



Collaborative partnership between India and Brazil in aerospace and defence

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1. Overview of Aerospace & Defence in India

The aerospace and defence manufacturing in India involves three major stakeholders who are the representative of various aspects of governance, regulations and manufacturing.

1.1 Ministry of Defence

The Ministry of Defence (MoD) regulates the defence forces as well as the defence manufacturing in the country. It represents the Government of India (GoI), provides the policy framework and wherewithal to the armed forces. It consists of four departments under it are the following.

1.1.1 Department of Defence (DoD)

The DoD deals with the three services i.e. Army, Air Force, Navy and Coast Guard. It also deals with Inter-Services Organization. It is also responsible for the Defence Budget, establishment matters, defence policy, matters relating to Parliament, defence cooperation with foreign countries, and coordination of all related activities.

1.1.2. Department of Defence Production (DDP)

The DDP was set up with the objective of developing a comprehensive production infrastructure to produce the weapons, systems, platforms, equipment required for defence in 1962. All the public sector entities which include all DPSUs and all Ordnance Factories fall under the purview of DDP.

1.1.3 Department of Ex-Servicemen Welfare (DESW)

The DESW deals with all resettlement, welfare and pensionary matters of Ex-Servicemen.

1.1.4 Defence Research and Development Organisation (DRDO)

DRDO is the nodal agency of the Government of India with a network of 52 laboratories across the country engaged in R&D, testing and development defence technologies

1.1.5 Department of Military Affairs (DMA)

This department is headed by the Chief of Defence Staff as its ex-officio secretary and deals with the Integrated Headquarters of the MoD, the Territorial Army between different wings of the armed forces.

1.2. Public Sector Undertakings

The Department of Defence Production controls the Defence Public Sector Undertakings (DPSUs), which are government owned enterprises and Ordnance Factory Board (OFB).

The products manufactured by these DPSUs and the OFB include arms and ammunition, tanks, armoured vehicles, heavy vehicles, fighter aircraft, helicopters, warships, submarines, missiles, ammunition, electronic equipment, earth moving equipment, special alloys and special purpose steels.

The overall production value of defence equipment in FY19 by DPSUs and OFB (including their JVs) is INR63,208 crore. The public sector companies account for approx. 60-70 per cent of the overall defence production in the country¹.

There are the nine DPSUs across different segments of shipbuilding, aeronautics and electronics and along with the OFB, that consists of 41 Ordnance Factories, the DPSUs are engaged in production, testing, logistics, research and development of equipment.



1. Defence Production, DDP Dashboard, MoD (GoI), 2020

1.3 Private Sector Units

The private sector in the Indian defence sector comprises of the three major set of players in defence manufacturing across different capability levels.

1.3.1 Micro, Small and Medium Enterprises (MSMEs)

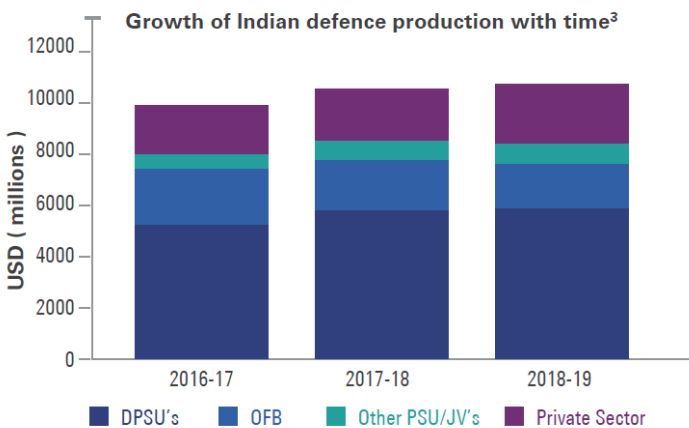
India currently has over 8000 Micro, Small and Medium Enterprises (MSMEs) vendors involved in defence production². They form a major part of the Tier-2 and Tier-3 suppliers to the global OEMs and the Indian primes. The MoD has taken steps to establish 16,000 MSMEs in the sector by 2025. The total defence production has been steadily growing in India in recent years.

1.3.2 Large Indian Tier -1s

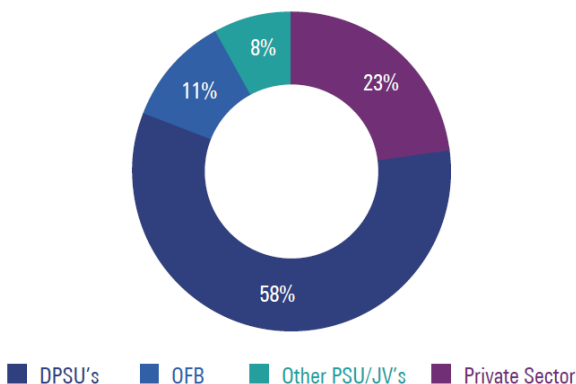
The leading Indian conglomerates who are majorly Tier-1 suppliers of the global OEMs have started developing capabilities in defence manufacturing and are eyeing on a pie from the upcoming defence contracts.

1.3.3 Global OEMs and Tier-1 companies

All the leading Original Equipment Manufacturers (OEMs) and the Tier-1 suppliers have their presence by having their manufacturing bases in India. Further, foreign companies are eager to partner with Indian firms and include them into global supply chain.



Share of Total defence production FY2019-20³



2. Press Information Bureau, MoD (GoI), September 2019
 3. Defence Production, DDP Dashboard, MoD (GoI), 2020



2. Defence Policies

Gol has come out with several policy changes and reforms to standardise procurement process and develop a robust ecosystem in India. Some of the key policies are highlighted in this section

2.1 Defence Acquisition Procedure (DAP) 2020

The Defence Acquisition Procedure is the central document that enlists the processes and procedures involved for the capital acquisition in defence. The DAP 2020, released in September this year. It brings in several changes for ensuring better and standard acquisition of platforms and equipment for defence. The changes are enlisted under the below sub-headings.

2.1.1 Capital Acquisition

The chapter on capital acquisitions in draft DAP 2020 deals with the categories under which capital can be spent for acquiring defence platforms/equipments/systems in India. In the latest draft, two new sub- categories have been added, namely - 'Buy (Global manufacture in India)' under the 'Buy' category and 'Make-III' under the 'Make' category. Further, two new categories for buying Indian manufactured platforms have been added, namely, through 'Leasing' and 'D&D/Innovation'.

The given table summarizes the changes made under these categories.

