

EXECUTIVE SUMMARY

Background

Indian Air Force (IAF) was operating MIG-21 series of aircraft manufactured during 1966 to 1987 and majority of these aircraft were expected to be phased out in the 1990s, thereby resulting in significant fall in combat level of IAF. Thus, IAF mooted the proposal (early 1980s) for a replacement aircraft for MIG-21 fleet. It was against this backdrop that the indigenous design and development of Light Combat Aircraft (LCA) was sanctioned (1983). Government of India constituted (June 1984) Aeronautical Development Agency (ADA), Bangalore, a society registered (June 1984) under the Societies Registration Act, 1860 under the Ministry of Defence, as a dedicated institution for the management of LCA project.

IAF had issued Air Staff Requirement (ASR) in Oct 1985 with a projected requirement of 220 Light Combat Aircraft (200 Fighters + 20 Trainers) to be inducted by 1994. As per the ASR, Light Combat Aircraft is required to be built as a light weight multi-mission fighter aircraft, having contemporary air combat and offensive air support capabilities with excellent maneuverability for close air combat at low and medium altitudes. The aircraft should be able to provide extended Air Defence cover over the forward bases and tactical battle area.

The LCA management structure consists of the General Body (chaired by the Defence Minister) responsible for taking decisions on the scientific and technical activities of ADA and the Governing Body (chaired by the Scientific Advisor to Raksha Mantri) for effective monitoring of its aims and objectives, apart from Technical committee (chaired by Director General, ADA) and LCA Programme Management Committee (chaired by Programme Director, ADA), which are responsible for the progress of the design and development of the LCA.

ADA executes the LCA development by utilising the capabilities of national agencies/institutions (referred as work centers) working in Aerospace technology. Hindustan Aeronautics Limited (HAL) is the principal contractor for detailed design, development, manufacture and flight testing of LCA.

Light Combat Aircraft Programme got delayed considerably and even after a lapse of thirty years, the Light Combat Aircraft has only achieved Initial Operational Clearance (December 2013) involving a delay of eight years and the Full Operational Clearance, which was scheduled to be completed by December 2008, is now scheduled to be achieved by December 2015 (as projected by ADA).

Audit Approach

The Performance Audit (PA) covers the progress made in execution of LCA programme since the last Review, i.e. Para 28 of the Report No. 8 of 1999 of the C&AG of India, Union Government, Defence Services (Air Force & Navy) for the year ended 31 March 1998. Our conclusions are based upon audit conducted at Aeronautical Development Agency, Hindustan Aeronautics Limited, Air Headquarters and DRDO Headquarters and its laboratories. The Report has five Chapters. Chapter I is introduction and Chapter II, III and IV contain audit findings. In Chapter V, the audit conclusions have been summarized.

Ministry of Defence (R&D)/ADA/Air HQ response

The PA report was issued to Ministry of Defence, ADA and Air HQ in December 2014. Our findings were finalized with reference to the replies furnished by ADA, HAL, Air HQ and DRDO Headquarters and its laboratories. Reply from Ministry of Defence is awaited (March 2015).

Key findings

LCA programme was initially sanctioned in 1983 with a development schedule of eight to ten years against IAF's requirement of induction by 1994. Our analysis revealed that the project schedules had slipped, mainly on account of design changes necessitated due to change in weapon requirements, non-availability of Kaveri¹ engine, delay in completion of work packages by the work centres, etc. LCA achieved IOC in December 2013 with 53 concessions/permanent waivers considerably reducing its operational employability, is yet to be inducted in IAF squadrons, as discussed below:

1. Execution of LCA Project, extent of meeting Air Staff Requirement including weaponisation

- ADA's decision to advance building of two prototypes from Full Scale Engineering Development (FSED) Phase-II to FSED Phase-I on the ground of accelerating the development process of LCA, failed to yield the desired results as the FSED Phase I was closed in March 2004 involving a delay of six years and without completing all the activities, which were carried forward to FSED Phase-II. More importantly, this decision of ADA rendered the prototypes deficient of critical onboard systems (Multi-Mode Radar, Self-Protection Jammer, Radar Warning Receiver) and led to ADA using the

¹ Gas Turbine Research Establishment, Bangalore could not develop the Kaveri engine, meant for LCA, as per the LCA schedule and specifications, necessitating ADA to go in for import of GE-F404-IN20 aero engine from M/s GE, USA to continue the development activities of LCA.

