's knowledge base and ongoing research", are a great way to facilitate that interaction***. ***Effective parks can aid in the transfer of technology and business skills between universities and industry teams, encourage the creation of start-ups, and promote technology-led economic development***. India's first and only University-based Research Park is in IIT Madras (DRDO has taken a whole floor in this park). However, there are some precursor examples in IISc, Bangalore, in the IITB, in the IITD, in the IITK and in the IITM itself. Notably, IITMRP has filed more than 70 patents in its first one and a half years of existence.

Academia is what is best suited to identify new knowledge being developed around the world and advise national agencies and industry how to appropriate that knowledge. A large participation of Industry is already there in advanced defence systems like Electronic Warfare (EW) systems and the nuclear submarine ARIHANT. Both Indian Industry and the Defence Ministry have shown great enthusiasm for enhanced cooperation in recent times (e.g. ASSOCHAM & DRDO documents). I have seen a very successful GOCO model in RCI Hyderabad for Laser Gyro manufacture.

For strategic systems, we can also consider creating (virtually) fenced centres in private companies, having requisite capabilities and resources with GoI maintaining strategic control of them. Indian companies are now setting up their own in-house R&D centres, and are acquiring companies abroad (you then acquire their IP also). Large Indian companies, while hiring young people in placement interviews, could place the brightest among them to work under professors who are already contributing to defence R&D.

Moreover, ***India should not hesitate to be a First Introducer of New Technologies***. The path to a knowledge-driven economy is paved by new advanced technologies. We should increase our appetite for risk-taking (our tendering process itself is often against new technologies). We should get accustomed to occasional failures when developing new advanced technologies. The so-called proven-technologies, unless subjected to continuous evolutionary improvements are often a synonym for obsolete technologies. Indeed, the issues which need to be addressed pertain more to policy than technology. These are:

- The ***relationship between the Armed Forces and DRDO*** should be a partnership and not a vendor-customer relationship.

- There should be '***Coherent Synergy***' among the approaches of DRDO, Directorate of Indigenisation, and the Army Technology Board.

- While laying down the GSQR for an imported defence system, the Armed Forces group involved could be given a ***short crash course in DAIT Pune***, with additional faculty drawn from academic institutions so that the scientific and technological significance of every specification is fully grasped.

- ***The leverage from offset (when importing) should be maximised at RFP stage***. The highest possible level of technologies, if introduced in the contract, can help indigenisation in the long term and also help develop OEMs, catering to the global market, in collaboration with the foreign supplier.

- When going for visits to the factories of foreign vendors before signing the contract to examine the system or for inspections before accepting the system, DRDO scientists (or scientists from academic institutions) working on similar systems, could be included in the delegation. This will help knowledge to flow into the country. Perhaps this is already being done.

- BARC/DAE has used the actual cost + 15-20 % profit paradigm to attract industry participation in development of new systems. The selection of the company should of course be through competitive bidding.

- We should also examine what advantage does the company get when the manufacturing tender is issued after the development work is complete. Does the tender take into account the indigenous knowledge created in the company during the development process? How does one balance the L1 Process with assurance of quality in critical technologies?

- ***The users should be willing to live with somewhat lower specifications (compared to what established global vendors can provide) in the short term, as long their critical requirements are satisfied***. Then only can India hope to be a global leader in the long term.

- ***There should be continuity in technology development*** (e.g. we should follow up now for a more advanced version of LCA Tejas). Otherwise knowledge tends to attenuate. Stop-and-Start ordering of advanced systems by user agencies can be disastrous for indigenisation. Finally, a realistic long term capability development plan would be needed to ensure continuity.

Session I - Policies and Procedures to Drive Indigenisation

Opening Remarks by the Chair : Lt Gen (Retd) AKS Chandele, Former DGEME

The subject of this seminar is self-reliance in land systems through indigenisation. A narrow view would be that we look only at the sustenance and maintenance of imported equipment in terms of land systems which are in-service for 3 to 4 decades. Ofcourse, it would be expanded into other issues of self-reliance and indigenous production. The importance of self-reliance has already been emphasised in the inaugural session in terms of critical technologies we should develop within the country. As we are aware that no country looks at manufacturing each and every items of weapons or equipment that is requires for defence forces and this may neither be economically viable and nor necessary. Nevertheless we have to be self-reliant in all critical technologies so that incase of political compulsions or otherwise if those technologies denied to you are not left high and dry. ***As far as India is concerned right from time of independence, defence production and defence R&D has been in exclusive reserve for the public sector. It is only recently that the defence production has been opened up to some extent to the private sector participation***. Subsequently a number of policies have been issued including the defence procurement policies, number of iterations in the last decade or so, and also the defence production policy. What we are looking to focus on in this session are policies and procedures to drive indigenisation.

Now coming back to the first point regarding the indigenisation for maintenance of imported equipment. Till about 2002 the responsibility of indigenisation of spares for maintenance of imported equipment was with the DGQA and it is only recently, in 2002 that it was decided, that except for imported equipment which is subsequently manufactured in India by PSUs or Ordnance Factories, indigenisation would be an endeavour steered by the respective Service Headquarters, this meant that the Army will look after the all imported equipment which is a key service and similarly Navy and Air Force. Therefore each of these headquarters has set up their own Directorates for Indigenisation. We have met with considerable success, but a lot more needs to be done. Our speakers today will be covering as to what are the measures of the indigenisation achieved in the major weapon systems, critical technologies and road blocks for achieving efficient indigenisation. ***An assessment of national technology threshold and capabilities to absorb transfer of technology including human and financial capital and infrastructure, and changes in policies and procedures require to accelerate indigenisation of defence systems***.

Changes in Policies to Accelerate Indigenisation: Shri N K Sinha, General Manager, Gun Carriage Factory

As we all know that the Bofors gun was last supplied to this country in 1989 and thereafter for historical reasons there could not be any further progress of the operationalization of the ToT. We had received certain documents, with which we have now completed the evolution of the gun system in our own country; we have also upgraded the 39 calibre gun to 45 calibre. In my presentation today I am going to cover my talk in four stages. The first stage is the process prior to seeking DAC approval for Ordnance Factory Board to manufacture this gun and what all has gone to manufacturing this gun system. In the second stage, I would like to spend some time on the DHANUSH Model that was adopted for this project and so far it has proved that we are quite successful. In the third stage, I would like to bring forward the contribution of the users, the partnership between the user, OFB and all other stakeholders which has contributed in such fast development of the weapon system and finally, I would like to conclude my presentation with the crucial takeaways from this project.

As I mentioned, the last gun was supplied to this country in 1989. And thereafter, there is no further progress on the operationalisation of ToT agreement. Therefore, Ordnance Factory Board in consultation with the Armed Forces conducted development of certain crucial spares that may be required for keeping gun system operational. Way back in 1990 the effort to develop these spares was initiated. Simultaneously, we also started developing an upgrade on 130 mm gun chassis for 155/45 caliber gun system. Three factories in the Ordnance Factory Board that is Ordnance Factory at Kanpur, Field Gun Factory, Kanpur and Gun Carriage Factory, Jabalpur started development of these. Between 1993 and 1999, three different versions of the upgrade for development were progressed. The first gun which was developed, with a breech screw similar to the one available on Bofors. The second one was developed with a sliding breech that was developed by Ordnance Factory Board designers. And the third, with 45 caliber barrel with sliding breech screw. ***The final version of the upgrade was proof fired and all the parameters were established***. This was the first step which laid the foundation for the development of a 155/45 calibre Dhanush today. But after 1999, there was a lull and no further work or development in productionising of this particular weapon system was undertaken. In 2002 once again in a meeting with Chairman as MGO, the proposal for development of a gun system was discussed. The first proposal was for upgrade of existing 155/39 gun to 45 caliber gun and the Ordnance Factory Board during that presentation made a pitch for development of this gun. It was also proposed that we upgrade one of the guns electronic systems and electronic sighting. This proposal was accepted by Army Headquarters. OFB then started with these projects as an R & D project. Internal R &D project office of Ordnance Factory Board was chosen and a barrel design was finalized by OFB engineers, which was shared with CQA (Metallurgy) for validation and inspection coverage. At this stage

one of the international suppliers, SAGEM offered an INS to be mounted on this gun system. It was accessed that a upgrade of 45 calibre which generate the kind of forces which will not be possible to be absorbed by the muzzle brake provided on the Bofors gun. So therefore it was necessary that a muzzle brake be subsequently designed and also the integrated on this barrel with the breech ring, which also had to be developed. With these design issues in mind, specific Design Review Committee was formed. Chairman of the Upgradation Committee was GM, GCF and that was the beginning of design effort for a new barrel, new muzzle brake and integration. Three Product Development Committees were formed, one each for breech and breech mechanism, carriage and muzzle brake with the involvement of stakeholders such as DGQA, OFB and DRDO.

Between 2004 and 2005, we developed the barrel of 155/45 and it was test fired in September in 2004 at PXE, Balasore. The 1st strength proof for 155x45 calibre barrel was done in Jan 2005 was supervised by representatives from SQA (Weapons), SQAE(Ammunition) and GCF. This particular ordnance had a muzzle brake which was newly designed Vaned Slot Muzzle Brake. The result of the firing was very fulfilling, satisfactory while length and maximum pressure was quite satisfactory and could be adopted. However, during different stages of design evolution, concerns was expressed about these muzzle brake. After detailed analysis of various parameters of barrel performance it was concluded that this particular muzzle brake may not work, it has to be changed and a modified double baffle brake modified muzzle brake was considered to be a suitable option. The evaluation constituted many firings including comparative firing between L/39 and L/45 barrels, the carriage though at that stage was the same. The modified double baffle muzzle brake was designed and trials were conducted and it was found that the maximum pressure of buffer and recoil length were observed to be well within limits of original ordnance 139/45 gun system. And therefore this design was found to be acceptable. The efficiency which was available in the original muzzle brake of Bofors was 33% was further improved up to 53% in the case of double baffle muzzle break and as a result of that the forces on the gun structure was substantially reduced and there was no significant change required in the gun system.

Simultaneously we also developed and integrated an electronic suite completely with gun system. This electronic suite was again supplied by Bharat Electronics Limited and we had been able to integrate that with the gun and we fired electronically upgraded gun system at Balasore. Both the firings were successful. After the success of these initial firing, range and accuracy firing also was done at PFFR.

I will now bring out certain comparative characteristics of these two guns. The Bofors 39 and Dhanush. The barrel length increased almost by one meter and the weight of the barrel increased by 200 kgs approximately. The ordnance weight similarly increased by 200 kgs. The chamber capacity, that was one significant design increased frem 19 to 23 litres. Maximum range consequently increased to 39 kms and the muzzle velocity increased marginally. Auto frettage of the barrel which was

done at Gun Factory Kanpur was increased to 675 mpi. The type of ammunition that could be used in the upgraded gun system included almost all varieties. The upgrade was also made compatible for taking BMCS ammunition of highest charge. After the firing in 2008, where all parameters of the newly developed gun system were validated, i.e., after three years of successful first test firing of the gun, in 2011 Defence Acquisition Council accorded AoN for 155 mm x 45 Cal Gun System for procurement from OFB.