Category/ Sub-category	Proposed requirement in the draft DAP 2020
Buy (Global- Manufacture in India)	<ul style="list-style-type: none"> A new sub-category has been introduced under the 'Buy' category viz. Buy (Global-Manufacture in India) wherein the outright purchase of equipment shall be made from a foreign vendor. However, it imposes the obligation of a minimum 50% Indigenous Content (IC) on a cost basis of the total contract value, which can be achieved through its subsidiary in India. IC can be achieved through the manufacturing of the entire equipment or spares/assemblies/sub-assemblies/maintenance, repair and overhaul (MRO) facility for the entire life cycle support of the equipment.
Lease (Indian) Lease (Global)	<ul style="list-style-type: none"> New category of leasing has been introduced wherein acquisition can be made under two sub-categories - Lease (Indian) and Lease (Global). It is applicable in case where procurement is not feasible due to time constraint, or the asset/capability is needed for a specific time or smaller quantities. It would also be applicable in cases where service life lease rentals are a better option compared to a one-time acquisition cost. This process will: <ul style="list-style-type: none"> — obviate the delays in procurement of equipment — address the budget constraints for capital procurements — help to gain experience for operational exploitation of equipments.
Design and Development (D&D)/ Innovation	<ul style="list-style-type: none"> This category has been added to give boost to indigenous manufacturing and R&D in defence sector. Acquisitions under this category refer to systems, platforms and upgrades to be designed, developed and manufactured by Indian vendors. Creating an ecosystem to foster innovation & tech in A&D sector by engaging entrepreneurs, startups, MSMEs through iDex. To promote out-of-the-box thinking by encouraging innovators on solving defence problem statements.



2.1.2. Offset guidelines

There have been significant changes in the offset guidelines. The key pointers to note with regards to the off- set guidelines are:

- Removal of offset banking as not many OEMs were opting for this avenue
- Deletion of avenues of discharge for “investment in kind” through non-equity route.
- Offset discharge partially through a Tier-1 sub vendor on case-to-case basis has been permitted.
- Redefinition of the multipliers
- The list of eligible products has been refined as per India’s developmental needs.

2.1.3. Other changes in the DAP 2020

Apart from the changes mentioned under the above headings, there are other changes, though minute, that must be looked in the overarching structure of the DAP 2020.

- **Price Valuation Clauses (PVC)**
PVC has been introduced for procurement (> INR1000 crore) and delivery period (> 60 months). It also addresses the price variations concerns due to fluctuations in exchange rate, inflation etc. over a period of 5 years for the OEMs.
- **Annual Acquisition Plan (AAP)**
Annual Acquisition Plan (AAP) will now be a 02- year annual plan and having three sections containing list of carry over acquisition proposal, acquisition proposals likely to be initiated for AoN and list out cases under the ‘Design & Development’ category.
- **Post contract management**
The chapter defines the procedures to be ad - hered for post-contract management, clarifying the decision-making matrix to bidder
- **Additional category in Make-in-India**
The new category Make-III (Indigenously manufactured) would encompass subsystems, assemblies, materials, etc., which although not

designed/developed indigenously, are being manufactured in India towards import substitu- tion for product support.

- **Acceptance Testing Procedure (ATP)**
Clarity on quality assurance and ATP will be prepared by the user with vendor consultation during technical trials. Third party inspection has been permitted for acceptance, in accordance with the laid down ATP in the RFP.
- **Committee for Service Quality Requirements (SQR)**
A committee for defining SQRs has been pro- posed for Service HQs, with members from all stakeholders.
- **Shipbuilding**
The chapter has been elaborated to cover acquisitions of naval warships of indigenous designs by the Navy to be constructed by DPSU/private shipyards. A separate sub chapter has also been created to deal with the demand for ship repair.
- **Provision for miscellaneous issues**
Provision has been made for the incorporation of artificial intelligence, subject matter experts, indigenous materials and indigenous software among others to develop for future needs.



2.2. Defence Production and Export Promotion Policy (DPEPP)

To position India amongst the leading countries in A&D sectors, the Ministry of Defence (MoD) has formulated the draft **Defence Production and Export Promotion Policy (DPEPP) 2020⁴** as an overarching guiding document of MoD to provide a focused, structured and significant thrust to defence production capabilities of the country for self-reliance and exports. It aims to accomplish the following.

- Achieve a turnover of INR1,75,000 crore (USD23 billion) including export of INR35,000 crore (USD4.6 billion) in A&D goods and services by 2025.
- Develop a dynamic, robust and competitive defence industry, including aerospace and naval shipbuilding industry to cater to the needs of armed forces with quality products.
- Reduce dependence on imports and take forward “Make in India” initiatives through domestic design and development.
- Promote export of defence products and become part of the global defence value chains.
- Create an environment that encourages R&D, rewards innovation, creates Indian IP ownership and promotes a robust and self-reliant defence industry.

The different reforms taken under the DPEPP to realise the above-mentioned capabilities are across different segments and categories. They are mentioned as follows:

2.2.1. Procurement reforms

- Setting up of a Project Management Unit (PMU), with representation from the services, to support the acquisition process and facilitate management of the contracts.
- Creation of a Technology Assessment Cell (TAC), with representation from the services to design, develop and produce the systems projected in the Long Term Integrated Perspective Plan (LTIPP). In addition, the TAC would carry out the scan of regional and global technological capacities and would also render advice to the services while formulating Staff Qualitative Requirements (SQRs).
- Review and overhaul of the trials would be done to reduce the procurement cycle time of indigenously developed products/systems.

2.2.2. Indigenisation and support to MSMEs/Start-ups

- Development of an indigenisation portal for DPSUs/ OFB/ Tri-Services with an industry interface to provide development support to MSMEs/start-ups

ups/industry for import substitution.

- Defence Investor Cell (DICs) will provide hand-holding to MSMEs, investors and vendors in defence production for resolving issues with central, state and other authorities.
- Services will hand-hold the industry through continuous interactions, sharing of information and arranging visits to repair establishments/ field depots for better understanding/appreciation of the requirements.

2.2.3. Optimise resource allocation reforms

- Carve out of a distinct budget head for domestic capital procurement and to have an enhanced allocation at the rate of minimum 15 per cent per annum for the next 05 years.
- OFB/DPSUs will be mandated to increase productivity, enhance quality, reduce costs and ensure timely execution of orders by optimizing inventory management, greater vendor outsourcing at all levels, improving skill levels and overall project management.

2.2.4. Investment promotion, FDI and Ease of Doing Business (EoDB)

- Investment promotion would be done for strengthening defence ecosystem by identifying existing gaps and by offering high multipliers through offsets obligations.
- Efforts would be made to attract FDI through Invest India, DIC and licensing process for defence industries would continue to be eased in a time bound manner.
- Reform of the productionisation process to cut down the ‘lab to lines’ time conversion of prototypes into commercially useful products, by roping in production partners at an early Technology Readiness Levels (TRLs).