***Performance Audit on 'Design, Development, Manufacture and
Induction of Light Combat Aircraft'***

Limited Series Production aircraft (meant for IAF use) towards flight testing/evaluation of these critical on board systems, in contravention to the commitment given to the GoI while obtaining sanction (November 2001) for building of these aircraft. **(Para 2.1)**

- LCA Mark-I, which achieved Initial Operational Clearance (December 2013) has significant shortfalls (53 permanent waivers/concessions) in meeting the ASR as a result of which, it will have reduced operational capabilities and reduced survivability, thereby limiting its operational employability when inducted into IAF squadrons. Shortcomings in LCA Mark-I (increased weight, reduced internal fuel capacity, non-compliance of fuel system protection, pilot protection from front, reduced speed) were expected to be overcome by development of LCA Mark-II, an aircraft with lower weight and a higher thrust engine which is expected to meet the ASR, had been taken up by ADA in November 2009 and is scheduled for completion by December 2018. **(Para 2.3)**
- IAF would be constrained to induct fighter LCA without availability of trainer LCA, adversely impacting pilot training. Production of trainer aircraft at HAL was delayed as the trainer LCA had not achieved IOC/FOC. As regards flight training simulator, IAF was using an upgraded Full Mission Simulator (FMS) at ADE for pilot training, pending supply of a FMS by HAL at LCA operating base. **(Para 2.3.1)**
- Addition of new weapons by Air HQ for operational edge of LCA (March 1997, December 2009) necessitating design changes on the aircraft, coupled with delayed specifying (December 2009) of integrating R-73E missile with Multi-Mode Radar/Helmet Mounted Display and Sight and delayed identification (December 2009) of Beyond Visual Range Missiles also contributed to the delays in achieving IOC/FOC by LCA. **(Para 2.3.2, 2.3.3)**
- LCA Mark-I is deficient in Electronic Warfare capabilities as specified by IAF, as the Self Protection Jammer could not be fitted on the aircraft due to space constraints and the Radar Warning Receiver/Counter Measure Dispensing System fitted on the aircraft are having performance issues, which are yet to be overcome (January 2015). **(Para 2.3.4)**
- LCA programme is being monitored by General Body, Governing Body, involving the representation of MoD, Ministry of Finance at the highest level,

various committees at ADA/HAL, Empowered Committee chaired by Chief of Air Staff. In spite of this, delays in completion of work packages which affected the LCA programme schedules, indicates that coordination of efforts at various levels and monitoring of the programme by all the agencies involved, has not been as envisaged. **(Para 2.4)**

- Need for a Liaison Group between Air HQ and ADA to ensure closer interaction between the design team and the user for better appreciation of mutual perception, had been recommended by the LCA PDP Review Committee² as early as in 1989. However, no such liaison group was formed and active user (Air HQ) participation in the LCA Programme started only after November 2006, which also impacted the LCA development. **(Para 2.5)**

2. Development of Indigenous capability through LCA Programme

- Government of India had emphasized (June 1993) on increasing the indigenous content of LCA while sanctioning FSED in phased manner, but ADA did not make any roadmap for indigenization during LCA development. As a result, indigenous content of LCA estimated by ADA as 70 *per cent* actually worked out to about 35 *per cent* (January 2015). **(Para 3.1)**
- LCA systems such as Kaveri engine, Multi-Mode Radar, Radome, Multi-Functional Display System and Flight Control System Actuators taken up for indigenous development could not be developed successfully, resulting in LCA's continued dependency on import of these systems. Development of Jet Fuel Starter, though achieved indigenously, had performance issues which are yet to be resolved (January 2015) **(Para 3.1.1).**

3. Creation of manufacturing facility at HAL for LCA and operational impact on IAF

- Prototype version (PV) and Limited Series Production (LSP) of LCA³ built by HAL had low serviceability due to delay in snags analysis, slow recovery of aircraft from rectification, shortage of critical LRUs at flight hangar, aircraft being used as test rigs, large number of unproductive sorties etc. which impacted availability of aircraft for flight testing and contributed to delays in development of LCA **(Para 4.2.2).**

² A committee chaired by Director, NAL, and consisting of members from ADA, HAL, ADA and Air HQ, constituted by SA to RM in May 1989 to review the comments of Air HQ on the LCA Project Definition Phase report prepared by ADA in September 1988.