The Dhanush Model : I would like to share the experience of recent Dhanush performance in sub zero temperatures in Sikkim which implies that it is satisfactorily working in the extreme climatic conditions and performing admirably. ***Dhanush today has 23 major assemblies and 874 sub-assemblies, 80% of which have been indigenized. The system has 3430 manufactured items/sub-systems which have been mostly manufactured in house by OFB and about 4902 bought out items, which are being looked at for indigenisation***.

Evolution of Dhanush, started out from upgrades done in the 2008 to another upgrade in January 2012 155 mm FH Electronics and 155 mm FH Project DhanushOFB Prototype -1 in Dec 2012. Finally, in 2013-14 OFB Prototypes - 3,4,5 and 6 were developed. ***Step by step development of Dhanush was undertaken which meant that the major sub-assemblies were manufactured separately in stages. We changed the indigenous components, one by one and proof fired them to establish the correctness of the manufacturing process***.

To this end before we took two guns from Army. The first one was upgraded with the 45 calibre barrel and the complimentary components. The second one was upgraded electronically and both these gun successfully proof fired at Balasore. The success of these two gun systems helped us in taking the next step forward. At this stage we were to decide whether to go in for 45 or 39 calibre gun systems. But seeing the success of the upgraded 45 calibre gun, it was then concluded that we should further proceed on the same path by developing 45 calibre gun systems only. ***Both these guns developed had 45 to 65% of indigenisation components at that stage***. Both these were test fired at Balasore and proved to be quite satisfactory. In January 2013 we had a demonstration firing of these weapons at Pokhran. Many of the senior officers of the Army witnessed the performance of these guns. From January 2013 to end of the year, OFB carried out several firings in different locations in the country. The prototype number three was manufactured in April and successfully test fired at Pokhran. The fourth gun was subsequently manufactured and taken for user trials, which is where as many of us know the unfortunate incident took place. As a result, detailed analysis was again conducted and the barrel and structural designs revisited, which clarified that there was no deficiencies in the gun system. The fifth prototype was developed after two months and recently trial evaluated in Sikkim.

Associations and Stakeholders: The project was progressed by the active involvement and commitment of all stakeholders. Indian Army as Users provided support, monitoring and coordination. DRDO was responsible for design support, DGQA for proof testing and validation, SAIL as suppliers of micro alloy steel plates, 506 ABW as partners in development and maintenance and BEL supported the Electrical & Electronic Modules for the sighting system and electronic suite. Associations and contributions of the different organisations within OFB as well as other DPSUs and private sector in the development and manufacture of Dhanush gun systems have been noteworthy, particularly for laser cutting, fabrication, machining, integration & assembly of Dhanush prototype by GCF, Wheels by Wheels India, MRF, DLSI, Braking system by WABCO, Hydraulic systems by DANTAL, Power plant by DLSI, Investment castings by OFM, Heavy steel castings by OFM, Micro alloy steel plates by SAIL, metal and forging by MSF, Ordnance by OFC/FGK, Electronic suite and electrical by BEL, Wheel base assembly by MTPF, Structural items by Punj Lloyd.

Major sub-assemblies indigenized in India are chassis manufactured by GCF, Jabalpur from the micro alloy steel plates which were supplied by SAIL. The outcome of the indigenasation is primarily in hydraulics which has indigenised from 20% to 100%, pneumatics from Zero to 100 % and Electrical/ Electronics from 46 sub assemblies to 112 sub assemblies.

Development Milestones: The milestones ranged from the mechanical upgrades of in-service 39 to 45 calibre which was proof fired within four months, mechanical and electronic upgrades of L/39 to L/45 gun which were validated for trials within nine months. Building of the 1st and 2nd prototypes, conduct of several validation firings within 15 months and finally, development of the 3rd prototype, PQSR trials were done in 17 months. Now, three more prototypes manufactured and user trials are in progress. ***Role/involvement of user in the development and manufacture of Dhanush is a project monitoring model at four levels; Multi-Tiered Special Project Management Group located at IHQ and GCF which is the Apex Board, next is Weapon Design & Development Steering Committee followed by Weapon Design & Development Committee and Weapon Design & Development team and, finally Weapon Development & Execution Team (WDET)***.

Charter for WDET: WDET worked as a single point referral and co-ordination agency with user for efficient execution and time bound activity including anticipatory, actions by users, designers and manufacturing agencies. Weekly monitoring of production and development of outsourced components and conduct and coordinate testing/evaluation also was a part of their charter and, finally, implementation of user, feedback into redesign/upgrading of components. Conceptualization in maintenance/repair schedule and lifetime spare.

Role/Involvement of EME: 506 Army Base Workshops were permanent members in WDET and part of the initial training to core team on gun assembly, testing of hydraulic and gun systems, maintenance cover during trials and support in indigenisation of sub assy.

Role/Involvement of DGQA & DRDO: DGQA provided support in proof testing, proactive participation in development and design validation while DRDO was involved in the areas of design validation, range tables and technical/design support.

The crucial takeaways from the project are the synergy between user, designer and manufacturer, single window user interface, need for compressing trial and evaluation times, flexible procurement provisions, and access to specialized design validation and testing agencies.

Measures to Fast Track Indigenisation: Shri Praneet Gupta, Director for Sales and Marketing for Cummins India

The purpose of the talk of this seminar is the fast tracking India's defence indigenisation. I think we need to figure out how to go about increasing the speed of indigenisation and it is also important to understand why we need to do that. India is world's largest importer of defence systems and weapons, which clearly shows how important the indigenisation of the defence system is to our country. Dr. Chidambaram mentioned that it is a matter of ensuring technological security and that really is the forefront of this problem. If we look around in the world, it clearly shows that technological security has always heralded the indigenisation process. It is also pertinent to understand the nature of the country from which we are importing our defence equipments. ***Another important fact discussed in the morning was that there are a lot number of projects going on, which is true, but it is critical to ask the question, as to what are we indigenising and what is the amount of indigenisation we are achieving? Even though, there are often a lot of discussions on the content of indigenisation being fairly high. We need to figure out what is really needed to indigenised. Has it been a critical component? Has it been the power pack or advanced radar systems and that kind of technologies? The importance therefore rightly so should be to the indigenisation of core systems and technologies which can lead the path of indigenisation***. ***The amount of industrial contribution in the path of indigenisation in creating other industry is phenomenal, for every dollars a country spends on the indigenisation of a system, it creates eight to ten dollars of contribution by enhancing domestic industry, creating jobs and wealth etc. within the country. This implies that we are basically spending 2to 2 ½ % within the country for indigenisation and generating returns of almost 20% to the country, that is a huge impact on a country. Indigenisation helps not only in terms of security but also growth and development of the country***

and that's something really important since these are payoffs other than national security.

Dr. P Chidambaram also mentioned about DARPA. Well some may say we have DRDO, an equivalent of DARPA. My answer is we need not follow DARPA, per se but see what the model has delivered for the United States and emulate atleast its best practices, in any form that you may like. Has DRDO till date delivered anything in time, at costs initially estimated and above all beyond defence systems. If we look at the numerous projects being run by DARPA – be it the Biofuel Project, in which US is spending a lot of money in this sector for development in terms of energy security and national and technological security. The payoffs are far beyond the Armed Forces alone. Thermal Management Systems for Ship Docking, Advanced RF Mapping, Portable Blood Scrubber, ARPANET – mother of Internet, all these projects have had a remarkable impact on civilian life and society, much beyond national security. If we do more such development internally something I say again and again, we will have a huge impact on common lives as well as help in creating industry and achieving security for our nation.

Out of our Defence spending, almost 60% amounts for revenue and 40% for capital. There is only 04-06% of defence budget spending on R & D. ***Without spending adequately on defence R&D and building the right partnership between the government bodies such as DPSUs, military organisations, alongwith the academia and industry, and establishing of an efficient and complete eco system, we will actually not be able to go forward towards a path which is necessary for meaningful research***. If we just keep spending on buying defence equipment and not spending on real sense of indigenisation, we will not really be indigenising. That is something really critical from that perspective and Mr Sinha in his earlier talk on Project Dhanush has shown us that how different bodies are involved in the development of gun system. It could not have done by one body or organization only. ***Any such project and defence projects in particular require a lot of stakeholders to come together. We need to keep that picture in our path towards indigenisation***.

In India, the key factor is not lack of talent or capabilities. We have done nuclear development in the country, while most other countries have just dreamt of it. ***If we take the number of engineers, science, technology and mathematics graduates being churned out by our universities, it clearly shows that India is in the number two position after China; in terms of growth India is again high***. If we look at US, Brazil, UK, Germany and many others considered as developed countries, which are importing technologies to us, very few have the growth and potential we have. Hence, if we channelize this human resource in the right direction towards indigenisation we will benefit more and that's really what we need to think about.

Another thing we need to realize for indigenisation or in- house production is that we should go through a maturity curve like any other industry. ***In the beginning, government actually needs to support the industry and academia to really take forward them for the development of capability, this will then achieve a collaborative approach with a win-win for all parties involved***. The industry and academia is then able to support the government as well, this kind of collaboration is really needed. This collaboration needs four different parts of eco system to come together to work closely also from a policy and procedure point of view to take a step forward, the first one is the political leadership. Second one from a clearly Indian military perspective, third one is the role and involvement of DPSUs and last one is industry and private sector players. Let us think about the role each one of them can play towards the indigenisation of defence systems.

Down the path, we need a clear vision of indigenisation, as to which technologies, which areas we really need to focus on in our journey to indigenisation and as to how we can bring the eco system altogether for these. Secondly in terms of FDI, if we allow inflow of greater FDI, that could lead more industry and growth in India and will also bring technologies and research into India. From an industrial perspective, Formation of Experts Panel Group, which will help create level playing field for domestic players by ensuring exchange rate protection, self-certification, immediate payment through LC, bilateral forums, product cost ratio differential etc. ***Since we are already importing technologies we are actually promoting foreign content coming to India. You may help foreign companies but not by outright buying from them but by partnering with them, working with them, which will help to work jointly and take it forward***.

Those are some of the things which really needs in terms of what kind of eco system we create for the development to happen in India. ***From military standpoint; we need to have a clear vision of the projects in the pipeline, which technology and which areas are they looking at and in what timeframe***. Some important points are promulgation of long term common and synchronized procurement plan as well as for new product development and product support. ***Move away from L1 system– introduce ranking to incentivize better quality products – develop mechanisms for price discovery focused on life cycle costs, move away from NC-NC basis of development – introduce risks and penalties instead. Let's create a public - private partnership by developing and promoting R&D, collaborating for development with the PSUs which is very important from both sides. It's about establishing and nurturing a long term partnership***.

From a private sector perspective, we are also faltering since at times we have technologies that may be useful for the Armed Forces, we have not come forward and showcased what we can do, instead we have been in a reactive mode responding to requirements, as and when they come up. Today's exhibition is the right kind of forum showcasing that private players can also collaborate for the development of good and world class defence eco systems.