4. Press Information Bureau, MoD (GoI), August 202

2.2.5. Innovation

- Efforts would be scaled up for promoting creation of IPs and filing of greater number of patents through the previously launched Mission Raksha Gyan Shakti.
- iDEX would be scaled up to engage with 300 more startups and developing 60 new technologies/products during the next five years, and their procurement under Make-II route of DAP.
- Reforms to be made in the offset policy to encourage defence investments and acquisition of critical technologies through higher multipliers.

2.2.6. DPSUs/OFBs

- Efforts to be made for positioning the DPSUs as system integrators and create a multi-tier domestic supply chain.
- OFB/DPSUs will be mandated to maximize outsourcing from indigenous sources.
- Encouraged to move towards “Industry 4.0” by using innovative strategies and tools like digital threading to include Internet of Things (IoT), timestamping by the use of block-chain technology, Artificial Intelligence (AI) etc.

2.2.7. Quality assurance (QA) and testing infrastructure

- Quality assurance process and delivery would be rationalised and monitored by developing an IT platform with an industry interface.
- Accredited third-party inspection bodies will be promoted to augment the resources of Director

General Quality Assurance (DGAQA) by outsourcing certain QA functions throughout the value chain.

- ‘Zero Defect Zero Effect’ is being encouraged for quality consciousness of the MSMEs assisting them to adopt self-certification route through a facilitated process.
- Efforts to be made to streamline the airworthiness assurance functions of Center for Military Airworthiness and certification (CEMILAC) and strengthen its operations.
- Creation of testing infrastructure through Defence Testing Infrastructure Scheme (DTIS) by aiding the industry to set up common testing facilities.

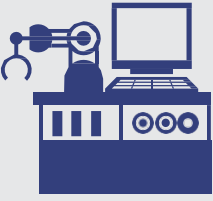

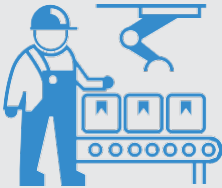
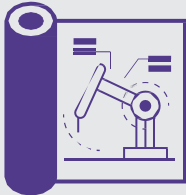
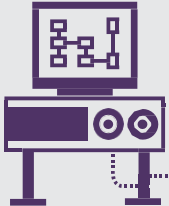

2.2.8. Export Promotion

- Defence Attachés (DAs) have been mandated to promote export of indigenous defence equipment abroad.
- Export promotion cell to be set up to promote defence exports would be further strengthened.
- DPSUs/OFBs to have at least 25 per cent of their revenue from exports including success fee earned as targeted by 2025.
- DDP would facilitate on boarding of Indian Offset Partners (IOPs) in the discharge of offset obligations by OEMs.
- Def Expo and Aero India will be positioned to showcase defence manufacturing capabilities and encourage exports.



2.3 Recent Reforms by the MoD

In the wake of the COVID-19 crisis, several measures were announced by the Finance Minister, to boost the defence manufacturing in India. These reforms have been listed under.

	<p>FDI limit in defence manufacturing under automatic route raised from 49% to 74%⁵</p> <ul style="list-style-type: none"> • Addresses the primary concern of global OEMs on control to protect IP and technology. • Automatic approval route could ensure minimal procedural delays. • Foreign investment in the sector is subject to security clearance by the Ministry of Home Affairs and as per guidelines of the Ministry of Defence. • Expected to result in enhanced FDI from foreign OEMs especially from key defence manufacturing hubs.
	<p>Reforms to encourage greater private participation in the space sector</p> <ul style="list-style-type: none"> • Govt will provide level-playing field to private companies in satellites, launches and space-based services. • Private entities can use facilities owned by ISRO and its relevant assets. • Govt will also roll-out a liberal geospatial data policy for providing remote-sensing data to technology start-ups. • Provides boost to Indian space entrepreneurs and enterprises working to leverage geospatial and remote sensing data for space exploration.
	<p>New policy for Public Sector Enterprises (PSEs) and Corporatisation of Ordnance Factory Board (OFB)</p> <ul style="list-style-type: none"> • All sectors, including strategic ones open for private sector. In strategic sectors such as defence, at least one and up to four PSEs allowed. • Professional management in ordnance factories will reduce slag, improve quality of products, timely delivery and enhanced accountability.
	<p>Protect domestic industry by disallowing global tenders for contracts up to USD27 million (INR200 crore)</p> <ul style="list-style-type: none"> • Emphasis on indigenisation of imported spares - separate budget to be allocated for domestic cap procurement. • Procurements of value of up to INR200 crore (approximately USD27 million) to be reserved for domestic industry.
	<p>Time bound defence procurement through a Program Management Unit, realistic GSQRs and rationalised trial and testing procedures</p> <ul style="list-style-type: none"> • MoD is sensitive to the inordinate delays in procurement and need for procedural overhaul. • Reforms in procurement processes are expected to significantly improve business confidence for both Indian and foreign OEMs.
	<p>Make India a global hub for MRO for defence and civil aircraft by rationalising tax regime and associated ecosystem</p> <ul style="list-style-type: none"> • Major engine manufacturers expected to set up engine maintenance facilities in India. • Aircraft component repairs and airframe maintenance could increase from USD100 million to ~ USD300 million in three years⁶.

5. Press Information Bureau/Highlights of Finance Minister's Stimulus Package – IV, Ministry of finance, May 2020

6. Govt plans to make India global hub for aircraft maintenance, Business Today, May 2020

2.3.1. Licensing and Regulatory Reforms

The Department of Industrial Policy and Promotion (DIPP) under the Ministry of Commerce and Industry issued a notification in 2019 that aimed to liberalise the manufacturing of defence components in India. The notification draws a clear line between the list of defence items that need license authorisation from the DIPP and the ones that need the license under the Arms Act of 1956. In other words, it states that all items that are of dual use and/or are components of the larger defence platform, can be manufactured under the ordinary licensing requirements of the DIPP. This distinguishes these equipments and items from the larger defence platforms (at the end of the defence value chain), that require stringent testing and checks and hence are to be authorized/licensed only under the Arms Act, 1959. The notification, in a way liberalises a plethora of items and equipments from the license regime

The DDP also released a notification in 2017 allowing the exports of items under the "Munitions List" by defining a new SOP and standardising the process of the items under the Category 6 of Special Chemicals, Organisms, Materials, Equipment and Technologies (SCOMET)



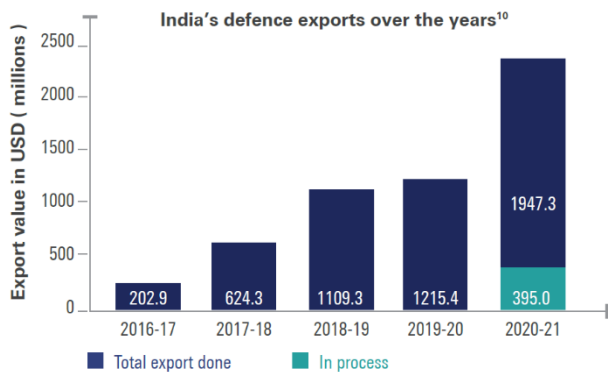
3. India's Defence Exports

3.1 Manufacturing capabilities in India

In the recent years, defence exports have been a central part of India's defence manufacturing capabilities with a focus on developing a credible and structured defence export programme that functions as an extension of Indian diplomacy. The current indigenous defence production is estimated to reach INR90,000 crore⁷ (USD12.5 billion) in 2019-20 and in order to achieve the targeted annual growth rate of ~15 per cent, the MoD is focusing on boosting defence exports.

