BALANCING MAKE IN INDIA: AEROSPACE SECTOR

RAJIV KUMAR NARANG

India and Russia signed 16 agreements, including a deal worth $1 billion to build 200 KA-226 Light Utility Helicopters (LUH) in India during the 16th India-Russia Annual Summit at Moscow on December 23, 2015[1]. These helicopters would be manufactured in India in collaboration with the public sector unit, Hindustan Aeronautics Limited (HAL). The KA-226 will be the first 'Make in India' aviation project, which is being undertaken in collaboration with one of India's trusted partners, Russia. 'Make in India' received a boost for the private sector when Reliance Defence signed a deal worth $6 billion with the Russian company Almaz-Antey, which builds air defence systems, to establish manufacture and maintenance facilities in India on the sidelines of the summit meet.[2] These defence deals are likely to improve India's capability in manufacturing and Maintenance, Repair and Overhaul (MRO) of defence equipment. In another deal, India signed an agreement to procure 36 Rafale fighter planes during the French president's visit to India in January 2016, whose the financial aspects are still being

Group Captain **Rajiv Kumar Narang** is a Senior Fellow at the Centre for Air Power Studies, New Delhi.

1. Manu Pubby, "India and Russia to Jointly Manufacture Kamov 226 Helicopter Under 'Make In India'", December 24, 2015, http://economictimes.indiatimes.com/news/defence/india-and-russia-to-jointly-manufacture-kamov-226-helicopter-under-make-in-india/articleshow/50316231.cms. Accessed on December 27, 2015
2. "Reliance Defence Signs $6 Billion Pact with Russian Arms Firm as Modi Visits Moscow", December 24, 2015, http://www.firstpost.com/business/reliance-defence-signs-6-billion-pact-with-russian-arms-firm-as-modi-visits-moscow-2558678.html. Accessed on December 27, 2015.

The joint ventures in design, development and manufacturing have many advantages and are necessary for the growth of the indigenous aerospace manufacturing industry.

worked out.[3]

A closer look at the history of India's indigenous aircraft projects indicates that such deals in the past had resulted in shelving of indigenous projects, thereby, further increasing our dependence on import from foreign suppliers. The gains made in the process of development of indigenous designs till then were lost due to the shelving of indigenous projects. India has been taking one step forward and two steps back in indigenous aerospace manufacturing. The joint ventures in design, development and manufacturing have many advantages and are necessary for the growth of the indigenous aerospace manufacturing industry. However, even joint ventures can fill technological gaps but do not become replacements for indigenous equipment. As a result, dependence on imports has not reduced. Therefore, there is a need for us to step back and ask ourselves a few questions if we want to get the most out of these deals. Will the deals result in shelving of indigenous aircraft being built by HAL? Could we have gone for collaboration to make indigenous aircraft a success? What is the plan for using technological gains made during the process of developing indigenous aircraft? Will the KA-226 deal bring adequate Transfer of Technology (TOT) to achieve self-sufficiency in the long run? Will it help in improving indigenous manufacturing capabilities?

The present government wants to push 'Make in India' as well as 'indigenisation', therefore, there is a need to study the impact of these deals on these two key campaigns. What will be the impact of the deals on the Indian defence minister's ambitious target of 50 percent indigenisation by 2017 and 60-70 percent in the next five years.[4] Therefore, the paper would

3. Manu Pubby, "Rafale Deal in Last Lap, may Cost Rs 60,000 Crore for 36 Fighters", January 13, 2016, http://economictimes.indiatimes.com/news/defence/rafale-deal-in-last-lap-may-cost-rs-60000-crore-for-36-fighters/articleshow/50553762.cms. Accessed on January 29, 2016.
4. http://economictimes.indiatimes.com/news/defence/2015-a-year-when-defence-manufacturing-got-a-fillip/articleshow/50365588.cms. Accessed on December 30, 2015.

look into KA-226 deal, the LUH programme of HAL, imports, and the impact, strengths and limitations of Joint Ventures (JV), indigenisation challenges, and the need for balancing 'Make in India' to make it an engine of growth and an enabler in aerospace manufacturing.

