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DESIGN, DEVELOPMENT, MANUFACTURE AND INDUCTION OF LIGHT COMBAT AIRCRAFT (LCA)

[Action Taken by the Government on the Observations/Recommendations of the Committee contained in their One Hundred and Fourteenth Report (16th Lok Sabha)]

MINISTRY OF DEFENCE

PUBLIC ACCOUNTS COMMITTEE (2020-21)

TWENTY THIRD REPORT

SEVENTEENTH LOK SABHA

LOK SABHA SECRETARIAT
NEW DELHI

PAC NO. 2205

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सत्यमेव जयते

Presented to Lok Sabha on: 02.02.2021

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LOK SABHA SECRETARIAT
NEW DELHI

February, 2021/ Magha, 1942 (Saka)

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(2020-21)

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INTRODUCTION

I, the Chairperson, Public Accounts Committee (2020-21), having been authorised by the Committee, do present this Twenty Third Report (Seventeenth Lok Sabha) on Action Taken by the Government on the Observations/Recommendations of the Committee contained in their One Hundred and Fourteenth Report (Sixteenth Lok Sabha) on **'Design, Development, Manufacture and Induction of Light Combat Aircraft (LCA)'** relating to the Ministry of Defence.

2. The One Hundred and Fourteenth Report was presented to Lok Sabha/laid on the Table of Rajya Sabha on 14 December, 2018. Replies of the Government to the Observations/Recommendations contained in the Report were received on 9th December, 2019. The Committee considered the draft Report on the subject and thereafter adopted the Report at their Sitting held on 1st December, 2020. Minutes of the Sitting of the Committee form appendix to the Report.

3. For facility of reference and convenience, the Observations and Recommendations of the Committee have been printed in **bold** in the body of the Report.

4. The Committee place on record their appreciation of the assistance rendered to them in the matter by the Committee Secretariat and the office of the Comptroller and Auditor General of India.

5. An analysis of the Action Taken by the Government on the Observations/Recommendations contained in the One Hundred and Fourteenth Report (Sixteenth Lok Sabha) is given at Appendix-II.

NEW DELHI;
2 February, 2021
13 Magha, 1942 (Saka)

Adhir Ranjan Chowdhury
Chairperson
Public Accounts Committee

REPORT

This Report of the Public Accounts Committee deals with the Action Taken by the Government on the Observations and Recommendations contained in their One Hundred and Fourteenth Report (16th Lok Sabha) on the subject **"Design, Development, Manufacture and Induction of Light Combat Aircraft (LCA)"** based on C&AG Report No. 17 of 2015 related to Ministry of Defence.

2. The One Hundred and Fourteenth Report (16th Lok Sabha) which was presented to Lok Sabha/laid in Rajya Sabha on 14th December, 2018, contained 12 Observations/Recommendations. Action Taken Notes in respect of all the Observations and Recommendations have been received from the Ministry of Defence and are broadly categorized as under:

(i) Observations/Recommendations which have been accepted by the Government:

Para Nos. 1, 3,5,8,9,10,11 and 12

Total: 8
Chapter - II

(ii) Observations/Recommendations which the Committee do not desire to pursue in view of the replies received from the Government:

NIL

Total: NIL
Chapter – III

(iii) Observations/Recommendations in respect of which replies of the Government have not been accepted by the Committee and which require reiteration:

Para Nos. 2, 4,6 and 7

Total: 4
Chapter - IV

(iv) Observations/Recommendations in respect of which Government have furnished interim replies:

NIL

Total: NIL
Chapter -V

3. In their 114th Report(16th Lok Sabha), the Committee had found that Light Combat Aircraft (LCA) programme was initially sanctioned in the year 1983 with a development schedule of eight to ten years against Indian Air Force's (IAF's)

requirement of its induction by the year 1994. However, the project schedules slipped, mainly on account of design changes necessitated due to change in weapon requirements, non-availability of Kaveri engine, delay in completion of work packages by the work centres, etc. LCA achieved Initial Operational Clearance (IOC), as late as December 2013 with 53 concessions/permanent waivers that reduced its operational employability considerably.