As per the data published by the Stockholm International Peace Research Institute (SIPRI), in March 2020, India is ranked 23rd in the list of major arms exporters for 2015-2019⁸. This is the first time India has been ranked among the top 25 arms exporters in the world.

Frugal engineering, cost-arbitrage due to the availability of high-quality competitive engineering talent, IT infrastructure and labour provides India an opportunity to aim at further improving its defence exports. Given the potential for defence exports, the MoD targets exports of INR35,000 crore (USD5 billion) till 2024⁹ and in order to achieve this target, the exports have to grow at a CAGR of >40 per cent till 2024.



3.1 Capabilities of defence manufacturing in India

Over the years, the Indian defence manufacturing ecosystem has developed its capabilities across product groups. The presence of large India primes and MSMEs alike, have created a diverse set of capabilities among the Indian manufacturers.

3.1.1 Composites

There has been significant growth in composites and allied technology in India because of widespread adoption in defence along with other commercial applications. Today, India has the capabilities in prepreg moulding, Vacuum Assisted Resin Transfer Moulding (VARTM/resin infusion, multi-axes filament winding and hand layup. Using these

capabilities, the raw materials are being processed into composites like woven carbon and glass-based reinforcements, glass filament manufacturing, epoxy resin manufacturing, higher grade imide and phenol production, high temperature foam manufacturing and so on. India has dedicated plants for manufacturing of resins, reinforcements, fillers, adhesives and consumables for composites.

3.1.2 Precision manufacturing

India is home to a plethora of companies in the precision manufacturing space. The manufacturing capabilities currently in India include precision machined parts, mechanical parts assembly, CNC machining, precision lathe work, complex milling operations in hard metals, cylindrical and surface grinding, electrical discharge machining and surface treatments and finishing. The manufacturers in India are utilising turning and turn mill centres, vertical, horizontal and five axis CNCs to produce thin walls, tight tolerances and intersecting intricate features.

3.1.3 Forging and sheet metal work

Capability of Indian companies in the field of forging and sheet metal work has been recognised globally for its high quality. India has the capability to forge variety of raw materials like Carbon steel, alloy steel, stainless steel, super alloy, Titanium and Aluminium. Indian manufacturers have forging capabilities in hot closed dies, open dies, cold closed dies, ring rolling, CNC and VMC machining, gear finishing (hobbing, shaping, shaving, broaching), robotic welding, heat treatment, ED painting, tool designing and development.

3.1.4 Special processes for aerospace components

Special processes for aerospace components include procedures that alter or change the mechanical, chemical or physical parts of products within the operation or process. They involve a variety of processes, some of which are listed below:

- Cadmium and Zinc Nickel Plating
- Non-Destructive Test
- Chromic Acid Anodizing
- Adhesive Bonding
- Passivation
- Tartaric Sulfuric Acid Anodizing



7. DDP dashboard, Ministry of Defence, March 2020

8. Trends in international arms transfer, 2019, SIPRI, March 2020

9. Press Information Bureau, Government of India, Ministry of Defence, March 2020

10. Defence Exports, DDP Dashboard, MoD, 2020

3.1.5 Shipbuilding

Shipbuilding in India, particularly Defence Shipbuilding, has come a long way since its fledgling years, when it began in 1950s. Like in many warships in services, MSMEs have played a key role in indigenising and retrofitting many marine grade military components during repair, refit and Mid Life Upgrades (MLU). Some of the thrust areas wherein MSMEs in the manufacturing sector have played and will continue to play a major role include manufacture of shipboard pipe fittings, valves, electrical switches, panels and fittings, components of motors and pumps, insulating material and rubber components. In the service sector, MSMEs in the sub-contracting vendor base of yards have played a key role in pane level hull fabrication/repair, hull outfitting work, painting work, piping and cabling layouts, accommodation space outfitting, installation/repair/overhaul of engineering and electrical equipment etc.

3.1.6 Upcoming Defence Corridors

The GoI has initiated the process of the creation of two defence industrial corridors in the states of Uttar Pradesh (UPDIC) and Tamil Nadu (TNDIC). These corridors would consist of clusters of industries working in tandem to manufacture defence components and would also have establishments dedicated for research and development. The proposed capabilities include:

- Establishment of defence testing facilities across the nodes by the MoD through the DTIS scheme; for e.g., upcoming UAV testing facility in the Tamil Nadu Defence Industrial Corridor (TNDIC)
- 3D printing (additive manufacturing), machining, precision manufacturing, prototyping to come up across the nodes.
- Centres for Excellence to be created in association with DRDO and the IITs in the corridor, to bring academic research for the industry¹¹.
- Creation of Aerospace and Defence parks and Incubation centres for the growth of the industrial start-up ecosystem.
- Common Facility Centres (CFCs) to come up in partnership with global OEMs and Indian primes, to handhold the MSMEs enhancing manufacturing capabilities.
- Skill development centres to come up to equip the workforce for the required skills of the sector.



11. KPMG in India analysis, 2020

3.2. Defence platforms currently exported

India currently exports a variety of platforms/equipments and systems to countries with friendly relations. The exhaustive list of these platforms along with their description has been listed by DDP and has been reproduced below¹².