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INDIGENOUS LUH

The delays in the signing of the LUH contract with foreign vendors and the proposal by HAL had led to the birth of the indigenous LUH programme. The Indian government sanctioned the development of a three-ton weight category LUH by HAL in February 2009 with an estimated development timeframe of six years to replace the ageing Chetak/ Cheetah helicopter fleet of the armed forces.[5] HAL had displayed its naval variant of the LUH with foldable rotors in Aero India-2015.[6] The Initial Operational Clearance of LUH was scheduled in 2017 prior to commencing serial production in 2018.[7] HAL had earlier signed a contract with Turbomeca in June 2015 for a JV on an MRO facility for the Shakti and Turbomeca TM 333 turbo shaft engines for the Dhruv Advanced Light Helicopter (ALH) and Light Combat Helicopter (LCH) in India.[8] HAL had planned to integrate the Shakti engine into the LUH. The modification of the twin engines to a single engine configuration for the LUH entails designing of a new gear box and certification by the European Aviation Safety Agency (EASA). Safran demanded Rs 190 crore for modification and

5. "LUH", http://www.hal-india.com/Product_Details.aspx?Mkey=54&lKey=&CKey=64, December 28, 2015
6. "Navy Cold on Joining HAL's Light Utility Helicopter (LUH) Program?", August 1, 2015, http://idrw.org/navy-cold-on-joining-hals-light-utility-helicopter-luh-program/. Accessed on December 28, 2015.
7. Rahul Bedi, "HAL Pushing for LUH First Flight in December", September 9, 2015, http://www.janes.com/article/54146/hal-pushing-for-luh-first-flight-in-december. Accessed on December 28, 2015
8. Ajai Shukla, "HAL-Turbomeca Sign JV in Paris for Rs 200 Crore MRO Facility for Helicopter Engines", June 18, 2015, http://www.business-standard.com/article/economy-policy/hal-turbomeca-sign-jv-in-paris-for-rs-200-crore-mro-facility-for-helicopter-engines-115061800028_1.html. Accessed on December 28, 2015.

certification of the Shakti engine for the single engine LUH.[9] This forced HAL to talk to other engine manufacturers like Rolls Royce, Honeywell, Pratt & Whitney and General Electric.[10] This stalemate resulted in uncertainty over the timelines of the LUH project, which probably played some role in the signing of the KA-226 deal.

KA-226 DEAL

The KA-226 deal is a culmination of one and half decades of struggle of the armed forces for replacing the age old Cheetah and Chetak helicopters. The Request for Proposal (RFP) for the LUH was issued in 2003.[11] Since then, the LUH project has seen many ups and downs. The contract for procurement of the LUH from foreign vendors was cancelled for the second time in 2014.[12] Rostec Corporation (Rosoboron Exports and Russian Helicopters Company are part of Rostec) of Russia and HAL signed a deal on December 28, 2015, for the assembly of at least 200 helicopters in India with an option of supplying to a third country.[13] The signing of the KA-226 deal, however, happened only 12 years after the issuing of the RFP, indicating the huge delays involved in the procurement process and in meeting the needs of the armed forces.

The KA-226 deal is the first 'Make in India' deal in the aerospace sector under Prime Minister Narendra Modi's Make in India campaign. The KA-226 is equipped with two 580 hp Arrius 2G1 engines by Turbomeca, Safran of France.[14] HAL beat its rival, the Anil Ambani led Reliance Defence, a private

9. http://www.rediff.com/news/report/engine-snag-hits-hals-light-utility-helicopter/20100701.htm. Accessed on December 28, 2015.
10. "Hal Turns to other Engine Makers for Light Helicopter Project as Turbomeca Hikes Fee", http://www.defencenow.com/news/195/hal-turns-to-other-engine-makers-for-light-helicopter-project-as-turbomeca-hikes-fee.html. Accessed on January 29, 2016.
11. "India's Light Helicopter Contract Hits Turbulence, Stalls. Again, Starts", March 3, 2015, https://www.defenseindustrydaily.com/eurocopter-bell-battling-for-500600m-indian-army-contract-0725/. Accessed on December 29, 2015
120 Vivek Bhardwaj, "HAL Light Observation Helicopter (LOH)/Light Utility Helicopter (LUH)", *Indian Armed Forces*, August 2015, http://aermech.in/hal-light-observation-helicopterlohlight-utility-helicopter-luhindian-armed-forces/. Accessed on December 28, 2015.
13. "The Russian Ka-226 Helicopters Assembled in India", December 28, 2015, http://mundo.sputniknews.com/industriamilitar/20151228/1055303794/rusia-india-helicopteros.html. Accessed on December 30, 2015.
14. http://www.russianhelicopters.aero/en/helicopters/civil/ka-226t.html. Accessed on December 29, 2016.

sector entity and became the Indian partner for manufacture in India. HAL is setting up a complex in Bidarhalli Kaval village (Gubbi taluk) in Tumakuru district of Karnataka for manufacturing the helicopters. The complex will help increase the helicopter production capacity of HAL.[15] HAL is likely to act as an integrator of various components of the KA-226 helicopters. The deal provides a short to medium term solution in meeting the needs of the country albeit with only a marginal reduction in dependence on the supplier since it is unlikely that core technologies would be transferred by the Russian side. The terms of joint manufacture and extent of technology transfer could decide the possible sale of KA-226 helicopters in the civil sector and export to other countries in the future.

