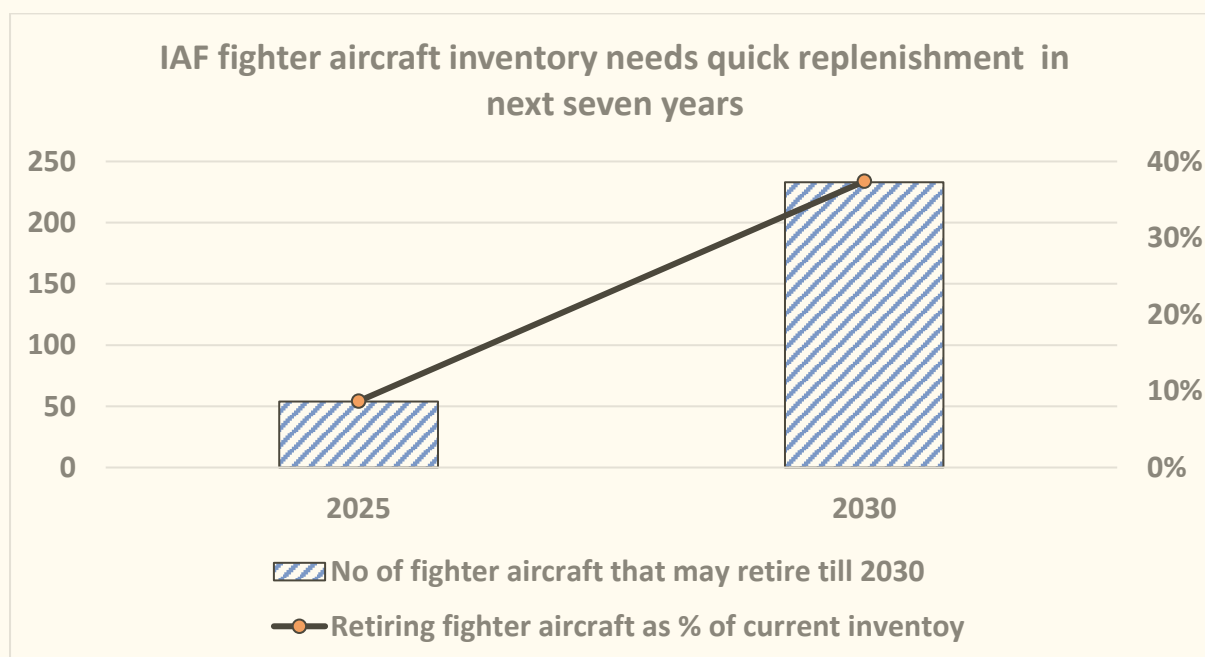


The Difference Between Semi Conductors and Fighter Jet Engines

During Indian Prime Minister's ongoing visit to the United States of America two proposed deals will likely catch special attention of geopolitical and strategic observers, and economists and investors. Among other pacts the two countries are likely to sign an agreement to expand the semi conductor supply chain in India. Another high profile deal that is likely to be concluded is for transfer of technology for fighter jet engines. The key difference in the two is the highly advanced technology of fighter jet engines that suppliers do not share with buyers. Semi conductor technology on the other hand, is not difficult to acquire. Instead, entry barriers for semi coductors are posed by lack of a proper ecosystem and of a well developed supply chain.

What is the big deal regarding the proposed fighter jet engine pact

The GE- HAL engine deal, depending on details, can bring about an orbital change in India's defence manufacturing ecosystem. The proposed pact between GE (General Electric) Avionics with HAL (Hindustan Aeronautics Limited) will likely facilitate joint production in India with ToT (transfer of technology), of the GE 414 engine. This can pave the way for high level of indigenisation for HAL's/ India's three fighet jet programs namely Tejas MkII, AMCA (Advanced Medium Combat Aircraft), and possibly TEDBF (Twin Engine Deck Based Fighter). Indeed, this deal may even bridge the viability gap for the TEDBF and AMCA programs of India. The thrust on Atmanirbharta has assumed further significance for Indian defence planners post lessons from the Ukraine war. IAF(Indian Air Force)'s depleting inventory of fighter jets is also sparking some urgency in Indian defence decision makers.