4. The Action Taken Notes furnished by the Ministry of Defence on each of the Observations/Recommendations of the Committee contained in their One Hundred and Fourteenth Report have been reproduced in the relevant Chapters of this Report. The Committee will now deal with the action taken by the Government, on some of their Observations/Recommendations which either need reiteration or merit comments.

5. The Committee desire the Ministry of Defence to furnish Action Taken Notes in respect of Observations/ Recommendations contained in Chapter I within six months of the presentation of the Report to the Parliament.

(Recommendation Para No. 2)

6. The Committee in their Original Report had noted that the ADA advanced building of two prototypes (PVs) from Full Scale Engineering Development (FSED) Phase-II to FSED Phase-I on the ground of accelerating the development process of LCA, however, the decision failed to yield the desired results. The FSED Phase-I was closed in March 2004 after a delay of six years and without completing all the activities which were carried forward to FSED Phase-II. Further, building of PVs was completed three to eleven years beyond scheduled date delaying IOC from December 2005 to December 2013. The Committee found that all the major objectives of FSED Phase-I i.e. 42 work packages pertaining to development of Multi-Mode Radar, Flight Control System, Actuators, Digital Flight Control Computer, Jet Fuel Starter, Drop Tanks, etc. were not achieved and were carried forward to FSED Phase-II and resultantly, prototypes were rendered deficient of critical onboard systems {Multi-Mode Radar (MMR), Self-protection Jammer (SPJ), Radar Warning Receiver (RWR)} which eventually led to using the Limited Series Production (LSP) aircraft (meant for IAF use) towards flight testing/evaluation of the critical on board systems, in contravention of the commitment given to the GoI while obtaining sanction (November 2001) for building of these aircraft. The Committee noted from the reply of the Ministry that the timelines in respect of critical on-board systems like MMR, RWR etc. initially planned to be integrated on Prototype Version (PV)-1 & Prototype Version (PV)-2, based on schedules provided by the work centres, could not be met by the work centres due to technological complexities. The Committee reproached the ADA for taking decisions that lacked scientific basis by advancing building of prototypes overlooking the fact that neither the critical technologies were developed by then nor the Technology Demonstrators flight tested for specified 210 hours. The Committee while noting that the decision resulted in deficient prototypes further leading to diversion of LSP towards flight testing, desired to be apprised of the details of the expenditure incurred on deficient aircraft.

7. The Ministry in their Action Taken Note submitted as under:

"The advance manufacture of two prototypes PV1&PV2 from FSED Phase 2 to FSED Phase 1 was undertaken based on the decisions given by General Body and Governing Body of ADA and later approved by CCS.

Manufacture of Two Prototype Vehicles PV1 & PV2 was advanced from FSED Phase 2 to FSED Phase 1 programme to expedite flight testing to prove core technologies like Open System Architecture based Avionics, Carbon- Carbon composites, Composite Drop Tanks etc to make sure that these technologies are matured and are available early in the programme to accelerate subsequent phase of realizing LCA as a potent weapon platform.

If these two prototypes were not advanced, it would have taken more time to prove the core technologies with only two prototypes (TD1 & TD2) and would have had an adverse impact on the LCA programme. For example Open System Architecture based Avionics could be proven on PV2 early and has paved the way for realizing state of art advanced digital avionics suite and all glass cockpit. Similarly extensive use of carbon-carbon composites resulted in weight savings leading to improvement in aircraft performance.

The decision to advance prototype vehicles PV1 & PV2 in FSED Phase-I has given Technology edge for proving critical systems like, Drop Tank Integration, Avionics Architecture Upgrades, Extensive use of Carbon-Carbon composites, Aircraft Performance and Envelope Expansion flight testing.
The above technologies required extensive flight testing for maturity. It is to be noted that awaiting maturity of these technologies with only two TDs would have had resulted in further delays in the programme.