Impact: It is a coincidence that the French engine manufacturer Safran is the common connection between the KA-226 and India's indigenous LUH. The KA-226 is fitted with the Arrius 2G1 engine built by Safran and LUH was also planned to be fitted with the Shakti engine, which was being developed in collaboration with Safran of France before the differences emerged between HAL and Safran on the costing of modification and certification. The TOT in the licensed production of the KA-226 is likely to remain limited to assembly, maintenance, overhaul capabilities and it may be premature to assume that India would get access to the core technologies associated with the manufacture of the helicopter.

HAL has invested six years of Research and Development (R&D) in the development of the LUH. The deal may adversely impact the continuation of the indigenous LUH helicopter programme of HAL. HAL becoming the production partner for the KA-226 may not be a progressive step considering the fact that now HAL would get involved in the less important task of assembly of helicopters and move away from the capability building strategy of indigenisation thereby, adversely impacting India's interests in the long run.

15. Chethan Kumar, "Boost for HAL Chopper Complex Plan in Tumakuru, Cabinet Agrees to Clear Power Lines", October 1, 2015, http://timesofindia.indiatimes.com/india/Boost-for-HAL-chopper-complex-plan-in-Tumakuru-Cabinet-agrees-to-clear-power-lines/articleshow/49182942.cms. Accessed on December 29, 2015

IMPORTS

India imports about 70 percent of its defence equipment from foreign vendors, amounting to 15 percent of world arms imports.[16] Russia has been a trusted partner of India. India-Russia trade is worth around $10 billion and both countries are aiming to take it to $30 billion by 2025.[17] The balance of trade has been in favour of Russia in the past. India has been importing military aircraft while giving the assembly work to the state owned HAL. After the break-up of the Soviet Union, the Indian Air Force had faced spares shortages, poor serviceability and other maintenance issues with its Russian fleet. It, therefore, looked towards the West for supply of modern military equipment, with high serviceability and reliability.

The improved economic conditions and quest for weapons made India a lucrative market. The removal of sanctions and improvement in relations with the US had made it easier for India to acquire advanced defence equipment. The US overtook Russia in becoming the leading arms supplier to India in 2014[18] and India climbed the import chart in becoming the top arms importer of the world.[19] However, the acquisition of military aircraft from the US was without any technology transfer. These contracts also came with a rider of India signing the End User Monitoring Agreement (EUMA) with the US.[20] The signing of EUMA means that the US government/ supplier has the right to know where the equipment is being used. There are apprehensions that the US could leverage this clause for favourable dispensation in adverse circumstances.

Import deals with or without TOT are tricky. The 126 aircraft Medium Multi-

16. Sushant Singh, "SIPRI Data Shows India World's Biggest Arms Importer at Three Times of China", March 16, 2015. http://indianexpress.com/article/india/india-others/india-remains-worlds-biggest-arms-importer-sipri/. Accessed on January 04, 2015.
17. Pubby, n.1.
18. Shamil Shams, "How the New India-US Defense Deal Would Impact Regional Security:, June 2, 2015, http://www.dw.com/en/how-the-new-india-us-defense-deal-would-impact-regional-security/a-18492143. Accessed on January 01, 2016.
19. Saroj Bishoyi, "Onus on US to Boost Defence Ties with India", December 12, 2015, http://www.dailypioneer.com/columnists/oped/onus-on-us-to-boost-defence-ties-with-india.html. Accessed on December 27, 2015.
20. "US Pushes India to Ink Contentious Defence Pacts", February 27, 2015, http://timesofindia.indiatimes.com/india/US-pushes-India-to-ink-contentious-defence-pacts/articleshow/46389579.cms. Accessed on December 27, 2015.

Role Combat Aircraft (MMRCA) deal in which Rafale had emerged as L1 with $12 billion could have been a flawed deal since Dassault had kept several items out of the offer to keep the prices down. It was estimated that the procurement of this equipment would have taken the cost up to $24 billion for its operational life. In addition, Dassault refused to take the guarantee of 108 Rafale aircraft, which were to be built in India.[21] The revised agreement for the purchase of 36 Rafale fighter aircraft from France is likely to cost over Rs 60,000 crore (approximately $9 billion) amounting to Rs 1,666 crore for each aircraft with its operational equipment.[22] The cost of the Tejas as per the 2014 estimates was Rs 220 crore and even if the cost due to escalation and associated equipment is included, it would still be cheaper than any other foreign fighter aircraft of the same class[23] and is best suited to replace the depleting MiG-21 fleet.[24] The Indian Air Force (IAF) is planning to induct 100 Tejas aircraft, which would help it fill up the deficiency in its fighter aircraft squadron strength. The import of defence aircraft from foreign vendors is extremely expensive and limits the number of aircraft which can be bought from the taxpayers' money. The indigenous aircraft are cheaper and could be produced in greater numbers to provide self-reliance in defence aviation in the long run and must be persisted with.