Therefore, finally what we require is industry, academia, defence forces, DPSUs/ OFs, all come forward as partners to pace towards the goal of indigenisation.

Indigenisation Effort in Indian Navy: Commodore Aseem Anand, PDOI, Indian Navy

The Naval indigenisation programme was started in 1960s and the indigenisation in Navy includes our own frigates, destroyer, self-defender, nuclear submarine, even our own aircraft carrier. Without the support of DRDO, PSUs and private sector that would not have been possible. The key objectives of our indigenisation was to meet challenges of future wars, rapid and continued progress in the fields of warship construction materials, propulsion and power generation, weapons and sensors, network centric operations, electronics and cyber warfare by including the utilization of industrial base, both public and private sector, tapping resources of academia and import substitution.***The IN has always focussed on a systems approach that is not entirely by reverse engineering at the component level but in terms of entire equipment that has been quite successful***. Three main functions of a ship are; it can move, float and fight. The float is basically the ship's hull and deck fittings, that is the basic of the ship construction. The movement - which is the basic propulsion package, it could be moved by gas, diesel or nuclear fuel and fight, which is necessary during wartime by necessary support of weapons. In floating Indian Navy has indigenised as much as 90% and only 10% is the imported content. In the area of movement upto 60% indigenisation and 40% outsourced and in the fighting area only 30% are indigenised and 70% are imported. The main indigenisation focus of the IN is in the fight category. ***Our strength has always in the ship building and ship designing in our own naval system. Manufacturing of equipment are supported by SAIL and ESSAR, both supporting our specific Naval requirements***.

In above mentioned functions carried out by the ships; move, float and fight, I would like to discuss as to what can be done by the Industry, the DPSUs in these areas and what is the progress and how the Industry can take a role for furthering the future aim of Indian Navy systems. Coming to the float, private industries have done hanger doors and shutters, anchor capstans/windlass, chain cables, davits, boats/Gemini/crafts/ribs are all almost fully indigenised. In progress in the floating areas, where private industry is involved are high tensile steel for submarine pressure hull and very special titanium alloys. Plans for the future are marine grade aluminium, composite material for ship construction, flight deck and heavy duty lifts specially for aircraft carrier, anechoic coating for submarine hull, radar absorption paints and also has a scope in anti-fouling system for future development. Already research is going on for the indigenisation of the composite super structure building.

In the function of moving of ships for Naval purpose already DRDO/DPSU have indigenised the requirement for Navy by constructing nuclear power plant. Arihant is one of the examples of indigenous submarine, boilers, steam turbines, main condenser and GTG control system are others, which have either come through DPSUs like BEL or private industry routes. Projects undertaken for indigenisation in Navy are mainly marine diesel engines, shafting and propeller, AC and refrigerator plants, air compressor, steam auxiliaries, pumps and valves, steering gear, stabilizer, and submarine batteries are almost 100% indigenous. These projects are undergoing and have already indigenised with the support of organisations such as DRDO, PSUs, L&T, BHEL and with some other private industries. Plan for future all electric compulsion, water and pump jet propulsion, high speed capacity light weight marine diesel engine and integrated platform management system are on the anvil. The auxiliary equipment for submarines including propellers, control systems, high density batteries and the auxiliary machinery with low acoustic signatures are some projects to be developed in the next decade. Coming to the fight category in the anti-submarine warfare, rocket launcher have been made indigenously by L&T. installation of advanced torpedo defence system, Sonars - Humsa and Ushus by MPOL, torpedo tube launcher again by L&T and Mahindra Defence Systems. In the surface warfare category we are all aware about the Brahmos missile system, AK 630 AA gun, super rapid gun mount have now been indigenised. Coming to surveillance in the surface warfare category fire control radar-LYNX U2/ Shikari LYNX U1, Revathi surveillance radar, ESM/EW systems (Sanket MK II/Ellora) and the installation of FCS LYNX U2 is on board. Miscellaneous projects in indigenisation of the surface warfare system are going under both private sector and DPSU routes, such as the development of Combat Management System, Inertial Navigation System etc. Different types of fight weapons are the future plan in the warfare category such as development of different types of Anti-Ship Missiles(shore/ship/submarine launcher based) to Extended Range Surface To Air Missile, Sea Base Ballistic Missile Defence Systems & Integrated Anti-Air and Ballistic Missile Defence Sensors and the manufacturing of naval guns (12.7 MM, 30 MM & 127 MM). In the category of fight sensor future plans for indigenisation, this includes 3D Air Surveillance Radar, Surface Surveillance Radar, ESM systems, Integrated Mast And Control System for submarines and manufacture of Portable Diver Detection Sonar. Coming to the underwater warfare which includes the future indigenisation of Advanced Light Weight Torpedo, Heavy Weight Torpedo, Anti-Torpedo Decoy, Processor Based Ground/Moored Mine, Glider Technology and Autonomous Underwater Vehicle/Remotely Operated Vehicle. For the purpose of fighting future plan of indigenisation areas also includes vertical takeoff and landing of UAVS, Automatic Carrier Landing System, Fibre Optic GYRO and Guided Ammunition.

For the indigenisation of above mentioned areas of requirement of Indian Naval system I would now like to focus on the areas of challenges including policies and procedures. First and for most is the complex procedure, capacity

constraint for ship building in PSU shipyards, cost and time overruns in weapons and sensors development, licensing required for private sector for defence production, inadequate clarity on processes for the utilization of private sector as production agency, technology obsolescence from prototype to installation on board and finally low volumes/multi-vendor procurement process.

In the final part of my presentation I would like to mention ***the way ahead which has been presented to the highest echelons in the Ministry of Defence and have been taken very positively by them as well, for the indigenisation of Indian Naval defence systems are, increase capacity augmentation by modernisation, value of production being inadequate in PSUs/OFBs, where they have been told to upgrade and go in for capacity enhancement to keep pace with the orders already placed on them, quality issues, capacity assessment of DPSUs/private sector prior nomination as production agency, streamlining of processes for issue of licences to private sector, monitoring mechanism for ToT to DPSUs/OFBs be promulgated for the enhanced technology absorption, establishment of a partnership model between DPSUs and private sector for production sharing, early revision of procedures, appropriate tax/ERV policy guidelines to resolve issues, empowered committee with enhanced powers for collegiate vetting of indigenous development/import substitution of in-service products, assured repeat orders for specified period specially for low volumes and lastly, development for modalities for academia as a 'Centres of Excellence' in key technology areas***.

Policies and Procedures to Drive Indigenisation – An industry Perspective: **Col (Retd) RB Jadeja, VP, TATA NOVA**

From the perspective of business we are really concerned about the role business will play in the indigenisation of defence system. First thing from business side is what the indigenisation is. Is it a business or investment? What are the policies and procedures we need to evolved. It is a cost plus model. If we look for the volumes we find that outshoring is a difficult proposition due to certain restrictions. The most important barrier in front of indigenisation as already mentioned in the earlier session is that the funds are always a bottleneck for any kind of development or project, let it be the example of US, Russia or us. ***Hence from business point of view, what are the activities which can enhance indigenisation as such, these could be engineering, maintenance, assemblies, integration, ToT and positively development and scope of production system can also enhance a business venture in the indigenisation of defence system from a business perspective***.

The role of stakeholders such as PSUs, OFBs, agencies and on the other hand buyers and service provider, there is no MoU between these two which is a very

important thing towards the way of indigenisation. In the early beginning although there was a huge demand but in recent times there is not much demand for indigenisation projects in the terms of numbers for the industry, although there is scope on ground. In terms of capabilities to produce, I think we are well poised, money has been invested and that's happened after the good certification in the business case. We are having many success stories for example the TATA Advanced Systems has two major plants in Hyderabad where we are churning out C-130J assemblies with Lockheed Martin as our partner. This is not for offset or indigenisation but purely based on business purpose to produce for world or OEM. It's a major journey of how the aircraft parts are manufactured. Is it a very high technology, definitely no, but then we need to start small before looking at the bigger picture that may emerge after twenty or thirty years. So if we look at the mapping again if we look at the financing, India is a very costly country to get any finance. ***At the policies and procedures level, delays at decision making level is an important point to be concerned. From industrial point of view, it is very important. Risk management by diversifying the management system is also an important component for the successful indigenisation process by attracting the private industrial investment in diverse sectors. And lastly, as a business venture at the end of the day we need to justify to the shareholders and stakeholders that there is a possible boost to set up and positive revenues will flow which is very important and looking the Defence sector scenario I think it has the lowest level of RoI***. If we map telecom industry, medical industry, service industry etc. but still this is fact of life and we have made a commitment to support the indigenisation of the defence many large business houses volunteer as emissaries and are coming to help, to support the national endeavour of self-reliance. So is there any scope of industrialisation of indigenisation, well as a standalone business model, the answer sadly is, "No".

Going to the experience of other countries in indigenisation, we can see that only when price pressures, or some kind of technological barrier or denial regimes or sanctions are imposed, then the indigenisation process is taken forward. India as country has a huge scope for indigenisation of defence systems eversince we have seen the wars of 1965, 1971 or Mumbai attacks and even Kargil. But unfortunately we need to work more on paradigm shift and policies & procedures to go forward with it. What needs to be done at policy level to support indigenisation, well the foremost important point which Dr. Chidambaram made as well was about achieving technological security. This is an issue that needs to be developed right from the top in terms of establishing a ***National Technological Council which essentially identifies which technology we should concentrate or invest in and whether there is an opportunity where we can essentially sign, although we not a part of agreement because there are some technologies which can be re-used but we are not able to get it, can be a way forward***. ***DRDO already has achieved much technological advancement but are unable to leverage that because DRDO does not have a model to transform their technology***

dominance to open forum or transfer it to any private company. ***The second important thing is that defence equipment is very expensive since we need to maintain a strict quality check in the product with ruggedized military specifications for every part, sub assembly, assembly, system and sub system. We also need to have national level testing facilities since it is very difficult for the industry to undertake this from within its own resources. We therefore need some cooperation which can help to move forward from the government for the industrialisation of defence sector. And last although but not the least, there is need of convergence at MoD in terms of indigenisation of defence sector as a policy. TPCR is a very good document released by the Ministry, but we need an assurance from the Services or MoD, that this is an actionable document, in its present format it does not assist the industry in making any strategic partnerships or investments. Harmonisation of FDI to make the defence sector lucrative needs to be taken up in due course to see actions on ground. DPP 2013 is a step in the right direction and the 'Make' procedure, which is presently being refined has so far seen to be a bottleneck for indigenous defence production.***

Having talked from an industrial perspective as to what we need other stakeholders to do including the Services, MoD, DRDO, DPSUs, we also need to see what we as Industry should do to come with solutions for indigenisation projects and programs, the mantra is to we need to deliver at minimal cost growth by having a diligent supply base. ***We need to remain focused on capital integration and sourcing but not forget the maintenance costs, which is a major chunk of lifecycle cost of a system or a product. We also need to address the low rate of production and maintain a low rate of infrastructure. Fit to design will reduce costs***. Lastly, yes it takes time in Defence industry and we need to cater for it in our business plans as well. We are catering for the industrialization of business plans in defence system and also I would like to request from the customer end to develop certain kind of mechanism for catering for cost overruns on account of change in specifications.