3.2.1 Land Systems

Sr. No.	Export Item	Description
1	Akash	An area defence system for defending vulnerable areas/ points against penetrating targets at low, medium and high altitudes. The system can engage multiple targets simultaneously.
2	BRAHMOS	A supersonic cruise missile which can be fired from various platforms under stringent launch conditions. BRAHMOS missile has identical configuration for land, sea, sub-sea and air platforms.
3	Milan – 2T	A man portable (infantry) second generation ATGM, with tandem war head to destroy tanks fitted with Explosive Reactive Armor for both moving and stationary targets.
4	Dhanush	Artillery gun system equipped with INS based sighting system, auto laying system and on-board ballistic computation and day/ night direct firing system. Can be deployed in mountainous terrain and deserts.
5	Advanced Towed Artillery Gun System	A 155 mm/52 calibre artillery system developed by ARDE (DRDO) to sustain high pressure.
6	K9 Vajra – T	An artillery gun system equipped with longer firing range and can be positioned in both severely cold areas as well as in desert terrain.
7	Bharat T-52	A long-range 155 mm/52 calibre towed gun, equipped with maneuverable field artillery solution. It has a self-suspension arrangement which is achieved by using walking beam system.
8	Upgraded L-70 gun	L-70 Gun Upgrade consists of the developments in electrical servo drives, electro-optical Fire Control System (FCS) and video tracking
9	Garuda 105	A light-weight field gun based on the 105 Indian Field Gun and incorporates soft recoil technology resulting in a lightweight and modular howitzer, integrable with many types of combat transportation. It also has shoot and scoot capability.
10	Zu-23 Upgrade	It converts the manually laid gun into an all-electric system with autonomous functionality. It enables effective engagement of aerial and ground targets, Incorporates the automatic target tracker and complies with the operating and storage temperatures, humidity, dust and rain protection requirements.
11	Upgraded Schilka Weapon System	An all weather self-propelled Air Defence Weapon System primarily designed to protect mobile formations against aircraft and helicopters. It consists of 3D planar Active phased-array solid state radar and electro-optical Fire Control System (FCS).
12	WhAP	A wheeled amphibious Infantry Combat Vehicle (ICV) jointly designed and developed by DRDO and VRDE. Its 8x8 under chassis driveline with double wish bone type independent hydro-pneumatic suspension provides mobility across all kinds of terrain – land and water.
13	Weapon Locating Radar (WLR)	It has been primarily designed to locate hostile guns, mortars and rockets.
14	Battle Field Surveillance Radar - Extended Range (BFSR-XR)	A man portable, battery powered Pulse Doppler Surveillance Radar capable of automatically detecting and displaying a diversity of moving targets. It is light weight and operates whole day under all weather conditions.
15	30 Low Level Light Weight Radar (Aslesha)	Aslesha is a ground-based S-Band 3D Low Level Light Weight Surveillance Radar for deployment in diverse terrains like plains, deserts, mountain tops and high-altitude regions. Aslesha detects and tracks heterogeneous air targets.

12. Export Booklet, Department of Defence Production, MoD (GoI), 2020

Sr. No.	Export Item	Description
16	Military vehicles	Vehicles for defence in light, medium and heavy-duty segments. Indian manufacturers provide different power packs for Armored fighting vehicles and self-propelled guns, power pack for different uses. These vehicles are used for a variety of applications apart from normal load carrier to ambulance, recovery, firefighting, refrigerated lorry, fuel and water bowsers, rocket launcher, radars, missile.
17	Mine Protected Vehicle (MPV)	MPVs can carry upto a dozen fully armed personnel and have a provision for gun sights in bullet proof glass from where troops can take on targets outside. MPVs can move cross-country across most terrain even while taking fire and hitting back at terrorists.
18	Pinaka Multi-Barrel Rocket Launcher (MBRL)	A high-tech, all weather, long-range, area fire artillery system built on an 8 x 8 chassis with high cross-country mobility. It is fitted with electro-mechanical outriggers with an auto levelling feature to stabilise the launcher during launch.
19	Sarvatra bridge system	An optimally designed scissor launch system with hydraulic system that provides multi span capability.
20	Pontoon Bridge System	The bridge has a maximum load carrying capacity of 60 tonnes and can transport military vehicles over water obstacles and marshy grounds.
21	Communication Integrated Electronic Warfare System	An Integrated Electronic Warfare system operating in HF and VUHF band.
22	Ground-Based Mobile ELINT System (GBMES)	The System is capable of detection, monitoring, location fixing, complete analysis of RF signals in the frequency range of 70 MHz to 40 GHz.
23	155-mm HE-ERFB BT	Rapid and accurate firing at long ranges to attack the ground targets..
24	Instavest G6	Instavest offers protection from handgun ammunition, RCC 's and FSP's at improved energy absorption and dissipation levels.
25	Advanced Combat Helmets	Boltless combat helmets are manufactured using special trauma reduction technology.
26	Ballistic Shields	Handheld and trolley mounted ballistic shields with large view ports and transparent armor offer coverage during counterterrorism, insurgency and riot control operations.
27	Ballistic Protection	<ul style="list-style-type: none"> Advanced Ceramic B4C (CaraSTOP) Plates Tiles for Light Weight Armour. Personal Ballistic Protection.
28	High Energy Materials and Multi Mode Hand Grenade	Multi-Mode hand grenade offers advantages over conventional grenade in terms of safety, dual mode capability and lethality.
29	CMDS (Counter Measure Dispensing System)	Chaff and Flare Dispensing System, CMDS is a micro controller based airborne defensive system. It can be activated either by pilot or RWR.
30	Handheld/Helmet Mounted Night Vision Devices	An uncooled thermal sight which can view through dust, smoke, fog, haze and other battlefield obscurants.



3.2.2 Naval Systems

Sr. No.	Export Item	Description
1	Anti-Submarine Warfare Corvette (ASWC)	A frontline warship with stealth features. Advanced heat signature management techniques such as IRSS device has been installed for infrared signature.
2	Offshore Patrol Vessel	Equipped with weapons and sensors viz Bofors anti-aircraft gun, Racal Decca 2459 search radar and BEL 1245 navigation radar.
3	Advanced Offshore Patrol Vessel (AOPV)	Designed for patrolling and policing maritime zones, search and rescue, pollution control, external firefighting and embarkation and operation of ALH for long-range all-time search and surveillance.
4	Fast Patrol Vessels	Designed for patrolling, anti-smuggling and anti-terrorist operations, it can also support the Navy during wartime as a coastal convoy escort and as a communication link.
5	High speed Patrol Boat	A day/night surveillance and investigation vessel operating in shallow coastal waters in and around harbour and anchorage.
6	Fast Interceptor Boat (FIB)	Designed for roles including anti-smuggling, anti-infiltration, fisheries, patrol and immigration and anti-terrorism activities.
7	Inshore Patrol Vessel (IPV)	Designed and developed for coastal patrolling, anti-smuggling, search and rescue operations, fisheries protection, monitoring, and providing communication links.
8	Landing Craft Utility (LCU)	These are deployed to transport troops and equipment from ship to shore and vice versa.
9	Voith Tug	Designed and developed for towing and assisting naval ships, submarines and crafts in harbour and restricted water.
10	Torpedo Advanced Light (TAL)	An underwater weapon with homing and guidance technique including proportional navigation, pure pursuit and interception.
11	Heavy Weight Torpedo (VARUNASTRA)	A ship launched weapon. It weighs around 1.60 tonne and carries about 250 kg of explosives at a speed of 38 nautical miles per hour.
12	Submarine Fired Decoy	It acts as a preferred target in presence of own submarine to a passive or active homing torpedo
13	CRN 91 Naval Gun	A modular weapon intended for use against armoured targets and air targets flying at low altitudes.