Unfavourable Arms Trade Treaty (ATT): The ATT is a multilateral, legally binding arms export treaty, which was passed by the UN General Assembly on April 2, 2013, with a simple majority, with 154 in favour, 3 against (Korea, Iran and Syria) and 23 abstaining (including India, China, Russia and Pakistan). Of the 193 member states of the UN, there are 40 countries with major arms production capability and another 60 with small scale arms production capability. The treaty puts the onus on the states to control the sale of arms. The treaty can only become a law if a period of 90 days has passed after the ratification of the treaty by 50 countries. The

21. "International Relations: What is the Current Status of the India-France Rafale Deal?", https://www.quora.com/International-Relations-3/What-is-the-current-status-of-the-India-France-Rafale-deal. Accessed on January 31, 2016.
22. Pubby, n.3.
23. "Tejas Project to Cost Rs 55,000 Crore", February 13, 2014, http://timesofindia.indiatimes.com/india/Tejas-project-to-cost-Rs-55000-crore/articleshow/30307248.cms. Accessed on January 29, 2016.
24. C. Manmohan Reddy, "Affordable Air Power", April 17, 2014, http://www.thehindu.com/opinion/op-ed/affordable-air-power/article5919437.ece. Accessed on January 29, 2016.

The arms importing countries are susceptible to diplomatic and political pressures by the exporting countries. The import of arms may put restrictions on the independence of a nation's foreign policy and the conduct of its affairs.

treaty opened for signature on June 2, 2013 and came into force on December 23, 2014.[25]

The arms importing countries are susceptible to diplomatic and political pressures by the exporting countries. The import of arms may put restrictions on the independence of a nation's foreign policy and the conduct of its affairs. There are apprehensions that certain provisions of the ATT could be used as an excuse by the arms suppliers for favourable dispensations. The treaty could also be used as a pretext by the arms exporting countries to stop supply of arms.[26]

JOINT DEVELOPMENT: ADVANTAGES AND LIMITATIONS

India had signed an agreement worth $30 billion with Russia for co-development of the Fifth Generation Fighter Aircraft (FGFA) with a 50:50 joint venture in 2007 to produce 127 single-seat fighters in India.[27] However, the Russian designers were reluctant to involve Indian counterparts in the design and development process of the PAK-FA aircraft. Russia made a revised offer for TOT on the Sukhoi T-50 fighter aircraft (PAK-FA) and three prototypes at $3.6 billion, during Prime Minister Narendra Modi's visit to Russia in December 2015.[28] India did not gain much from the design and development phase of the PAK-FA project. It has again reached a situation, where the technology is developed by the Russian experts and then the

25. Press Contact: Daryl G. Kimball, Executive Director, 463-8270 x107, https://www.armscontrol.org/factsheets/arms_trade_treaty. Accessed on January 28, 2016.
26. Santanu Choudhury and Tom Wright, "India Fears U.N. May Block Arms Imports", April 12, 2013, http://blogs.wsj.com/indiarealtime/2013/04/12/india-fears-u-n-treaty-may-block-arms-imports/. Accessed on January 4, 2015.
27. "Russia Offers Cheaper Deal On PAK-FA Fighter To India", December 23, 2015, http://www.defenseworld.net/news/14916/Russia_Offers_Cheaper_Deal_On_PAK_FA_Fighter_To_India. Accessed on December 27, 2015.
28. Sushant Singh, "PM Modi's Russia Visit: New, Cheaper Deal on Sukhoi Fighter Planes", December 23, 2015, http://indianexpress.com/article/india/india-news-india/pm-modi-leaves-for-moscow-russia-offers-new-cheaper-deal-on-sukhoi-fighter-jets/. Accessed on January 2, 2015.

practical aspects of assembly, maintenance and overhaul of aircraft would be passed on to India.