Q & A Session:

The Chair asked the house for discussing recommendations for changes in policies and procedures.

1. ***The role of DGQA in indigenisation or as a stumbling block to indigenisation needs to be discussed***. ***The second issue is regarding the export of current weapons already in service with the Army***, for example Israel made radio sets (TADIRAN) are allowed to be imported but the Indian manufactured radio sets in service with IA cannot be exported as a result of which we lack of market exposure. ***The third issue is the application of the military standard and the need to review them***.

2. In this session we were supposed to discuss the policies and procedures, but I am afraid we discussed very few points on that, anyway speakers have given us very good information and suggestions, what I would like to say that self-reliance ought to be a national objective, is it ?. Secondly, DPP starting 2005 stated that LTIPP emanates from Defence Capability Plan which is based on Defence Planning Guidelines but we have only achieved 30% to 35% of whatever was listed in LTIPP in the last three plans and it is very clear that defence budget is not going to increase from whatever it is now, therefore my point is ***what are the we doing defence policy guidelines, LTIPP and capability plan and if our start point is not going to be realistic we will never achieve anything***. ***And finally there needs some transparency, who, what, when and to whom. Accurate information should be there. Therefore we need to authorize people through DPP.***

3. I would like to say that there are several such events in the past also this is not a start, this is a process ***and there should be a future outlook in the indigenisation of critical technology so that*** business ventures and private industries can invest on that.

4. I would like point out the level playing field between on one hand government bureaucrats and on the other side PSUs by the private industries. So the question is that are we are providing the level playing field. ***There are two major players, the government bureaucracy and the users. However, the decision makers are the bureaucrats. Since users are in the forefront hence let the user decide and not by policy makers.***

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SESSION II - PPP Challenges & The Way Ahead

Remarks by Chair- Lt Gen IJ Singh (Retd), Former DGEME

India has fairly large defence industrial base which needs to be effectively trained, monitored and directed to meet the country's defence needs. Central to this base are over 40 Ordnance factories, 09 Defence PSUs and a network of over 50 DRDO laboratories. Despite their existence, India's arms continue to increase over the years, they have been going consistently and given the dubious distinction, our country happens to be today one of the largest importer of the arms***. If India has to be counted in the community of nations, it cannot continue to be a net importer of national security. The question which needs to be answered therefore is that do we want to continue to be a net importer or should become self-reliant. I think the answer is obvious to all of us. Clearly in the last fifty years we have remained net importers and this has to change***. We in India have

a history of purely government sponsored defence industrial base, private partnership has to become a part of the process in which the government cycle needs to be compressed considerably. It has to move beyond being just the part of the race. We need to make conscious efforts for a paradigm shift from the existing buyer - seller relationship to heavy partnership between the industry, the armed forces, the defence PSUs, Ordnance factories and the DRDO, perhaps a consortium approach. Since the end product is vital to all of us, we need to share responsibility eagerly and vision. So what is the way ahead, in an attempt to answer this, let us briefly look at the defence production policy which was enunciated in 2011, the policy has the objective to achieve substantive self-reliance in defence production, it states that in order to synergise and enhance the industrial competence in producing state of the art defence products within the price lines and timelines that are globally competitive. All viable approaches such as formation of consortia, joint ventures and public private partnership etc. within the government approved network will be undertaken. ***Also in order to harness the emerging dynamism of the private sector as well as the increasing opportunities to obtain advanced technologies from foreign sources, there is a need to bring about a synergised approach that further the objective of achieving this self-reliance. It is therefore high time that we consider formation of suitable partnerships both with Indian as well as foreign vendors in order to harness new opportunities. These partnerships could be of various forms starting with outsourcing, subcontracting, formation of consortium, projects specific joint ventures etc***. All participants therefore should make an assessment of various options available to the private sector for the engagement and there should be a processing in JV cases, only when they are cleared with defence possible solutions as compared to other forms of partnerships. While establishing JV companies, the defence PSUs also need to ensure that their existing capacities will not remain idle and they are utilized. In order to achieve successful indigenisation by such joint ventures we have to create a conducive environment so that such companies can operate freely. ***There is also a need to lay down a long term indigenisation plan which spells down the requirement of the services in the fifteen years or so***. While the DRDO recently drawn up science and technology roadmap and capabilities which need to be built over the next 20 years, the same needs to be updated and passed on to the industry on a regular basis. This roadmap will no doubt give out a picture of the technologies and products that are foreseen for industry and will further help to refine what can be taken up by the industry by the public private partnerships as well as by other means. Not only will this private public teaming upgrade synergy but the resulted diversification is going to give an option in terms of post multiplier which is going to be a creation of centre for excellence. We may also look at creating dedicated groups comprising representatives of services, the Department of Defence Production, the DRDO and the private sector to address specific areas which are identified by the services. I think we have a long way to go frankly. Today our public sector do possess excellent infrastructure, manufacturing facilities and a highly experienced task force. On the other hand the private sector can bring in latest

technology, managerial processes and practices, marketing skills and financial management. ***Therefore a well- blended fusion of both will certainly result in synergizing of strengths to economies of scale and prove mutually beneficial. All these issues are not only important for making it possible for the private sector industry to participate in the defence production processes but also it is very vital to ensure a healthy competitive environment in which both the industries and defence production units can thrive and prosper while at the same time achieve the national objectives***. Now this session is therefore devoted to discussion on mutual benefits of public private partnership and promoting accelerating indigenisation of land systems.

Indigenisation of Defence Equipment: Industry Perspective – Brig (Retd) AS Nagra, Mahindra Defence

Right from the morning we have been talking about self-reliance in the defence forces, it's not that the country is not requiring self-reliance; maybe the models which were taken up during various stages of modernisation and development were inadequate to ensure self-reliance in defence technology. If we go back to the eras when we got our independence, the total developmental cycle for the weaponisation and organisation can broadly be classified into three sub cycles of modernisation. First one which was just after the independence during that time the total defence budget was only 1% of the GDP and there was not much of thrust on enhancing the combat capabilities of the defence forces. After that the second cycle of modernisation started after 1962 wherein India went in a big way to procure equipment from abroad, that was also the era when licensed production was given a head start, it was used to attain self-reliance but it came off as an optical illusion. DRDO and the DPSUs failed to innovate at that point in time and did not bother about upgradations and new development projects because they had the customer which was only meant for them. This finally led to the era of 1991 when the Soviet Union collapsed and that resulted in the non-availability of key players and also responsible for the key for maintenance and sustenance of the equipment which the Indian Army is holding today. After 1992 the economy had a very bad time, everyone knows that our economy hit rock bottom and for the next ten years the modernisation plan was put on a virtual hold. It was only in the year 2001 that the new focus emerged wherein, the new policies were evolved to involve private sector in modernisation and indigenisation of defence equipment. Till that time private sector was only waiting to be called for making some contribution towards indigenisation. The various stakeholders in this particular process were firstly our defence forces, the DRDO and the DPSUs and the private industry in addition to the political leadership. Defence forces had their own roadmap of achieving indigenisation, the DRDO and DPSUs had their own and the private industry was not involved in this. Though they were all worried and wrong in their own places. Defence forces wanted state-of-the-art equipment which was not available with us at that point in time. The DRDO and DPSUs wanted that customers accept whatever they produce and the

private industry kept on harping loudly to get some share in modernisation and indigenisation of defence forces. And above all the political leadership did not have any idea about the issues which were involved. What are the options if we have to achieve self-reliance in defence equipment segment, to import which in any case is not possible because the very idea of self-reliance will be defeated. Indigenous route to the DRDO and DPSUs which we have not seen for the last so many years and have reached nowhere. Third option is the private sector which may not be desirable at this stage and at this point in time because of the constraints which are involved in the defence procurement system. So what are the options, maybe we may have to follow a middle path. If we take an assessment as to what the public sector brings on the table and what the private sector has you will see that the DPSUs and the DRDO have enough of domain knowledge as they have been working on the defence equipment for so many years. ***Over the years they have created infrastructure which is required to manufacture, design, develop and test the weapon systems***. But if we see the weaknesses, I will not call them weaknesses maybe these are the areas on which they have not focused, the freedom of innovation is not available with them. There is a need to improve the project management capabilities. Now look at the private sector side, the weaknesses we have seen with the DRDO and the DPSUs are the strengths of the private sector. They have the excellent professional management skills; they have completed projects in a timebound manner and produce equipment of the highest quality. They are very efficient organisations, they stick with time, also they have the freedom to operate and take decisions without looking over their shoulders. The major players in this industry , have sufficient financial strength to invest in high cost design projects and one their marketing skills is marketing the equipment which they produce for export purposes and on top of that they bring on the table the best global practices which are being followed across the world. Whereas they have excellent management skills and manufacturing infrastructure, they do not have domain knowledge for the development of these systems. They do not have experience whereas they have worked in this industry for some years so some of the companies have gained some experience but they are nowhere near the world leaders in this sector. Whenever a private company looks at the defence project the first thing they look at is the risk involved which is one of the great weaknesses of the private industry. ***So what is the way forward, the best thing is to fuse the best elements of both the sector, in the public private partnership we bring the strengths of both to produce world-class defence equipment***. What will the public private partnership lead to; the skills and assets of each sector whether it is public or private would be shared. It will result in the procurement of state-of-the-art equipment for the defence purposes. It will result in long term committed relationship. The transfer of technology will be accepted which will also give a push to the defence research and development. It will also lead to overall industrial development in the country, ofcourse it will give you your own indigenous products. Indian economy overall will start improving, efficient and cost effective results will be visible and it will also lead to a greater transparency. The optimum combination of the competencies, capabilities and expertise of

commercial sector and government agencies will achieve this particular goal. Not only the gains are shared even the risks are shared in this model. What are the prerequisites? The prerequisites for entering into any public private partnership are firstly sharing of the strengths of both the parties involved, identification of risks and opportunities in the defence sector, estimation of volume of business and commitment on timelines. There will be a need from the government side to show their willingness and positive support to legislations. There will be a need to create a suitable financial institution for financing and there should be a willingness from both the parties to evolve the culture of mutual respect in the PPP operations. What are the various opportunities which are available which can be exploited in the public private partnership? The major ones are firstly self-reliance and secondly export potential. The way forward is a need to seek policy and procedures which are right for the defence indigenous ecosystems, the first impetus should be given to research & development, competitive bidding and providing a level playing field and there should be direct offset for manufacturing parts, policy of no commitment should be replaced by risk sharing, licensing system should be given a relook, long term projects should be based on a period of time, regular warranting and reporting analysis should be carried out, accountability should be enforced and insistence on joint development, design, trial, testing should be ensured. ***A DARPA like entity should be established in the form of National Technology Council and the design agency should be shifted to the PSUs. Private players can absorb the maintenance ToT and provide the continuous support to the local equipment. EME is looking after the maintenance and the repair, as of today they do not get any incentives for the upgradation of that equipment, upgradation and modification is another area which can be given to the private industry***. In a nutshell the private industry in the defence equipment has come in a big way and brings best management practices on the table, they have achieved this not only in the automobile sector but also in the telecom sector and they are ready to take it provided there are right procedures.