What if the GE engines deal falls through the cracks, or gets delayed

On the other hand, if a mutually satisfactory agreement for aircraft engine technology is not arrived at in near term then AMCA program may get derailed and Tejas Mk2 program may get delayed and smaller. Uncertainty on TEDBF planned for Indian Navy's aircraft carriers will grow further. Of course, as investors we need to avoid looking at this in binary terms.

What is there for HAL – 4x the current orderbook in next 10 years

A joint production agreement for these engines, coupled with smooth progress on development of various aircraft programs by ADA (Aeronautical Development Agency), DRDO(Defence

Research and Development Organization) and HAL (Hindustan Aeronautics Limited) can provide the Indian Air Force and Indian Navy enough confidence to procure more than 400 aircraft made in India over next 20 years. If things go as per plan assuming this deal goes through, then by 2045 more than half of India's fighter squadrons will be have come from the HAL stable.

The consolidated order size can be in excess of Rs 300,000 crores for HAL over this period. To put some context, HAL's market capitalization per closing price on 19th June, 2023 is Rs 1,30,190 crore and its order book as on 31st March, 2023 is Rs 81,784 crore. HAL's revenue in FY2023 stood at Rs 26,928 crore, out of which Rs 18,817 crore was from MRO (Maintenance, Repair and Overhaul), a relatively stable stream of revenue for the company. Thus aircraft manufacturing was just about Rs 4,700 crore of revenue for HAL in FY2023.

For HAL, certainty on engine technology and capability will ensure business visibility for next 15-20 years obviously adding to the company's long term sustainability and to the stock's fair value. At the same time, it is important to discount the hype in such situations. In specific terms, we also need to keep in mind the delays in development and delivery of aircraft in the past by ADA, DRDO and HAL. There are many factors that can wrong even once the deal is done.

GE Engines, Tejas Mk 1 A , Tejas Mk 2 and AMCA

Indian fighter aircraft designers and manufacturers ADA, DRDO and HAL- have so far managed to make decent progress in electronics and weaponry but are still lacking in the field of engines to power a fighter jet. Notably, there are just five countries that have the engine technology – USA, France, UK, Russia and China. India has been running its Kaveri jet engine development program since 1983 but a breakthrough has been elusive. Thus the local fighter jet development programs have to work with imported engines thus curbing the local content in the aircraft. This deal can change the status. Some media reports have suggested that this deal proposes local content in the engines produced in India at 80% to begin with, and moving up towards 100% progressively.

India's locally produced aircraft Tejas Mk 1 of which 40 aircraft have been delivered to the IAF (Indian Airforce) and Tejas Mk 1 A of which 83 aircraft will be delivered to the IAF between 2024 and 2029 have been using another engine from the GE stable , the GE 404. HAL had signed a deal in 2021 with GE to purchase 99 GE 404 engines for Rs 5,375 crore (USD 650m). However this engine does not have enough thrust to power a 4th generation fighter jet. With relatively low thrust of 78 KN (Kilo Newton) the maneuverability, cruising ability, and mission endurance are much lower than expected from a 4th generation fighter. Also, there was no clause for joint production or technology transfer in that deal. Indeed the engines are to be delivered in ready condition.

GE 414 engine on the other hand can provide a thrust of 98 KN. Based on this engine capacity and its better fuel efficiency, Tejas Mk 2 has some meaningful upgrades planned versus Tejas Mk 1A. The payload capacity for Tejas Mk 2 is 6.5 tonnes (versus 4 tonnes for Tejas Mk 1A), mission endurance is 120 minutes (versus 57 minutes for Tejas Mk 1A), and has 11 weapon pods (vs 8 in Mk 1 A).

AMCA, the 5th generation fighter aircraft under development in India is also likely to be powered by the GE 414 engine. However AMCA will have better stealth capabilities and weaponry such as active electronically scanned array (AESA) radar, unified electronic warfare suite, missile approach warning system, infrared search and track system, large area display, higher level sensor fusion, and networking.