The US has been reluctant to share advanced defence technologies and form joint ventures with Indian companies. It continues to insist that India sign the Logistics Support Agreement (LSA), Communication Interoperability and Security Memorandum (CISMOA) and Basic Exchange and Cooperation Agreement for Geo-Spatial Cooperation (BECA), on which India has reservations.[29] These agreements go against the fundamental principles of the independent policy being followed by India. The Defence Technology and Trade Initiative was created in 2012 on the direction of then Secretary of Defence Leon Panetta to provide increased US senior level oversight to overcome bureaucratic hurdles.[30] The intensive consultations and the renewal of the Indo-US Defence Framework Agreement in 2015 have raised hopes for greater cooperation in the defence manufacturing sector.[31] In the meantime, India and the US have agreed to pursue cooperation in aircraft carrier and jet engine projects. This is a promising start, but without any agreement of substance. However, cooperation in the defence manufacturing sector could provide the right beginning for the long-term partnership between the two largest democracies.

The Defence Technology and Trade Initiative was created in 2012 on the direction of then Secretary of Defence Leon Panetta to provide increased US senior level oversight to overcome bureaucratic hurdles.

The Swedish giant Saab has offered India TOT for the Gripen, developing aerospace capability, and has become a partner in developing the Light Combat Aircraft (LCA) Mk-II and Advanced Medium Combat Aircraft

29. "US Pushes India to Ink Contentious Defence Pacts", February 27, 2015, http://timesofindia.indiatimes.com/india/US-pushes-India-to-ink-contentious-defence-pacts/articleshow/46389579.cms. Accessed on December 27, 2015.
30. http://www.acq.osd.mil/ic/DTTI.html. Accessed on January 01, 2015.
31. Anjana Pasricha "India and US Sign Defense Cooperation Pact", June 4, 2015, http://www.voanews.com/content/india-and-us-sign-defense-cooperation-pact/2807023.html. Accessed on January 1, 2016.

(AMCA).[32] Saab has a reputation of maintaining a liberal policy in TOT. It won the contract to supply 36 Gripen aircraft to Brazil in 2013, beating the F-18, Super Hornet of the US and Rafale of France. Gripen is not new to the world of fighter aircraft since it is already in service with the UK, Czechoslovakia, South Africa, Hungary and Thailand. The main reason for Saab winning the contract in Brazil was its willingness to share the technology, easy financing, industrial cooperation and building 80 percent of spares locally.[33]

A joint venture or collaboration may be a necessity in areas where indigenous capability is lacking. However, the success of a joint venture is largely dependent on the bigger partner or the technology provider. The huge amount of money demanded by Safron, France, for modification of the Shakti engine for the LUH indicates the limitations of joint ventures, and dependence on the bigger partner. The failure of Russia to honour its commitment for joint development of the PAK-FA fighter aircraft indicates that it may be difficult to get core technologies through joint ventures. Therefore, it would be in India's interest to collaborate with companies which are ready to share technology and/ or set up .manufacturing units in India. Joint ventures or collaboration may complement indigenous capabilities but cannot completely replace them and, thus, indigenous projects must be progressed on the sidelines.

INDIGENISATION AND CHALLENGES

Prime Minister Narendra Modi was concerned that even teargas shells are imported by India.[34] He wants to change India's image from being the biggest arms importer to an arms manufacturer. There is a complex relationship between various stakeholders viz the government, manufacturers, R&D

32. "Saab Offers to Help India Develop AMCA in Lieu of Orders for Gripen Gen 5 Concept", December 20, 2015, http://idrw.org/saab-offers-to-help-india-develop-amca-in-lieu-of-orders-for-gripen-gen-5-concept/. Accessed on December 29, 2015.
33. "Saab Gets $4.5 Billion Contract From Brazil for 36 Fighter Jets", December 18, 2013, http://www.wsj.com/articles/SB10001424052702304866904579266332354721604. Accessed on December 29, 2015.
34. Anand Jayaram, "Namaste Singapore: 10 Highlights from Modi's Speech at Singapore Expo", November 24, 2015 |, http://indiatoday.intoday.in/story/namostesingapore-10-highlights-from-modis-speech-at-singapore-expo/1/530611.html. Accessed on January 31, 2016

agencies and users, which plays an important role in the indigenisation process. The government has played the role of a facilitator, which has not been enough to produce favourable results in this sector. India's endeavours in indigenisation of defence aircraft and equipment have achieved low to moderate success. The indigenisation process in India is not a synchronised activity and the challenges to indigenisation are many, which are discussed in the succeeding paragraphs.