Sr. No.	Export Item	Description
14	Kavach MOD – II Chaff Rocket Launcher	Designed to counter the threat of various anti-ship missiles by using chaff decoys.
15	ASW Rocket Launcher	The ship-based anti-submarine weapon system is capable of firing 212 mm depth charge rockets at submerged targets, in single and salvo mode, from remote as well as local control stations.
16	Torpedo Launchers	The torpedo launchers have triple tube configuration and are installed on P16A class ships of the Navy. The heavyweight torpedo launchers have twin-tube configuration and are installed on P15A and P28 class ships.
17	WM-18 Rocket Launcher	This weapon system designed for beach-clearing by LST class of ships before executing amphibious operations.
18	53,000 DWT Bulker	Designed and developed for carriage of 53,000 Dwt bulk cargo materials, vessel is accommodated with five cargo holds and equipped with heavy cranes for loading and unloading cargo.
19	Floating Dock	Designed for operation alongside a jetty or with a mooring system, it is capable of meeting requirements for repairs of warships and submarines.
20	Advanced Composite Communication System (ACCS)	Designed to provide communication over VLF/MF/HF and V/UHF bands on board Naval Ships and Submarines for facilitating ship-to-ship, ship-to-shore and Ship-to-Air communication.
21	Coastal Surveillance System	The Surveillance System comprises of a network of radars with a centrally located Control Centre and Communication System for data and voice connectivity between Radar Stations and control Centre.
22	Combat Management System (CMS)	Automates tactical data handling from the ship's sensors and provides a decision support system to the command.
23	Electro Optical Fire Control System - Upgrade 2 (EOFCS-U2)	A compact, 2 axes stabilized, high performance system for control of short and medium range naval gun mounts. It has capability of panoramic detection, identification and gun engagement of all types of surface and air targets.



3.2.3 Air Systems

Sr. No.	Export Item	Description
1	Light Combat Aircraft (LCA) Tejas	Tejas is a 4th generation single engine fighter jet with technologies such as relaxed static-stability, fly-by-wire flight control, advanced glass cockpit, integrated digital avionics systems and advanced composite materials for the air frame.
2	Light Combat Helicopter (LCH)	A twin-engine, dedicated combat helicopter of 5.8 tonne class. This helicopter has a narrow fuselage and a tandem configuration for Pilot and Co pilot/ Weapon System Operator (WSO).
3	Advanced Light Helicopter (ALH) Dhruv	A 5.5 tonne class category helicopter with side by side cockpit configuration, built to FAR 29 specifications.
4	Cheetal Helicopter	A single-engine, multi mission helicopter in 2-tonne class and controlled by Fully Authority Digital Electronic Control (FADEC) system.
5	Dornier (Do-228)	A light transport aircraft developed specifically to meet the requirements of utility and commuter transport, third level services and air-taxi operations, coast guard duties and maritime surveillance.
6	Brake Parachute For SU-30 A/C	The brake parachute is intended to reduce the Aircraft landing run length or aborted takeoff.



3.2.4 Communication Systems

Sr. No.	Export Item	Description
1	Secure VHF Handheld Radio LVP 341	A VHF handheld radio with in-built digital secrecy and interface provided for Headgear and Crypto key loading.
2	Secure UHF Handheld Radio LUP 291	A UHF handheld radio with in-built digital secrecy and interface provided for Headgear and Crypto key loading.
3	Software Defined Handheld Radio	Developed to meet the required short-range ground to ground, ground to ship and ship to ship communication needs with protection against Electronic Counter Measures (ECM).
4	HF Transceiver LHP 265	An DSP based lightweight 20W HF SSB manpack radio. It provides a complete solution to the short-range communication requirements in the crowded HF band.
5	VHF FF Transceiver	A fixed frequency radio in the frequency band of 30MHz to 87.975MHz.
6	Vehicle Based Satcom For Disaster Management	The portable HSPA mobile BTS is required to establish mobile communications, in remote locations, where the overall WCDMA network does not provide local coverage.
7	CB/LB Field Telephone PTRIOOO+	A 2-wire analogue field telephone for voice communication.
8	Weapon Sights for Target Observation and Aiming	A combined device for the Commander of an armoured vehicle or tank for day/night surveillance of targets, terrain and vehicles during battle situations.
9	Multiband Cellular and BWA Jammer	A portable multi-band RCIED barrage sweep jammer, covering cell phone bands and BWA band. The shielding frequency range covers almost all cell phone bands, including GSM, CDMA, DCS, 3G and also the broadband wireless access (BWA) band, upto 2.5 GHz.
10	VHF Base Station LVM 342	The Secure VHF Base station radio LVM 342 is useful for ground communication at the platoon level.
11	V/UHF AM/FM Transceiver LUP 329	It meets the required long range ground to ground, and ground to air communication needs with protection against Electronic Counter Measures (ECM).
12	Software Defined Radio Manpack	A compact V/UHF band radio designed to provide fast, reliable and secure LOS voice, data and video communication

Other Systems

Sr. No.	Export Item	Description
1	Combat Training Centre (CTC)	A training infrastructure solution for defence, security, paramilitary and the Police forces. It consists of simulators and live training solutions to enable coordinated team training under various realistic threat scenarios.
2	Titanium Alloys	Titanium alloys find use application in the aerospace, chemical, petrochemical, marine, paper pulp, textile, food and dairy industries
3	Special Purpose Steels	The special steels have improved mechanical properties and better workability which are essential for special applications in aerospace, power generation, nuclear, defence, cryogenic and other general engineering industries.
4	Non-Pressure Bearing Parts of Small Arms	Complex-shaped metal parts manufactured by Metal Injection Moulding, as per customer drawings
5	Airframe Structures and Engineered Products	Highly engineered products, airframe structures for Aircraft

4. Collaboration with Brazil

4.1 India – Brazil relationship

India and Brazil share a close and multifaceted relationship at bilateral level as well as in plurilateral fora such as BRICS, BASIC, G-20, G-4, IBSA, International Solar Alliance, Biofuture Platform and in the larger multilateral bodies such as the UN, WTO, UNESCO and WIPO. The bilateral strategic partnership, has opened a new phase for India-Brazil relations since 2006, which is based on a common global vision, shared democratic values, and a commitment to foster economic growth with social inclusion for the welfare of the people of both countries. Brazil is one of the most important trading partners of India in the entire LAC (Latin America and Caribbean) region. India-Brazil bilateral trade has increased substantially in the last 02 decades. In 2019, the total bilateral trade was USD 07.02 billion and India was Brazil's 7th largest import source country, and 18th largest export destination.