HAL's Fighter Jet Program Pipeline

| | Number of aircraft | Price per aircraft (Rs crore) | Order size (Rs crore) | Status/timeline | Delivery timeline | To replace |
|--------------|---|-------------------------------|-----------------------|---|---|-----------------------------|
| Tejas Mk 1 | 40 aircraft already delivered | 223 | 8,900 | Orders for 20 aircraft each placed in 2006 and 2014. | 40 aircraft already delivered | |
| Tejas Mk 1 A | 83 aircraft order placed on HAL | 566 | 47,000 | Order for 73 Mk 1A and 10 Mk 1 trainer placed in 2021 | 3 aircraft to be delivered in CY2024. 16 aircraft to be delivered per year in CY2025-29 | Mig 21 |
| Tejas Mk 1 A | 40-50 aircraft order may be placed | | | Possible that orders be placed by 2027-28 | Delivery may begin in CY2029 | |
| Tejas Mk 2 | Not yet decided but order of 90 to 126 aircraft may be placed | | | First flight possible in CY 2027. | Delivery may begin in CY2031 | Jaguar, Mig 29, Mirage 2000 |
| AMCA | Quite early on the decision tree but if it is inducted the IAF may go for 144 to 180 aircraft | | | CDR (Critical Design Review over). CCS (Cabinet committee on security) approval may arrive by CY2025. Early expectation for first flight and can be for CY2032 | Delivery may begin in CY2035 | Sukhoi Su-30 |

For Indian policy makers this deal may provide more time to decide on the need for 8 squadrons (126 aircraft) of MRFA (Multi Role Fighter Aircraft). By the way, opinions are divided here - many experts believe that even as progress is being made on Tejas Mk II and AMCA, MRFA from an overseas supplier is a must for IAF to avoid severe depletion on its size and punch. Some other experts feel that the high cost tag (about Rs 150,000 crore) of MRFA will be better spent on accelerating and upgrading the development of domestic ecosystem for fighter jets.

Indian Air Force: Fighter Aircraft Inventory

| Manufacturer | Aircraft | Number in service | When was it first inducted into the IAF | Roughly how long has it been in service anywhere in the world (in years) | Planned for phase out by |
|------------------|-----------------|-------------------|---|---|--------------------------|
| Dassault, France | Rafale | 36 | 2021 | 10 | |
| HAL , India | Tejas MK 1 | 40 | 2016 | 8 | |
| Sukhoi, Russia | SU-30 MKI | 260 | 2000 | 25 | |
| Jaguar, UK | | 124 | 1979 | 50 | 2030 |
| Dassault, France | Mirage 2000 H/I | 44 | 1985 | 40 | 2030 |
| Mikoyan, Russia | MIG 29 UPG | 65 | 1987 | 40 | 2030 |
| Mikoyan, Russia | MIG 21 Bison | 54 | 1964 | 65 | 2025 |
| | Total | 623 | | | |

Why is this deal important for India

Fighter jet engine technology is one of the best kept secrets in the world. Only five countries have the technology for fighter jet engines. The complications involved here have prevented India's own Kaveri engine program from developing a viable India developed engine since 1983, notwithstanding the spectacular success achieved by the country's space program.

Understandably this is one of those instances where leave aside purchasing the technology, it is difficult to convince the supplier to share even production technology to facilitate local manufacturing. The strategic considerations are meaningful. Why would the five supplier countries invite any other country into this elite club of fighter jet manufacturing and let a strong strategic lever slip away ? The commercial perspective too is not negligible. For example the GE 414 engine has been fitted into 1,600 fighter jets globally so far. Hypethetically speaking if they agree for a full transfer of design and production technology, at some point in time won't the transferee company/country start competing with them for the next 1,600 orders ?

Indeed there is a chance that, apart from strategic considerations, American reluctance against ToT (transfer of technology) would also have a commercial angle. Inability on the part of Indian planners, so far, to provide a concrete estimate of how many jets will be fitted with this engine would be prompting GE to peg the price of high proportion of ToT at unreasonably elevated levels.

Interestingly, transfer of design technology is not even on the agenda here. What India has been seeking is transfer of production technology and if the USA agrees to share it along with progress on joint production it'll be a big development for India, its fighter jet program, and HAL.

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| Investment Approaches | Future Stars (Mid cap and Small Cap) Value For Growth (Multi Cap) |
| Investment Approach Launch | August 2021 |
| Custodian and Fund Accountant | Kotak Mahindra Bank |
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