PPP for Defence Indigenisation – Mr Mukesh Bhargava, L&T Defence

I think there is a need to understand where the industry has been and what the industry has done, there is still a lack of understanding amongst stakeholders in regard to the true potential and it is important we dwell upon that for some time. Maruti being the earliest PPP model, we all know the success of that. ***As far as the strategic and the security sectors are concerned there is a difference, there are technology incentives and the ToT is something which is not available and it comes at a huge cost***. We are talking about the defence sector and every country makes a product in defence for protecting its own country. It does not make products to sell to another country so when we in India have been continuously buying products from outside we are not buying products which are meant to defend India but we are buying products which are meant to defend some other country. The only way is to make our own product which has to be made for India and made by India

and that is where the entire shift of my presentation is and we will talk about some of success stories where L&T has contributed majorly and it is something that can be replicated across the industry. We talk about national security; twenty years back Dr APJ Abdul Kalam had come to my office during nuclear submarine design I was heading and made a statement that in the next ten years we should convert this thirty to seventy and this was 1999 and we are still talking about this after 15 years have gone past, from Scientific Advisor to President, he kept on repeating this and repeatedly every five years we hear this 30:70 ratio to be changed but are we going to continue to have a national security of foreign products from foreign countries. That is a question we need to ask. When we talk about the defence industry and I am talking about defence industry not the private sector, there are strengths, enormous investments, Ordnance Factories, and we all are stakeholders, whether we are public or private. ***A highly sophisticated infrastructure exists in the country, how much of it is being utilised is something we need to ponder over. Private sector has come of age and it has started to prove its mettle across every segment and the world is taking notice. The DPSUs have their strengths in terms of the infrastructure, domain knowledge, the expertise they have gained and seventy years of ToT absorption has happened only in Ordnance Factories and DPSUs; only in these two institutions for seventy years we have paid the taxpayers money for those technologies we have absorbed we need to harness that, we just can't let it go***. Very little indigenous development has happened. The private sector has been kept out of this particular segment for six years for good reasons partly but not necessarily. 2001 was a watershed year when for the first time industry was allowed to participate, the first PPP came out in 2005 and since then we have had many PPPs projects emerged. The procedures have been there since 2005, the first made procedure came out in 2011 and in 2014. We have R&D facilities but they are restricted only to the DRDO, it's not that the industry has not done R&D and in my presentation I will bring out some of those capabilities, what we need to see is the government and the policies incentivising R&D to be done in the industry like it is done world over. I head the international business and I talk to my counterparts they get surprised that for defence, L&T is spending its own shareholders money to develop technologies and the government is not paying the money, they say in their countries every single penny that they spend on defence is paid by the government because I am not making it for anybody else, I am making it for the government. Only when the government gives an opportunity the industry will invest and prove that they can do that but without giving an opportunity, you can't be throwing the baby along the back water. There is a talk about JV collaborations and the public private partnerships; I will cover some of the issues that are there, some of the challenging issues that are there and lastly cover some recommendations. But I am convinced that the public private partnership is the best way to move forward in this particular thing. Why it has not taken off and we need to ponder, is there a fear in the PSUs or DPSUs and the Ordnance Factories that their turf will get invaded. In some of the programmes that have been given the opportunity for the industry to participate in the maritime sector. Private sector is asking for a level playing field,

you can't be giving preferential treatment especially when seventy years have already been given to them, the industry has to catch up, and it should be other way round. PPP is a middle path we need to follow and it is sound route because it makes a win-win for all three the government, the public as well as the private. Look at some of the global models; in UK they have already almost a decade back shifted to PPP, the govt shipyards are getting merged with private sector shipyards. The government is getting out of business because the govt's role is governance and it has no business to be in business. There are some tools which are available like private financing initiatives and there are instruments created by the govt help the PPP succeed. So when we talking about the public private partnership we also see that if we are putting the enablers in place otherwise it would be a hollow talk not implementable. South Korea we know about the Hyundais, Samsungs and Daewoos I am not talking about the cars and electronics, I am talking about them in the defence, they created what is called 'Chaebols' and 'Chaebols' for something which were taking ownership of the private companies, giving them all the support and incentives for them to become the world leaders. Today these are the companies which are giving competition to the Europeans and the Americans and this was all created through a PPP model. We talked about the DARPA model and the success of Boeing, LM, Raytheon and Northrop Grumman, these are the four largest defence manufacturers, and they were created by the entire funding from the government. They follow two models, they follow the DARPA model where two companies are selected, the one which has got the best technology is reserved for the US Armed Forces, it does not go out and L2 or Q2 so that the world's best and world's most advanced technology is not available to anybody else other than the US. In India we have a challenge, we talked about FDI and there is already a debate and there are certainly some positive outcomes which are going to come out soon. Licensing should be there but the process should be made simpler. We need to look at some of the reforms that we need to bring to this sector; there have been PPPs which have come out in 2005 and 2013 which brought a true focus which the Chair mentioned about the Defence production policy. I will talk about some success stories and I will like to talk about the nuclear and the space sector, it started 40 years ago and now look at the success we have achieved in the model. We need to emulate, complimentary collaborative PPP approach, complimentary which means what they have they don't want industry to do and what they don't have they want industry to build up on that and collaborative which means holding hands all along the process and that is the way DEA and DOS focus basic know-how and development would be done by them, the design engineering and production equipment and systems which is not there core competence to be done by the industry and transparent sharing of the knowledge between the two shareholders not as vendors but as partners. ***FDI is company specific while the technologies are country specific and the countries and government invest in those technologies and they control it not the company, you give them 99% FDI you will still not get the technologies because the technologies would be cleared by the governments***. We know that these two sectors have overcome sanctions. In-depth understanding of the

technologies and processes is available in this country. We are very proud of INS Arihant, India became the sixth country in the world to make its own nuclear submarine and this is one highly successful PPP model. There are 180 products that have been developed in-house by L&T, some of them with collaboration with DRDO and some of them by in-house R&D, 05% of revenue of the company is spent on R&D. Some of the systems which were developed like Trishul, Aakash, Dhanush (the naval system) are highly successful programmes. We need your commitment and support and we will deliver. There are certain apprehensions, whether we can trust private industry. In 1999 when Mr Manmohan Singh was the Finance Minister, 'profits' stopped being a dirty word and we see that where the country has gone since then. We are as much Indian as a PSU. We have a biometric security system, a person cannot enter if he does not work on the project and these are some of the security systems which are better than some of the PSUs so please trust the industry. The most highly classified programme of the country till it was launched on 26th of July 2009, none of us spoke about it in the press, and we were working on it for ten years. ***Increased share of the private sector in a PPP needs to get implemented; the policy is in place the intent is not in the place. Consortia approach needs to be facilitated with the active involvement of users at every stage. ToT and 'Buy and Make' should be given to two distinct entities***.

Achieving Self-Reliance through Public Private Partnership: Opportunities & Challenges – Wg Cdr Anil Bajaj, IAF

My presentation will outline some of the major opportunities readily available for the public and private sector to grab and come forward in a big way to strengthen the minds of Armed Forces and enhance their capacity competitively as well as qualitatively. It also highlights some of the challenges which need to be viewed, reviewed and strategised in a collaborative manner to take them head on. One may ask a question that after so many years of independence are we truly self-reliant, the answer is no. I would be covering my topic under the following headings, what is PPP? Public Private partnership is a business relation between a government and a private sector for completing a project, it combines the best capabilities of both the sectors and the risk is transferred from public to private and the long term investments for both. Thus the armed forces, the DPSUs and the private sector can join hands to achieve self-reliance. Self-reliance means to reduce dependence on foreign vendors; achieving self-reliance can get rid of obsolescence and things like this. In the present scenario, the armed forces are facing a huge shortage in critical spheres. Why we need to go for public private partnership - we need to build product support, negate the technological obsolescence, non-availability of trance technologies, government sanctions, cope with increased number of defects, and extension of the equipment beyond service life. Have we accepted the need for going ahead, let us face with some hard facts, as mentioned earlier the desire to go solo do exist but there are certain constraints which are external as well as self-inflicted which exist in the system. India imports 70% of defence requirements as

compared to marginal figures of the US and the UK which is just around 2-5%. Very few private industries are involved in the defence production at the moment; L&T is an exception. The marginal increase may just take care of inflation; the 60:40 ratios is well known however, the year on year increase has just been 15% and capital expenditure increase has been 3%. India has around 80-100 billion US dollars' worth capital expenditure in the pipeline and it expected to grow in the coming years. As has been brought out by other speakers, India is in the top six in the defence imports, this makes India one of the most lucrative markets for defence products and defence suppliers are getting to compete. There is an urgent need to increase defence requirements by negotiating with global players. So what is the scope for Public Private Partnership? When equipment is bought from a vendor the provision of transfer of design and maintenance of technology should be there. Private sector can look at opportunities like reclamation of parts, training, design of distance learning packages and it is worth mentioning that information technology not only restores the consensuality but also improves the performance and the reliability. The field of material testing is another area which has a huge potential for the private sector as equipment, weaponry in the armed forces is weight of weighing material and it requires coronial testing and stress and strain alliances etc. Technical specifications are not available and can be indigenously developed by following the black box concept. Indian software industry is offering solutions worldwide and should be tapped for software development needs for the defence. Efforts have been on to own private partners at all levels of partnership for indigenisation of small to indigenisation of an aircraft. To name a few these are the vendors who have actually contributed to the cause of indigenisation but just to cite a few examples from Indian Air Force perspective, Tata Power have been involved, it is modernisation of airfield infrastructure it is been successfully implemented in various airfields. The successful migration from legacy cognisance system when we used airpower to be connected from one base to another has been achieved to migration to AFNET which has been achieved by HCL Infosytems. A very important revolution in the logistics procedures in Air Force which is called the IMOS Integrated Management Online System has been achieved by incorporating this partnership with TCS. A paperless office which is envisaged by the Air Force that is called e-mns is envisaged by having a partnership with WIPRO technologies which is under the pipeline and will see the light of the day in the two years or so. I am sure similar success stories in the Army and the Navy have been achieved through public private partnerships. Various opportunities do exist for public private partnerships in the air force in the following areas to boost the indigenisation process. Though the Air Force has been steadily modernizing its aircraft fleet, however the MIG, Sukoi, Mirage remain the backbone of the Air Force. The shortage of ground equipment and support equipment supplied by OEMs is being replenished by following the indigenisation route successfully. Various trolleys, jacks, ladders and other tools have been indigenized to support the flying squadrons and this is bound to continue. A unique facility has been set up at 9BRD Pune with modern automatic test equipment for the desk programmes to development and this can be utilised for PCB diagnosis and repair. To cite an