³ Technology Demonstrators, Prototype Vehicles and Limited Series Production aircraft.

**Performance Audit on 'Design, Development, Manufacture and
Induction of Light Combat Aircraft'**

- The manufacturing facilities created at HAL presently cater for production of only four aircraft *per annum* against the envisaged requirement of eight aircraft *per annum* due to delays in procuring plant and machinery, tools and jigs and also construction of production hangars, which would further impact production of LCA and induction into IAF squadrons. **(Para 4.3)**
- Repair and Overhaul (ROH) facility for LCA, as specified in the ASR has not been created fully at HAL. Out of the 344 Line Replaceable Units⁴ of LCA, 90 LRUs were considered non-repairable. Of the remaining 254 LRUs, while ROH facilities in respect of 185 LRUs were available, ROH facilities were yet to be established for 69 LRUs (January 2015). **(Para 4.4)**
- Design, development and productionisation of LCA through concurrent engineering did not compress the development time as envisaged in the FSED Phase-II sanction (November 2001) since LSP aircraft were built in a phased manner with specific capabilities for the purpose of flight testing/evaluation and even LSP-8 fell short of the ASR in terms of weight and speed, for which permanent waivers had to be granted by Air HQ when LCA achieved IOC (December 2013) **(Para 4.5.1)**.
- Awarding of the 20 IOC contract by MoD to HAL in 2006 when LCA design was nowhere near finalization, was premature, as only Technology Demonstrators/Prototypes were flying and LSPs were yet to be built. This led to delay in productionisation of LCA and formation of squadrons by IAF, as HAL is yet to supply any aircraft against the contract (January 2015). **(Para 4.6.1)**
- Awarding of contract (December 2010) for supply of 20 FOC configuration aircraft by MoD to HAL even before commencement of supply of IOC configuration aircraft, freezing of designs and achieving of FOC was premature. Further, HAL had advances of ₹1509.22 crore since 2010 without utilising it against the contract. (January 2015). **(Para 4.6.2)**
- Due to delay in manufacture and supply of LCA, IAF had to undertake alternate temporary measures such as upgradation of existing aircraft⁵ at a cost of ₹20,037 crore to overcome depleting squadrons with obsolete aircraft and

⁴ It is a modular component of an aircraft that is designed to be replaced quickly in case of failure, which reduces down time of the aircraft.

⁵ MiG BIS, Mirage, MiG-29 and Jaguar fleet.

IAF is looking forward for early induction of LCA to overcome the drawdown of squadrons. **(Para 4.7)**

4. Conclusion

While we appreciate the efforts made by ADA and its work centres in the indigenous development of LCA which is comparable to many contemporary aircraft in the world, considerable time taken in the development of LCA has delayed the productionisation and subsequent induction of the aircraft into IAF thereby impacting the operational preparedness of IAF with reduced squadron level. Moreover, the LCA Mark-I despite achieving the Initial Operational Clearance does not meet the ASR, which reduces its operational employability. Final Operational Clearance of LCA is yet to be achieved. This PA, therefore, points out the need for a more efficient management of planning and execution of aircraft development programmes, closer interaction and coordinated efforts among all the stake holders involved, ensuring effective indigenisation efforts, creation of adequate manufacturing facilities in a timely manner and supply of aircraft to IAF in line with their induction planning.

Recommendations

- Realistic timelines should be projected by MoD while seeking approval for such projects from the GoI and the same be adhered to during their execution with coordinated planning and effective in-built monitoring mechanism to produce desired results in time.
- In view of the complexity of the technology involved, while deviating from the approved plan of development, ADA should consult the user (Air HQ) and obtain prior approval of sanctioning authority/Ministry for such deviations, so as to minimize waivers and concessions at the time of acceptance by the user (IAF).
- The agencies *viz.* DRDO, ADA and HAL, should undertake the projects strictly in conformity with the specifications projected by the IAF, who should be involved right from the planning stage, so as to ensure timely achievement of their requirements.
- Indigenisation efforts should be made in coordination with all the agencies involved, with a well-defined indigenisation plan and a clear roadmap, so as to develop quality product as per the requirement, in order to avoid import substitution.
- MoD should award contract to production agency at an appropriate stage of development of a system/equipment in order to avoid the necessity of extending delivery schedule consequent to delay in development of the system, apart from the resultant blocking of funds/inventory and to overcome obsolescence of the components procured by the production agency.