India and Brazil signed an agreement in 2003 for cooperation in defence. The agreement calls for cooperation in defence related matters, especially in the field of Research and Development (R&D), acquisition and logistics support, military training and exercises between the countries. Subsequently, a defence wing has been established in the Embassy of India, Brasilia on 24 December 2007 and Brazil opened its defence wing in the Embassy of Brazil, New Delhi on 14 April 2009. Joint Defence Committee (JDC) meetings are held as an institutionalised mechanism for defence cooperation. 06 JDC meetings have taken place so far between where the 6th JDC meeting was held in February 2019 in Brasilia. During the state visit of President Bolsonaro to India (24-27 January 2020), PM Modi and President Bolsonaro reiterated the importance of broad-based bilateral defence cooperation in enhancing the strategic partnership. An event focused on defence industries took place on 27 January 2020 in New Delhi. A high-level delegation from Brazilian defence industry had also participated in the DEFEXPO 2020 in Lucknow, India. Brazil has also participated in Indian Technical and Economic Cooperation Programme (ITEC) where about 60 Brazilians have come to India under ITEC programme for training in communications, management, defence etc. in the last eight years.

Naval cooperation has also been strong between Brazil and India and is epitomised by the India-Brazil-South Africa Maritime (IBSAMAR) naval exercise between the navies of India, Brazil, South Africa. Initiated in 2008, the scope and complexity of IBSAMAR has increased steadily in the 06 editions till date and IBSAMAR has matured into a complex trilateral exercise involving participation of ships, aircraft and special forces from Brazil, India and South Africa.

Map image is for representative purpose only

4.2. Brazil defence industry

Brazil has a vibrant defence manufacturing industry and achieving self sufficiency in defence production has been a constant feature of Brazil's defence policy for decades. Brazil currently ranks 11th globally in terms of defence expenditure. The Brazilian Defense Industrial Base (DIB) achieved a significant share of world defence exports in the mid-1970s and early 1990s. Brazil was the 24th biggest exporter of major conventional weapons between 2008-2017 selling weapons to 21 countries, with no individual recipient predominating. The Brazillian government has taken several measures to revitalise the DIB with legislation as well as acquisition programs.

Brazil was the 35th biggest importers of major conventional weapons between 2009-2018. Its main suppliers were Germany (34%), the USA (22%), and the UK and Russia (10% each). France and Israel were also significant suppliers, at 8.7% and 6.6% respectively.

Brazil's acquisition programs have been consistent on local production of platforms. This has also been facilitated by strong capability that exists in the DIB Examples of such acquisitions are as follows:-

- Brazil ordered 04 Scorpene submarines and 01 SNBR nuclear submarine from French state shipbuilder Naval Group in 2009 for €6.8 billion, where most of the construction to take place in Brazil.
- Brazil has also bought a total of 48 EC725 Super Cougar helicopters from Airbus France, for €1.9 billion in two contracts in 2009 and 2012. Deliveries are ongoing for the helicopters, which are produced locally by Brazilian Airbus subsidiary Helibras.
- Swedish company Saab signed a \$5.8 billion deal in 2015 to sell 36 JAS-Gripen-E/F combat aircraft to Brazil, with much of the production to take place locally, along with major technology transfer.

4.3. Brazil defence acquisition plans and synergies with India

The Brazillian government has been pushing for increased spending on R&D and Transfer of Technology (ToT) to revitalize the defence manufacturing industry and the armed forces to maintain a technological superiority in the region.

In the PEM 2040, the navy wants to significantly increase R&D to develop shipboard systems, such as communications, detection, navigation, and electronic warfare. The navy also wants to achieve a minimum of 65% of ships and aircraft operational availability, update the service's leadership organisational structure, create a cyber-warfare squadron, and bolster its satellite ability to intercept maritime communications, according to the plan

The modernisation program also includes previously planned or initiated but not yet effectively implemented or concluded platforms such as

- Mine-hunting ships.
- Escort ships.
- Aircraft carriers.
- Logistics support ship.
- Coastal, and offshore patrol vessels.
- Antarctic support ship.
- Training ships.
- Survey ships.
- Unmanned Aerial Vehicles (UAVs).
- Fighter jets.
- Lightweight training and utility helicopters.

The militaries of India and Brazil share growing number of common platforms, increasing the opportunities for joint training and interoperability and MRO services. India extensively uses the E-145 platform from Embraer for its Airborne Early Warning and Control (AEW&C) aircraft. The acquisition of diesel submarines from France by both India and Brazil offers opportunities for long-term technical collaboration between the three countries in that domain.

India has also been successful in developing key capabilities in shipbuilding, missiles, aircraft and helicopters as well as several land platforms such as artillery guns.

4.4. Benefits of collaboration with India

Brazil has laid down the importance of a defence industry to support sovereign capabilities, cost effective and optimised equipment and system, economic benefit derived from the defence expenditure and maintain an essential level of strategic independence. India shares a similar understanding and has been the basis of several programs to create indigenous capabilities in defence manufacturing. Brazilian defence manufacturers and research and development organisations can realise several advantages by collaborating with Indian manufacturers. Some of the key advantages are as follows

4.4.1 Low-cost manufacturing

India has one of the most competitive wage rates in the world for high skilled labour as well as abundant availability of skilled labour. India's average daily wage rate in manufacturing is projected to trend around INR 480 (USD 6.5) per day. India has a over 6000 technical and engineering institutes in India with over 2.5 million students enrolling each year in these institutes.

Leveraging this talent pool and low-cost manufacturing, India has developed key capabilities in precision machining and assembly, ship building, composite components, electronics assembly, special processes as well as special materials such as titanium alloys

4.4.2 Export financing and line of credit

Indian government has extended line of credit facility available in Ministry of External Affairs suitably to promote defence exports from India on a case-to-case basis. It is also exploring wherever feasible, the possibilities for financing of defence exports from India through EXIM Bank. Similarly, Buyer's Credit facility of Department of Commerce would also be leveraged and a separate strategy to finance the exports to friendly countries as well as economically weaker countries would be worked out in consultation with MEA, EXIM Bank, DPSUs, private sector and other financial institutions.