example the development of software designed radio for Indian Navy by BEL Dehradun. Though the project is in the pipeline but is expected to be in the services by end of this year. Another successful public private partnership as brought out by the speaker from L&T is in the field of CBRN, the erstwhile NBC which various DRDO labs, Army MAGs and few private vendors like L&T have developed integrated centres. Few of the points in which private vendors can join all the defence services and specifically Indian Air Force are the RPs are uploaded on the e-portal, central public procurement portal is there and the single registration is valid for the vendors, easy access to all the test equipment, infrastructure on the IAF inventories, more awareness through conferences defence exposition is available like the one we are attending today, simplified inspection procedures and field trials, no testing charges for prototype development on aircraft is available, the samples are provided for feasibility studies and developing items. Implementation of the black hole concept and even in some cases raw material is provident. Definitely both the parties are bound to gain from the public private partnership in terms of enhanced infrastructure and capacity utilisation in the defence forces. Private partners get the opportunity to work in stringent quality environment, great standards are followed and both parties are exposed to high technology and foreign OEMs. Indigenisation leads to development of strong and wide industrial base, it leads to strong ties, obviously there is no dearth of money and private sector can tap the huge potential of the defence outlay to increase the profits and they tend to get the status as defence supplier. ***Every system has its own constraints and indigenisation is no exception, few of the challenges associated with PPP, lack of research & development which has been spoken about, the defence outlay may have increased by around 10% but on the R&D we have not given much impetus***. It was actually astonishing to see a drop in the R&D allocation from Rs 100,00, 00,00,000 to approx. Rs 60,00,00,00,000 in the year 2011-12 but it was corrected in the subsequent years. Another point is no proper allocation and accountability for building local capabilities is given. In the projects undertaken by DPSUs the amount of time and money spent rises exponentially which takes years to see the light of the day. Another inherent road block is the procedure of indigenisation, though the time has been considerably reduced by the e-portal, however the inordinate delay due to the financial scrutiny by the IFA, the tech audits by the RCMA takes considerable time, we need to reduce that. Officers and men get posted out every 3-4 years on an average and the domain expertise is lost. This we need to actually address because firstly we don't have the luxury of domain expertise as is available in the private sector. Another area to be addressed is low MAQ and no firm commitment. This is a deterrent for a small scale vendor to invest in the big ticket projects. The long development cycle of the project is also seen as a dampener. The need is to strike a fine balance in the motives of the project and profit driven private industry as a national security objective. So what is the way ahead for public private partnership, we need to reduce the imports from 70% to 30 %, we need to increase the share of private sector participation to 25%, the implementation of Rakshya Udyog Ratnas (RURs) has to be there because only when we give some

incentives we can encourage the private sector to participate in the indigenisation programme. More importantly the R&D in defence is to be given importance and impetus. Users need to be actively involved in the projects at all stages and as they just mentioned the postings of the persons working on the indigenisation projects needs to be addressed for longer duration of time. Finally a few recommendations before I conclude there needs to be accountability and monitoring mechanisms to avoid time and costs. The DPSUs and private sector players should be allowed to compete at a level playing field without giving any preference to the DPSUs. The upgrade programmes are to be reserved for the PPP consortium with ToT bindings and FDI limits in the Indian defence manufacturing industry needs to be increased for new technology and intensive competition. To conclude I would urge all to call sound maintenance philosophy by joining hands with the industry and academia to develop design and manufacture the necessary wherewithal indigenously to reduce dependence on foreign vendors and maintain high level of susceptibility and the state of the art equipment.

Q & A Session

Q No1: You mentioned about the price preference to the public sector, please elaborate as to what would it imply.

Ans: We give preference to the PSUs because of the seventy years of experience which they have and the track record. For instance in SU-30s there is a ladder, the cost of which from Russia was say around 15 lacs while we floated a tender, HAL gave say a quote of around 08 lakhs we gave the order to him because of the expertise they have for ground support equipment. However HAL was not able to supply that ladder in the stipulated time and one of the ladders broke and some AVM fell while climbing the ladder and this time the local vendor came with a cost of 2 lacs and he already knew the price of Rs 08 lacs and came with one fourth of it, we initiated in our Engineering Section to fabricate the ladder which we could make from MS material, obviously we negotiated with him and he said the material he is using is being imported so we accepted it. However, with the same material which he was offering earlier he gave the ladder for Rs 45,000/- and we have given the order to him. So yes we do a mind block of preference to DPSUs because they have an expertise in that particular field but at times it does not lead to price discovery.

Session III - Leveraging ICT and Modern Manufacturing Processes to Accelerate Indigenisation

Remarks by the Chair : Mr Tanmoy Chakraborty

I was back here last year the topic was different. I am very much enthused about this year's topic, which is really to look within to deliver capacity. I would also like to thank the eminent panelist who agreed to share their thoughts with us. I would like to

share some thoughts about this seminar. For a country that fought the battle for freedom by burning imported clothes, it is surprising that the tag of the largest importer of arms does not evoke the same strong feelings of hurt in proud patriotic Indians present in this room. ***Often at times one feels that this dependency is a manufactured event, benefitting everyone in the food chains from foreign arms companies' agents to scandal mongers***.

Indigenisation needs to be given a real hard push from the top to the bottom, we need to reduce our dependency on imports, and we need to give a leg up to indigenisation research and development and create a multiplier effect for bringing in civil technology; replicate the success of local players in the fields like IT services and manufacturing. Develop Government funding research; develop manufacturing export synergy which is all in isolated pockets as we speak of today. The world over complex technology ecosystem of aerospace and defence are organised in ill structure to one companies of both OES and LSI's, develop the base and hold suppliers to inbuilt them in funding, research ecosystems , so that everyone can compete and generate revenue . Unfortunately in India, we have set very low bench mark and very few can actually compete for every tender. One of the biggest problems that we have in indigenisation is what happens to be that of splitting the projects to suit the financial powers of the sanctioning authority. Ministry of Defence needs to develop and encourage an atmosphere of trust within this ecosystem. It might want to look at security classification of key employees, of Defence contractors as practiced in other countries which have perfected this practice. It will allow seamless data exchange and free movement of information. Our experience of dismantling Defence PSU's monopoly has been beneficial to the government and the end consumers in the field of civil aviation, telecom and banking. We have the case of separating the Ministry of Defence and the Ministry of Defence Production and the time has come for us to do that. One can understand the predominance of the PSU's in strategic fields like missile technology, atomic bombs but why not involve the private sector in heavy vehicles design, GIS application development, messaging system, logistics and other IT system that are the core of the defence system.

We are the only country in the world perhaps that is setting a difference between domestic industries and foreign suppliers. Looking at any RFP and from the point of relaxation of variation clauses, everything favors the foreign suppliers. I think the time has come for introspection and tough weeks for some, but that will get us the transformation that we are seeking of integrating indigenisation technology in the armed forces. We have seen DRDO specifically favoring dealings with small firms in a subsystem fashion, while giving due credit to the fulsome contribution to SSI's (Small Scale Industries). In the Indian success story one cannot over emphasize that the bigger players bring on the table larger skill base, risk assessment capabilities, management, process maturity, capital infusion, the ability to attract foreign partner and academia into the projects. All the talk of indigenisation will remain just talk as one would always find that make project were allocated just

1crore in a fiscal year, why not back our words with financial commitment and publicize targets? We should look at reducing the share from 70 and bringing it to 30 in terms of import quantum, identify equipments of subsystem and system for indigenisation and commit that these will not be imported. We should look to commit a 20% indigenisation budget for procurement and attach a cost measure to indigenisation.

"NSIC : A Vehicle for Growth of MSME's" - Col KV Kuber (Retd)

It is my privilege to be here to talk about this very important subject, NSIC and how we are a vehicle for growth of MSME's. The NSIC is in a unique position as of now, it has the largest reach within the country – both vertically and horizontally. The NSIC aims at the need to grown out of the conventional methods and seek out strategic sectors. The identified sectors include Defence, Aero-Space, Homeland Security, Space, Insurance, Banking and Finance. ***I represent 35 million or more MSME's in the country and they are growing at the rate of at least 06 million each year. We talk of developing the defence industrial base in the Ministry of Defence, we are talking about the base -, MSMEs are the base. The country cannot progress just by TATA's and L&T alone, only when you develop this base the pyramid can stand up. These MSME's contribute to about 45 % of GDP growth of this country and this is why we say our country is strong in manufacturing services. We are a service oriented nation, 46% of MSME's are in the services sector. We are not a country which buys and throws, we are a country which buys, uses and reuses***. Many times I have been told that indigenisation has import substitution for the spares that are not available, I always ask the question what about the spares which are available. So we keep buying the spares available with the OEM ex-import but only look towards MSMEs for spares which are not available with OEM, is that the correct approach. MSMEs should have been involved from day one. The Indigenisation Directorate therefore has role to play in the formulation of RFP. Then why aren't they involved at that stage. The Defence Budget for the year 2013-14 includes-

- Budgetary allocation towards capital expenditure, which caters mostly towards fresh procurement programs of military hardware and platforms, this has been kept at US$16.06 billion.
- The capital allocation has increased by 09 percentage points as compared to original planned capital expenditure of US$14.74 billion for the last fiscal year 2012-13.
- Against all expectations the defense budget was increased (though lesser) as compared to the previous year.
- Overall, the budgetary allocation for India's defence forces has been raised to US$ 37.72 billion as compared to last fiscal year figure of US$35.82 billion, an increase of 5.31 percentage points.

The opportunities in Defence are vast, a few of them are direct participation in defence contracts with Ministry of Defence which is centralised , indigenisation, Revenue procurement, Technology Transfers among a few. The NSIC's approach in defence sector is a four pronged strategy which is as follows-

- Indigenization in the Armed Forces.
- Revenue procurement(Systems and Supplies).
- Technology infusion.
- Capital procurement
  - Buy Indian; Buy & Make (Indian) and Make category
  - Offsets participation with OEMs for "Buy Global" and "Buy and Make" category

Large companies are able to liaise with the government and put across their view point. Who takes the responsibility for the MSME's? NSIC is aiming at spearheading initiatives for the MSME's. It is also looking at helping with liaison with the government and help with the funding as well as technology management. Organising high profile MSME DEF EXPO, compilation of database, creation of clusters, creating a strong information systems network, are a part of the NSIC's approach towards the Industry. I would like to focus on the MSME Development Act 2006, this act stipulates NSIC as a manufacturer; gives it the status of OEM & IOP. NSIC can directly receive and respond to RFP's from Ministry of Defence. NSIC will pass on RFI/ RFP information to units registered with it. There will be a single point registration scheme, single tender nominations in accordance to MSME Act 2006, Registration with quality compliances and certifications. The NSIC's activities include broad fields of – Marketing, Technology , Support Services and Credit . The charter in each of these fields is as given under :-

Marketing

- Raw material distribution.
- Registration for Government purchase.
- Tender & consortia marketing.
- Marketing events.
- Marketing intelligence.