Public Sector Units (PSUs), with huge infrastructure and government support, have a key role in the design, development and manufacture of critically important defence equipment. They would continue to be key players in developing niche technologies, which foreign suppliers would not like to part with, and sell to us at exorbitant costs. The reports of the Controller and Auditor General (CAG) and Controller General of Defence Accounts (CGDA) highlight the unilateral approach, and the lack of accountability of the R&D agencies and their inability to take users along.[35] There is a perception that these agencies work in isolation and keep users and sometimes even other R&D agencies out of the loop. There is a reluctance to hand over the manufacturing process to the private sector due to its commercial viability. The focus of the PSUs towards manufacturing limits their research and development capability in niche fields. Therefore, their involvement in assembly, repair and overhaul of military aircraft and other equipment, except the sensitive technologies, could be kept to the bare minimum and, if required, offloaded to the private sector.

The PSUs, despite criticism, have designed and developed some critical technologies like missiles, aircraft, tanks, unmanned aerial vehicles and other defence equipment. They are now working on another key aspect of aircraft development i.e. the jet engine, which is essential for achieving self-reliance in aviation. The difficulties faced in the development of the critically important Kaveri and Shakti engines, with the help of foreign entities, highlight the limitations of joint development. The high cost demanded by Safran for modification of the Shakti engine for the LUH

35. Lt Gen Prakash Katoch, "Defence Manufacturing and 'Make in India' – What will it Take?", May 17, 2015, http://www.niticentral.com/2015/05/17/arms-mafia-strikes-313630.html. Accessed on January 4, 2015.

forced HAL to work on indigenous development of the engine. It, therefore, came up with the indigenous HTSE (Hindustan Turbo Shaft Engine) 1200 in December 2015, which would power the ALH, LCH and LUH in the future.[36] India is also exploring the possibility of cooperation with leading engine manufacturers to develop engines through JVs to achieve self-reliance in engine technology. The PSUs would continue to be an essential part of the aerospace eco system of the country in developing critical and elusive technologies.

There is a feeling that the users have not been included during the formulation of the concept or the initial design and development phase by the R&D agencies. The development of aircraft is normally initiated by the R&D agencies independently and the armed forces normally join later as the users. The users are involved in testing and trials of aircraft, which are developed by development agencies like HAL and Defence Research and Development Organisation (DRDO). The lack of involvement of the users from the conception stage results in differences between the user expectations and the actual equipment produced by these organisations. However, the users are sometimes also criticised for placing unrealistic demands on the R&D agencies. A Reuters report dated April 8, 2015, cited unrealistic quality demands from the users and reluctance to buy from Indian firms as the some of the key impediments to 'Make in India'. The 'impossible' requirements asked by the users, which are possessed only by foreign manufacturers, limited orders and lack of commitment from the government on orders were some the reasons for Indian firms staying away from the defence manufacturing sector.[37] Aspiring to get operationally proven hardware is another aspect which prevents indigenisation.

The private sector has been reluctant to enter the volatile defence production market and its role so far was limited to providing low end support to the PSUs. Its reluctance to participate in the indigenisation

36. "HAL Launches Programme to Develop Engines for Small Helicopters", December 14, 2015, http://www.business-standard.com/article/current-affairs/hal-launches-programme-to-develop-engines-for-small-helicopters-115121400935_1.html. Accessed on December 28, 2015
37. Sanjeev Miglani and Tommy Wilkes, "Lapsed Tenders Hurt Modi's 'Make in India' Defence Industry Push", April 7, 2015, http://www.reuters.com/article/india-defence-idUSL6N0WY34D20150407. Accessed on January 4, 2015.

process is the key reason for the lack of growth in the manufacture of defence equipment in India. The liberalisation of policies by the Government of India to facilitate ease of trade and the improved diplomatic clout have given a push to 'Make in India' in the defence sector, which is likely to provide opportunities to both the private sector and the PSUs.

Abandoning Indigenous Projects: There are many public sector entities involved in R&D of aircraft which include the National Aeronautics Limited (NAL), various labs of DRDO and HAL. These agencies come under different ministries, and difficulties are faced in coordinating design, development and manufacturing activities. Many indigenous projects have been abandoned in the past when they either did not produce the desired results or hit technical glitches or similar equipment was offered by foreign vendors. The assembly of foreign aircraft by the PSUs often resulted in putting technological gains from indigenous projects into cold storage or their becoming obsolete with the passage of time. Some of these projects had the potential to become flagship projects of India. The differences in expectations, exceeding the timelines, operational necessity, lack of ownership, or aspiration for the best, are some of the reasons for inadequate endeavours to take such indigenous projects to a logical conclusion. A case in point is the 14-seat Saras light transport aircraft, being developed by the National Aeronautical Limited working under the Ministry of Science and Technology, which appears to have been put into cold storage.[38] The future of such projects and the plans for preserving the technology gains from these projects are not known. This could result in losing critical technological gains made during the process of a project's development. These faultlines make India's approach to indigenisation ad-hoc and lacking synchronisation.