4.4.3 Favourable regulatory environment

The world over, defence exports are covered by the defence diplomacy between friendly countries. This also contributes to building local operational capabilities and, therefore, also enhances collaborations and joint operations between the forces of both the countries, especially during UN peacekeeping missions. The Indian government will facilitate wider engagement with public and private sector manufacturers as well as their joint ventures in bilateral discussions between the two countries. This will help the industry of the procuring country due comfort while importing from India. This will be facilitated by Indian Embassy and missions in Brazil through its Defence Attaché (DA).

The militaries of India and Brazil share growing number of common platforms, increasing the opportunities for joint training and Industry bodies such as Society of Indian Defence Manufacturers (SIDM)) also helps in organising and initiating foreign delegations, identifying defence cooperation opportunities, establishing joint ventures and identifying suppliers and manufacturers of specific defence platforms and systems. Indian government has made several regulatory changes to ease manufacturing and export of components and platforms for defence application.

The government of India is also in the process of establishing Defence Exports Steering Committee (DESC) under the Chairmanship of Secretary, Department of Defence Production. The functions of this Committee would include consideration and taking decisions on cases of export permissions particularly export of indigenously developed sensitive defence equipment.



5. Way forward

The Indian aerospace and defence ecosystem are emerging as a preferred manufacturing and sourcing hub with development of indigenous platforms and capabilities at par with global platforms. The defence manufacturers in Brazil can leverage these emerging capabilities to realise the twin objective of cost and quality and fulfil the requirement of Brazilian defence forces as well as their global customers. Companies take one of the approaches to realise this.

5.1 Joint Ventures (JVs) and partnerships

This has been one of the preferred routes by the leading companies in the A&D sector. The JV route assures the commitment from both the sides where established defence manufacturing companies in both the countries bring in their brand, reputation and technical know-how and augment them with skilled manpower, land and facilities and local government relationships. This mode of engagement is expected to get further fillip with the recent easing of foreign direct investment limit to 74% from existing 49% through automatic route. This will elevate any IP related concerns that the OEM might have.

5.2 Procurement of systems and components

Several leading defence manufacturers globally have already leveraged this approach to source components and systems from India for their global clients and this has been a very important growth area for Indian companies. Indian companies have been able to bag prestigious contracts with OEMs and integrators as their suppliers.

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5.4 Joint development of defence platforms and systems

Brazilian OEMs and Tier-1s can bring their expertise and collaborate with Indian research organisations and manufacturers to jointly develop advanced platforms that both the countries might be independently working on. This will help reduce the development cost and create platforms that are effective in wider range of scenarios and terrains. These platforms will not only meet the requirement of the parent countries but can be exported jointly to friendly countries.



List of abbreviations

Abbreviation	Expansion
AAP	Annual Acquisition Plan
AI	Artificial intelligence
ALH	Advanced light helicopter
ARDE	Armament Research and Development Establishment
ASW	Anti submarine warfare
ATGM	Anti-tank guided missile
ATP	Acceptance Testing Procedure
BDL	Bharat Dynamics Limited
BEL	Bharat Electronics Limited
BEML	Bharat Earth Movers Limited
BFSR	Battle field surveillance radar
CAGR	Compound annual growth rate
CDS	Chief of Defence Staff
CEMILAC	Center for Military Airworthiness and Certification
CFC	Common facilities centre CDS
CDS	Chief of Defence Staff
CNC	Computer numerical control
CTC	Combat training centre
DA	Defence Attaché
DAP	Defence acquisition procedure
DDP	Department of Defence Production
DESC	Defence Exports Steering Committee
DESW	Department of Ex-Servicemen Welfare
DGAQA	Director General of Aeronautical Quality Assurance
DIC	Defence Investor Cell
DIPP	Department of Industrial Policy and Promotion
DPEPP	Defence production and export promotion policy
DPP	Defence procurement procedure
DPIIT	Department for Promotion of Industry and Internal Trade
DPSU	Defence public sector undertaking
DRDO	Defence Research and Development Organization
DTIS	Defence Testing Infrastructure Scheme
ELINT	Electronic intelligence
EoDB	Ease of Doing Business
EOFC	electro-optical re control system
EW	Electronic warfare
EXIM	Export import
FADEC	Fully Authority Digital Electronic Control
FCS	Fire control system
FDI	Foreign direct investment
FY	Financial year
GBMES	Ground based mobile ELINT system
GRSE	Garden Reach Shipbuilders & Engineers Limited
GSL	Goa Shipyard Limited

List of abbreviations

Abbreviation	Expansion
GSQR	General staff qualitative requirements
HAL	Hindustan Aeronautics Limited
HSL	Hindustan Shipyard Limited
IC	Indigenous content
ICV	Infantry combat vehicle
IIT	Indian Institute of Technology
IBSAMAR	IIBSA Maritime Exercise
INS	Indian naval ship
IOP	Indian offset partner
IP	Intellectual property
IRSS	Infrared signature suppression
ISRO	Indian Space Research Organisation
ITAR	International traffic in arms regulation
IBSA	India Brazil Brazil
JV	Joint venture
LCA	Light combat aircraft
LCH	Light combat helicopter
LOS	Line of sight
LTIPP	Long Term Integrated Perspective Plan
TNDIC	Tamil Nadu Defence Industrial Corridor
TRL	Technology readiness level
UAV	Unmanned aerial vehicles
UHF	Ultra high frequency
UN	United Nations
UPDIC	Uttar Pradesh Defence Industrial Corridor
VHF	Very high frequency
VLF	Very low frequency
VRDE	Vehicle Research and Development Establishment
TNDIC	Tamil Nadu Defence Industrial Corridor

About SIDM

The Society of Indian Defence Manufacturers (SIDM) is a not-for-profit association formed to be the apex body of the Indian defence industry. SIDM plays a proactive role as an advocate, catalyst, and facilitator for the growth and capability building of the defence industry in India.

SIDM's vision is to catalyse the Indian defence industry to effectively contribute to India's national security and become a trustworthy global partner. Its mission is to work closely with the Government towards enabling the growth of the defence industry and collaborate with experts from the Armed forces, Academia and Defence industry to optimize the industry's development capabilities. SIDM's values are India First; One Voice and Self-Reliant for Security.

SIDM facilitates the growth of defence industry in India through policy advocacy support to the Government, conduct of events which provide a common platform for interaction with three Armed Forces, DRDO, Ministry of Defence, Paramilitary Forces and, also, OEMs and other industry players, Defence & Aerospace Consultancy Services (DACs), conduct of Defence Acquisition Management Training Programme, provision of a platform for business to business connections and serving as a bridge between the industry, the Armed forces and the government.

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