Technology

- Training.
- Material testing.
- Job-work.
- Energy and environment audit.

Credit

- Credit for raw materials & marketing.
- Credit facilitation through 15 odd banks**.**

Support Service

- Performance and credit rating.
- B2B Portal.
- Training – cum –incubation.
- Software technology parks.
- International cooperation.

It is time to ponder over these questions/ comments - What is the role of the Indigenisation Directorate in the RFP? The Indigenisation Directorate should be in direct contact with the MSME's, there is a need for synergy between the two. We import raw material because raw material is not available in the country, what impetus are we giving to the country to manufacture the raw material which is required? ***The Ministry of Defence needs to acknowledge the existence of the various other industries which are present. I strongly believe that FDI should be increased; the licensing procedure should be eased up***.

Capabilities of ICT Industry to Align for Defence Production : Leveraging the Private Sector- Mr Jaijit Bhattacharya

Before I even start about Capabilities of ICT industry to align for Defence Production, I want to point out what do we need these capabilities for? Are we clear about the role we want the industry to play? Do we want the industry to play a peripheral role? Did we know a few years ago that terrorism will be a means of warfare? What is the next means of warfare that are being adopted? Are we going to use the private industry to leverage and be ready for the future wars?

It is not just IT, warfare by other means are becoming more important. Does Water warfare go off here? Does food security warfare go off here? As a military institution we don't even have the institutional structures to fully adopt to the kind and means of warfare which is going to get adopted widely. I am taking an extreme example of Lt Col Kapil Sharma, aged 40, who showed extreme presence of mind in using his Soldier-bots to maneuver through enemy territory and destroy key enemy assets using a combination of cyber attack on the mobile phone network and using on-ground weapons installed on the Soldier-bot and achieve decisive victory. Lt. Col. Sharma had earlier also designed and unleashed several viruses and worms that completely destroyed the enemy command and control system. This is not futuristic anymore. ***Point is that we are not futuristic, if we look at the current mechanism for getting in sub skills we have the periphery of the army concept where in we***

get skills from the civilian world on the basis that we have trusted relationship with these individuals, we don't have something similar to the ICT system. We are not just talking radars, software's. We are also talking about services coming in.

If we look up the traditional military support by Industry, an army is strong only if the economy is strong. Now if you look at Cyber-Enabled Military Requirements from Industry, what does the Indian Industry have? Does it have a data base? Does it have an operating system? Does it have a processor? Unfortunately the answer to all the above asked question is No. The telecom equipment that we have is also very little, positioning systems are just coming up. Is it too difficult for the Indian Industry to come up with all of this? The answer is No, it is a matter of demand being created. In the doctrine of the Indian Army, which is well documented one of the components is Future Visualization & Strategy leading to need for equipment and infrastructure and organisational structure. I am sure we are visualising what the future wars are going to be? What the future military engagements are going to be? Can we identify our needs and then get the local industry to build it up. Nanonization is required as of now. Nano could happen because Indian Industry owned the automobile technology. A "nano" in ICT related areas is a challenge since ownership of technology is a necessary condition. Design criteria and priorities for design trade-off needs to be India specific, smaller and faster is not an India design priority but high temperature and dust proof is a India design requirement . If the mules are so important to the Indian Army, can we not nanonize mules? Mechanical Mules have not been built in the United States because they fight on land and the terrain is not like that of India's. DARPA is actually building mechanical mules. What is required for industry to invest in new technologies? There is a need for an entire ecosystem to be developed. Significant investments needs to be made, there are very high risk environment and technologies. Once the industry develops something and if the order does not come through this means a lot of companies getting destroyed, there is an absence of long term partnership with the Indian Army. ***Joined ventures between the private sector and Indian Army will help in establishing long term relations, what the domestic Industry needs is assured business, the industry requires a focused path and clearly there a few road blocks***. Therefore the following points are important for a shared roadmap for Military Technology: –

- Allow industry to invest for long term.
- Allow academia to have directed research.
- Allow global players to form appropriate partnerships.
- Allow startups to propose and develop innovative solutions.
- Allow military to access solutions in a dependable, sustainable and ultimately cheaper manner.

The conclusions which came from one of the earlier seminars at CLAWS which was the National Conclave on Technology were:-

- Create institutional structures for leveraging the stakeholders for developing and sustaining the required ecosystem for military technologies.

- Further attuning the Defence procurement process to strengthen the domestic military industry.

There is also a need to involve all the stakeholders; this includes the defence forces, domestic industry, global industry, academia and startups. DPP 2013 is a positive step forward for tuning the defence procurement procedure towards greater local procurement however there continues to be perceptions that the defence procurement process disincentivizes local industry. In the process of categorisation committee, it needs to critically examine essential factors like: -

- Capability of the industry,
- The difficulty in mastering complex high end critical technologies,
- Foreign restrictions on military equipment ,and,
- The urgency of induction of equipment by the armed forces before carrying out procurement categorisation

In the matter of Indian production their needs to be clarification on issues related to taxation, clarity on industrial licensing, implementation and evaluation of offsets and point procurement v/s roadmaps. I would like to shortly tell you the procurement process which leads to faster obsolescence:-

- Shorter shelf life of ICT assets driven by obsolescence that is accentuated by
    - Multiple projects with pilot approach, followed by,
    - Planning for enterprise wide rollout, followed by,
    - Long procurement cycle.
- Leads to multiplicity of technology platforms
    - Issues of having an integrated solution.
- Need to plan for projects at enterprise level followed by phased implementation if desired,
    - Sharing project roadmap is critical.

RFP team must include experienced officers from the field units of the respective system or domain and involvement from stage of Accord of Necessity (AON) to the stage when the project is under development. Stakeholder consultation should be limited to vendors from specialized verticals and final RFP to be created from inputs from each of the consultative processes. I would like to end this presentation by saying – “Ask not what the Indian ICTEC industry can do for you, ask what you want from the Indian ICTEC industry”.

Procedures to Drive Indigenisation : Col (Retd) H Shankar.

The subject is Procedures to Drive Indigenisation, since the morning. I would therefore first talk about indigenisation with a few examples. I woish t what we aro apprise you of the efforts we are making to replace the Brahmos Missile Avionics Systems – Indigenous **–** Missile Seeker. The Brahmos Missile has got a Russian seeker which in fact seeks the targets. We have taken up as our own R&D to make an indigenously developed seeker, which incidentally is one third the size. The seeker being purchased from Russia is based on older technology; they have adopted the TWT power amplifier transmitters, while we are using newer technology in this field. We initiated a MoU with BRAHMOS to develop three prototypes. It took two years to develop, presently trials are on and hopefully in the next two years BRAHMOS missiles will have an indigenous seeker unit. Next we took the KOPYO RADAR from the Indian Air Force for MIG 21, we were not getting the spares from the Russians, so we took up individual units and kept the interfaces outside as it was and internally the total circuit was changed with the use of modern technology. Almost 30% of the critical units which had higher wastage figures have been indigenised. Thanks to the offset policy, we are doing two offset programs which is the TISK and TIFCS. We have developed a large number of MW sub-systems for DLRL / units for EW systems. The purpose of showing all this is these are the critical building blocks; with all the bad opinions everyone has about the DRDO there are good things also. In the sense that they have now made out for whether it is the ground application or ship borne application, they have made a standard EW modules which are being designed and developed by Alpha Design Technologies. We are also one of the few companies working on the Software Defined Radios.

The processes and the procedures that need to be adopted for indigenisation for systems which are already in-service, let us consider only those which are large quantities, high/medium cost products or systems. They should be, atleast 8 to 10 years old from the time of induction /procurement. Segregate the assemblies /sub-units whose MTBF is small and MTTR is large. Choose assemblies /sub units which are again of large/medium cost because there is no point in doing washers, nuts/bolts, etc. Segregate into technology areas such as, electronics, electrical, mechanical, gimbals, etc. Work out quantities and prices if they are to be procured from the OEM's. ***Now the question arises as to who will undertake the indigenisation? I can assure you that the big industries, whether Public or Private are just not interested. They are already overloaded with orders. DRDO has a lot of projects and hence is not able to undertake indigenous projects. The Army Base Workshop (ABW) has the focus but the critical manpower from EME is a floating population and constant changes affect progress of indigenisation adversely. Also, the financial powers vested in ABWs are limited and also a major drawback for Indigenisation. Hence, the only hope for Indigenization is from MSMEs. However, they also need funding and hand holding from Defence Forces***.

The method of indigenisation of obsolescent assemblies /sub units, are as listed below-

(a) Study all available literature, drawings, documents, input / output relationships.
(b) Take as much electrical / mechanical / interface measurements as possible.
(c) Check ATE / test equipment / test jigs provided by OEMs.
(d) Arrive at probable technical specification.
(e) Keeping the form-fit of the outer assembly / sub-unit and the input / output specification to be the same, re-design the internal circuitry / mechanical item to meet the required specification, using modern components.
(f) After prototyping, make engineered versions (with new hardware & software) and carry-out assembly / sub-unit environmental tests (of the same standard as per main equipment).
(g) Carry out intensive ground tests after fitting on main equipment. Also associate Indigenization Cells, Users & QA agencies.
(h) When successful, go for mass manufacture.

What are the changes that are needed? There are a lot of cells in the Air Force, the Army and the Navy, we need to give these cells certain power, certain autonomy and inherent strength. They should be funded by the Government of India separately and made to spend at least Rs100.00 Crores per year on specific pre identified indigenisation programs. Procedure for trails/ evaluations/ testing / qualification to be simplified and made time bound. Indigenization Cells to shortlist and select specific SMEs for undertaking the tasks. Funding to SMEs to be based on following:-

(a) NRE costs to the tune of, at least, 10 times the targeted price of the particular assembly / sub-unit.
(b) Minimum order quantity (MOQs), depending on the nature of main equipment / system to be assured to the SMEs in a time bound manner
(c) Once the SME's selection is made, there is no need for 3 quotes, L1 vendor, etc.,
(d) FE variation and escalation of costs per year to built into the structure.
(e) SMEs, so selected, should be given full access to the main equipment's, its technical literature and to the Training establishments.
(f) Selected SMEs, Indigenization Cells & User units should work as a team in an open and transparent manner.

Some of the examples just from my thought process are that there are so many old radars that we are still struggling with, so many missile system that are not modern n their functioning. We should focus on replacement of TWT transmitters with Solid State Transmitters, replacement of imported T-R modules with INDIGENOUS T-R

modules, replacement of imported receivers with indigenous receivers, replacement of antennas, drive units and other mechanical items. These are a few specific areas that we should indigenize for Army equipment / systems. In terms of the communication equipment, we need to replace all imported accessories with indigenous versions and older communication equipment with newer indigenous equipment. AFV systems, Night Sights: TIM / TISK for BMP instead of Russian systems, TIFCS for T-72 tanks to replace current equipment on tanks, including sights. Interoperability of AFV Radios with indigenous Man Pack Radios. Indigenisation / upgradation of Commander's Sights, etc.