The advanced military aircraft technology is the domain of a few due to prolonged development timelines and the requirement of huge investments. These countries use this strength to sell these weapons at exorbitant rates to customers. The failures and shifting timelines make the users unsure and dissuade the R&D agencies of the importing country

38. "NAL's Saras Remains off Radar", June 24, 2015, http://idrw.org/nals-saras-remains-off-radar/. Accessed on December 28, 2015.

Its Board of Directors had approved the establishment of a Registered Society as a not-for-profit category with the objective to establish an Aerospace University, on August 30, 2014. The society will give shape to detailed requirements of establishing the university for consideration by the relevant ministries.

from continuing with indigenisation. The pressure from the users and the difficulties/ challenges faced in the indigenous design and development programmes often force the government to procure military aircraft and other equipment from arms exporters. In fact, there is an opinion that sanctions help in achieving indigenisation and self-sufficiency because there is no other option but to look at indigenous R&D agencies to provide for needs. Pakistan's development of small drones[39] and India's achievements in the space arena are attributed to the imposition of sanctions on these countries.

India does not have sufficient technically skilled manpower to meet the present and future requirements of the aviation sector. The lack of adequate skilled manpower is an impediment in the growth of the aerospace manufacturing sector. There are not many institutions, which provide world class higher education with practical training in this sector. HAL has taken upon itself to address the deficiency of skilled manpower in aviation. Its Board of Directors had approved the establishment of a Registered Society as a not-for-profit category with the objective to establish an Aerospace University, on August 30, 2014. The society will give shape to detailed requirements of establishing the university for consideration by the relevant ministries.[40] Thereafter, it announced that it would invest Rs 100 crore initially for setting up an Aeronautical University in early 2015.[41] The university would play an important role in providing skilled manpower in the technology sensitive

39. "Pakistan Successfully Tests First Indigenous Armed Drone", March 13, 2015, http://www.dawn.com/news/1169341. Accessed on January 4, 2015.
40. "Aerospace University", December 12, 2014, http://pib.nic.in/newsite/PrintRelease.aspx?relid=113210. Accessed on January 31, 2016.
41. "HAL Plans to Set up Aerospace University", January 19, 2015, http://www.business-standard.com/article/current-affairs/hal-plans-to-set-up-aerospace-university-115011900984_1.html. Accessed on December 29, 2015

aerospace industry. This initiative of HAL would enable the future aviation workers and engineers to get world class education with hands-on experience of working in the design, development and manufacture of aviation projects.

BALANCING MAKE IN INDIA

'Make in India' is aimed at strengthening the manufacturing sector in India as well as developing indigenous capabilities in elusive niche technologies. 'Make in India' needs to be complemented by 'Start up India' by the private sector and indigenisation by the PSUs in capital intensive aerospace manufacturing to achieve the defence minister's ambitious targets for increasing indigenisation as well as encouraging manufacturing in India. The process of indigenisation of the aerospace industry has been a weak area, which would need bringing various stakeholders onto one platform and synchronising the efforts of various entities involved in this endeavour to make it a success.

There is a need to give a push to 'Make in India' in the aerospace industry but with a clear emphasis on TOT and not at the cost of abandoning indigenous projects. The country offering maximum TOT and willing to set up factories in India should be given utmost priority in the awarding of aerospace contracts.

There is a need to give a push to 'Make in India' in the aerospace industry but with a clear emphasis on TOT and not at the cost of abandoning indigenous projects. The country offering maximum TOT and willing to set up factories in India should be given utmost priority in the awarding of aerospace contracts. TOT or setting up of factories could be used for supply to the world market on mutually acceptable terms. A similar strategy had been adopted by Brazil when it decided to buy the Gripen fighter aircraft, since Gripen offered to set up factories in Brazil and agreed to share technology. The order of large numbers should make it possible for India to get maximum TOT from foreign suppliers. It is all about making the right choices while selecting partners for 'Make in India' in the aerospace sector. India need to look for deals where it can get as close as possible to core

technologies and have mutually beneficial arrangements with the suppliers for a win-win situation for both partners.

Joint ventures are an essential part of 'Make in India' for the growth of the aerospace sector, especially in the crucial and elusive technologies. The success of the joint ventures would depend on the bigger partners or the technology providers. India should not hesitate to form joint ventures within India or anywhere in the world. There is need to follow the innovative approach to make it lucrative for the investor to join India in joint ventures.