We will now come to the summary and the conclusion of this presentation. ***It is necessary to make a systematic study of all major products / systems which are in- service for more than 10 years in the Army by segregating them into high, medium cost and large quantity equipments, their defect proneness etc, procure assemblies / modules / sub-units and find indigenous solutions by keeping the external interfaces and form – fit the same by redesigning the internal circuits / assembly with modern state-of-art components and where necessary with new software. Funding is essential, for this purpose, at least, Rs. 100.00 Cr per year per Indigenization Cell in each Command to be earmarked for spending with minimal procedures for specific selected SMEs. Corps of EME to take pivotal role by involving Indigenization Cells, ABWs, MCEME, EME School, MAGs and SMEs***. These were the points that I had and wanted to focus on, Research & Development of the private sector when the private sector has made so much success in the civilian sector, why not put the money into major programs for the Indian Defence Sector? We as a part of the private sector must put as much money as possible in our own projects and utilize the SME's. My last thought is on the offsets, they need to bring up the Indian Industry and these offsets should bring up the Small Scale Industries and fund them so that they can become Medium Scale Industries, and eventually they become Large Scale Industries. After all of this the purpose of the Offsets which has been enshrined in the DPP and Indian Offset Policy. I would now end my talk with this thought.

Valedictory Session

Valedictory Address by Lt Gen Anjan Mukherjee (Retd), Former DG Artillery

It is not often that the Indian Army is directly taking responsibility for major indigenisation. Regarding this particular project of the gun - the OFB did try to make a gun – just a 155 millimetre to replace the existing Bofors gun. The entire project had become a failure by 2008. That is the time that the Artillery Directorate wrote to them asking them stop spending money on it since they were not interested anymore in what they had been shown. Instead they got permission from MoD to get 200 old and used pieces of 130 millimetre guns from Slovakia or somewhere.

When I became the DG Arty, I said this is not the way we should conduct our business. But before that in the beginning of 2011 when I was DG Financial Planning, I felt we should make some guns for India. I went to General V K Singh, the then COAS to give suggestions as to how we all in uniform can do things. I was those days in South Block so I had access to him. I walked up to him and said, 'Sir, can we make a medium gun?' He said, 'Again you want to start something? What do you want from me?' I said, 'Nothing sir'. He said, 'Why do you come to me? I said, 'At least if I try and do something I must ask you'. He said, 'Don't put yourself into complex situations but go ahead and do what you want to do'.

So I sought a meeting with Mr RK Singh, Secretary Defence Production, I impressed upon him, to give it a try? Thereafter, they took some initiatives to send a Chair in the Ordinance Factory Board.

The biggest and most difficult challenge that we faced was from our very own Army bureaucracy. It was a most difficult task to penetrate that whole system. It was impossible but since I was the DG FP who had the entire budget allocation was with me, so I could push a few things.

The amount of capability and interest that the OFB showed towards the project was tremendous as part of the indigenisation programme. One cannot imagine it.

This project has been coined as a national project on file by the Defence Ministry under the signatures of RM. This means money is not be a constraint. The other thing is that the barrel design, 30% of which is by the DRDO. The barrel was actually not achieving the pressure we required. The chamber was a much bigger than what OFB could handle.

By the time I became DG Arty I was part of all negotiations and had discussed every issue. Putting together 506 Army Base Workshop and OFB, like never before was General N B Singh's doing. Let's give him a round of applause. He went there, we went together, all kinds of things happened and his orders were, 'Please do it first and come back to the DGEME and we will give you clearance'. This is the kind of initiative needed and OFB acknowledges that.

Another aspect of indigenisation that needs to be told is that the biggest challenge in this project was the hydraulic system. We went to BAE Systems for the same. They quoted a cost at Rupees 04 Crores per system. This gun is for 14 Crores, further it would take two years because the production lines were not there anymore. We cannot make a gun in that manner. So we went all over to find out who are the best hydraulics makers for cars, internationally. We found one company called Dantal in Gurgaon. They only make them for foreign cars. We impressed upon them to give us

a try. Today for one crore or so we have got an entire hydraulic system, with all nine sensors. We have fired more than 200 rounds successfully during trials.

This is the strength of the Indian industry today. I am totally convinced that they can produce anything today with a bit of prodding, support and motivation. The work of both the OFB and the private makers of the guns are fantastic. So we have to be proud of the way our industry is coming up. The requirement of the gun is 52 calibre /45 calibre is nearly 3000 pieces. The appetite of the Indian industry will never be satisfied. They cannot actually produce such large quantities. So much business is available. Whatever guns we presently have in – service will be of no use after 10-15 years.

Similar is the case for our ammunition. We went in for *Thermobaric* ammunition. We had resistance from all over. Today everybody has accepted it. We have fired it sucessfully. One round of 105, has given the result. Can you imagine what the additional cost is? It is INR 500 only. So nothing is coming from outside. We have imported 10 Lakh of BMCS but that is it. We make it in India. So great work is being done by the Indian industry and our DPSUs with the help of the Army. This needs to be acknowledged.

Concluding Remarks by Col H Shankar, Alfa Design Technologies

In my opinion the situation is not as bad as it appears to be or is made out to be. The Indian industry is in good shape be it the public or private sector. The Ordnance Factories are coming up into the stage of competition. Hopefully with the coming of a more decisive government, we will have more projects being undertaken and cutting down on the procurement from abroad. Regarding funding for R&D, the industries should themselves invest their money and not be overtly dependant on the funds being made available by the government. We should be able to earn and put back our profits not into the pockets of the shareholders. They can wait. ***The money should be ploughed back into R&D and build up as many systems as possible***. In particular, the field of electronics we can take very strong steps forward. This particular seminar that has been done on indigenisation is a very relevant seminar. It has rightfully been done at an opportune time in the nation's political life.

Let us also acknowledge the good work that has been done by the public sector, specifically the DRDO and the private sector, in their own spheres. There have been gaps but I am sure those will be filled up in the days to come. This being an EME seminar, it is my own great pleasure as an ex-EME officer, 71 years old. I joined the Army when I was 21 years old. So it is about 50 years as a soldier and in our own company we have more than about 18 EME and Signals officers and men who are contributing.

Ofcourse, we also have with us ex-DRDO people there as well as about 300 youngsters. Thus, I am sure that there will be more such spheres of excellence made out in the MSME field. These will give support to the bigger organisations of TATA, Bharat Electronics etc. We should give total support to the Indian Army to have the indigenous back up for their own modernisation programme.

Concluding Remarks by Shri Rahul Chowdhury, CEO, TATA Power SED

There are basic issues that need to be highlighted if we are to succeed as a nation in the indigenisation venture. The word 'trust' is at the centre of it.

- ***If a private sector company does anything in this country with its own money, there is no way that the MoD can buy back anything from it***. Resultant single vendor is just not possible to be moved forward in anything either indigenisation or not.

- ***If you are embarking on something that is different or new, you have to be ready to allow failures. If you are not prepared or your systems do not allow you to move forward and see failures happening, you will never see progress. If you want to do something new, failures are a part of it. The country which tolerates failure best, is at the apex of the economic pyramid of the world*** i.e., USA. There is a phrase called 'Chapter 11'. If a company is going bankrupt, whatever happens, Chapter 11 takes over and the company comes out in a new avatar. So the knowledge is not lost.

There is famous story going around about Mr. Adani, at the time that he was a smaller businessman with 100-200 Crore net worth. He had a very good friend who worked together with him, made a mistake that lost him three 0crores and consequently went to him with his resignation letter. He said in Hindi, '*Teen crore ka loss karake aab tum kahin aur ja raho ho? Yahin rahoge*'. Now that is what we need if we want to move in the direction of indigenisation and really build capability. For this, trust is crucial.

We have this great process of security in everything. Indian companies run today through outsourcing, the world's largest communication network, largest banking network, some of which in a single day transact USD three trillion. An Indian company in the security sector cannot build a security system today. What you are telling us is, you are not Indians. If we have to talk about really moving forward and doing something together, those things have to change. The trust needs to be brought in. Thank you.

Closing Remarks and Vote of Thanks by Lt General NB Singh, DGEME

In the morning, I had listed the four stages of indigenisation, which I would like to emphasize once again: -

(a) Operational sustainment.
(b) Indigenisation to be done taking into account the obsolescence and legacy systems which we are still operating.
(c) Design and manufacture of new as well as replacement systems.
(d) Incubation of unique and breakthrough technologies with the idea of using them in existing systems.

We on our part, have taken up several initiatives to support the MSMEs and in the EOI, a very exhaustive vendor base has been prepared. Today we are interacting more with companies dealing with engineering and technology. The DG Arty has given you the example of Dantal taking up the entire hydraulics of the Dhanush. We are encouraging MSMEs as well as firms of national repute capable of taking up crucial indigenisation projects by placing orders on them through the OR. A number of companies like Bharat Forge have responded.

A separate chapter on procedures is being included into the DPM which looks exclusively at indigenisation. Otherwise it was being looked at a Walmart kind of procurement. You develop a vendor and subsequently you have to go and open tender and look for another vendor. We have now proposed that there should be guaranteed buy back from the vendor. We also propose to take up the issue of separate procurement procedure or as ICE procurements.

We also recognise that for indigenisation to be successful, a large number of policy changes are essential. These are being given out by a number of speakers today. We have taken note of them and will be including them in our recommendations. The industry on its part also needs to take up these issues at the highest level and keep up the pressure. In the morning we have given you the example of how the Dhanush project for the development of a 1/5 millimetre gun system has come to fruition through the collaborative efforts of the Arty, EME Directorate, OFB, DPSUs and a number of persons. In fact it is time that the documents of the OFB are also shared with reputed private Indian sub-system manufactures so that the quality of tanks and guns made meets DRDO standards. Today it is not happening. I also feel that the industry must have access to technologies that are currently there in our weapons systems. However, the issue of security looms large and that is why people are reluctant..

On my part I am recommending that these BDRs, BRDMs and the CORNET-E missiles which are being discarded by the Indian Army, can atleast be handed over to the private sector for evaluation and study. This can become the building block on

which another project can come up. ***Our efforts for Technology Security will have cascading effect in almost all spheres of the government***. Even the ordinary taxi driver will gain. This point must be understood. ***When the self-sustaining spiral of development and indigenisation will go hand in hand, we will automatically see our country transforming into a developed country***. The large scale development in Germany is courtesy of the MSMEs. That is the model which we have to adopt. There is also a need for the creation of technology corridors such as the Tel Aviv corridor which has catapulted Israel during the last 20 years to become a leading exporter of arms and technologies related to weapons systems. Finally, I thank all sponsors and organisers in the conduct of this seminar. I will also carry forward Dr. Chidambaram's message of continuing with this initiative. Therefore, we'll certainly meet after two years to take stock of where we are. I will end on an optimistic note that things will improve, keep looking, *Jai Hind*.