Indigenisation: 'Make in India' would bring best practices, processes and technologies supporting the aerospace industry but it would still not bring core technologies. The experience gained in 'Make in India' could be useful in developing core technologies. However, India would still have to depend on its own scientists for developing core technologies in order to achieve indigenisation and self-sufficiency.

The PSUs have an important role in protecting the technological gains and in developing elusive technologies. They could also be required to produce sensitive aerospace equipment. However, they have not been consistent in their approach. There is need to harness their potential in making India an aerospace hub. The successful aircraft designs remain in service for 50-60 years, sometimes extending up to 70-80 years. India, despite having built many prototypes in the past, does not have aircraft with similar success. The inability of these projects to become flag bearers of India's aviation innovations, highlights the need for correcting shortcomings and plugging gaps. The indigenous LCA, LUH, ALH and LCH projects have the potential to become the flag bearers of the country and could capture their share in the arms market of the world in their segment. There is a need to carry out a review of indigenous projects like the LCA, LCH, ALH, LUH, Rudra, Unmanned Aerial Vehicles (UAVs), etc and acquire only relevant technologies/ equipment, where scientists have hit a road block, till own scientists succeed in developing them. The support to indigenous aircraft would be a better option than importing entirely new aircraft. This strategy has been successfully followed by the Chinese to strengthen their indigenous aircraft industry. The JF-17 fighter aircraft, jointly built by China

and Pakistan, is likely to be equipped with the Russian RD-93 jet engines in order to fill the technological gap.[42] There is a need to make these aircraft world class products. Also, there is a need to make R&D agencies and other PSUs world class entities, with each having a centre of excellence of world standards. The separate helicopter manufacturing unit of HAL being set up in Karnataka could be made the centre of excellence for military helicopter design and development on similar lines. However, the focus of these entities should be on the R&D, design and development of aircraft and associated niche technologies.

The private sector excels in producing equipment in large numbers, in a shorter time and with less money, and there is need to tap its potential. The PSUs should choose reliable private partners to offload some portion of manufacturing. This would address the users' complaint about the inability of the PSUs to produce aircraft in large numbers in a given timeframe.

Aeronautics and Astronautics Universities: Another key element needed for the success of 'Make in India' is **skilled manpower**, which is lacking. The effort by HAL to create an Aerospace University is a late but important aspect in energising the aerospace industry. However, it is still not enough. Most countries having a well established aerospace manufacturing sector had realised the importance of setting up of Aeronautics and Astronautics Universities. India too would have to consider setting up at least three to four such universities, to exclusively provide higher education on various aspects of aeronautics, astronautics engineering, manufacturing, skilling, management, import and export.

Aerospace Commission: The lack of clarity about the role of various stakeholders, the inability to synchronise the R&D endeavours and the inadequate involvement of stakeholders in the design and development process could lead to duplication of endeavours or leave certain gaps in the development of technology. The lack of understanding of strengths and limitations could generate mistrust and prove counter-productive. Therefore, there is a need to synchronise indigenisation efforts and take

42. "Pakistan: JF-17 Engine Straight from Russia", February 15, 2015, http://airheadsfly.com/2015/02/15/pakistan-jf-17-engine-straight-from-russia/. Accessed on January 3, 2015.

various stakeholders viz the government, PSUs, private sector and users on board to make it a success. There should also be an endeavour to address those issues, which do not fall in the domains of these stakeholders but have long-term implications for the indigenisation process.

A higher agency or commission is needed to coordinate, monitor and facilitate indigenisation, 'Make in India', joint ventures, imports and exports to give an impetus to the aerospace industry in India. This agency could facilitate coordination among the government, R&D agencies and users to give an impetus to indigenisation and export of indigenous aerospace products. Proactive government support would be essential for these endeavours. Therefore, the setting up of an Aerospace Commission is necessary to achieve these goals.

Any country importing aircraft and other arms remains dependent on foreign suppliers for maintenance, overhaul and upgrades, etc., which curbs its strategic autonomy. The procurement of aircraft and associated equipment from foreign vendors is an expensive and high cost activity, which limits the quantity of equipment that can be procured through imports. Therefore, there is a need to strengthen indigenous aerospace manufacturing capabilities, which would provide self-reliance, create jobs and could even become a source of revenue through export to other countries. Indigenisation would reduce dependence on other countries and is an essential ingredient for an independent foreign policy. Therefore, indigenisation in the aerospace industry and military equipment has to be made a core strategic policy for India.[43]

43. Saurav Jha, "Indigenization has to be a Core Strategic Policy for India", September 28, 2015, http://www.ibnlive.com/blogs/india/saurav-jha/indigenization-has-to-be-a-core-strategic-policy-for-india-10879-1120350.html. Accessed on January 3, 2015.