Open System Architecture of obsolescence management of electronic and avionic system could be realised early on PV2 only because of the advancement of PV1 & PV2.

The critical onboard systems like MMR, RWR, etc. were initially planned to be integrated on PV-1 & PV-2 based on schedules provided by the work-centres. However, timelines could not be met by the work-centres due to the technological complexities.

Critical technologies which were required for Prototype and subsequent Production of LCA Mk-1 were successfully developed indigenously and demonstrated. All the major objectives of FSED Phase I were achieved, except the development of critical on board systems like MMR, RWR, etc., and demonstration on ground rigs.

Development of MMR, RWR, etc., was carried out based on schedules provided by the work-centres. However, timelines could not be met by the work-centres due to the technological complexities.

As such there is no deficiency in these prototypes since the aircraft were built to the desired Standard of Preparation (SOP) for specific requirement.

Use of LSP aircrafts

The LCA Programme has taken-up ab-initio development and realization of critical technologies/systems.

This development and flight testing has been planned in concurrently on various LSP aircraft to achieve IOC & FOC goals quickly.

During the course of development, *the changes in the critical system like communication system, Radar & Helmet Mounted Display System has forced SOP change staggered on different LSPs.*

The LSP Programme allowed the changes of Missiles, Engine, Radar, Fuel System, Communication System etc., to be incorporated.

Awaiting maturity of all the systems on PV series aircraft and completing IOC task involving around 2500 sorties with three numbers of PV series aircraft would have resulted in further delays.

As flight testing of LCA progressed, there was a need to modify wing and to integrate new weapons such as Derby BVR missile. This justifies the need for the LSPs for integration and flight testing. The plan for handing over the LSPs to IAF will be mutually worked out at the conclusion of FSED Phase 2 programme".

8. The Audit in their Vetting Comments submitted the following:

"The contention of the Ministry that there is no deficiency in two Prototype Vehicle PV1 & PV2 since the aircraft were built to the desired Standard of Preparation (SOP) for specific requirement lacks merit as critical systems like MMR, RWR etc initially planned to be integrated on these aircraft could not be achieved. Moreover PV's were built after delays of ranging from three to eleven years and have not achieved stated objectives yet due to deficiency on prototype aircraft, LSP aircraft meant to be handed over to IAF were also used as additional prototypes for achieving IOC/FOC. Further, FSED Phase-I was closed after six years delay without all the objectives being met and unfinished tasks were carried forward to FSED Phase- II."

9. The Ministry have further submitted as under:

"The LCA Programme has taken-up ab-initio development and realization of critical technologies/ systems.

This development and flight testing has been planned in concurrently on various LSP aircraft to achieve IOC & FOC goals quickly.

During the course of development, the changes in the critical system like communication system, Radar & Helmet Mounted Display System has forced SOP change staggered on different LSPs.

The LSP Programme allowed the changes of Missiles, Engine, Radar, Fuel System, Communication System etc., to be incorporated.

Awaiting maturity of all the systems on PV series aircraft and completing IOC task involving around 2500 sorties with three numbers of PV series aircraft would have resulted in further delays.

As flight testing of LCA progressed, there was a need to modify wing and to integrate new weapons such as Derby BVR missile. This justifies the need for the LSPs for integration and flight testing. The plan for handing over the LSPs to IAF will be mutually worked out at the conclusion of FSED Phase 2 programme.

Critical technologies which were required for Prototype and subsequent Production of LCA Mk-1 were successfully developed indigenously and demonstrated. All the major objectives of FSED Phase I were achieved, except the development of critical on board systems like MMR, RWR, etc., and demonstration on ground rigs.

Development of MMR, RWR, etc., was carried out based on schedules provided by the work-centres. However, timelines could not be met by the work-centres due to the technological complexities.

As such there is no deficiency in these prototypes since the aircraft were built to the desired Standard of Preparation (SOP) for specific requirement. Eventually all LSP aircraft will be handed over to IAF."

10. The Committee, in their Original Report, had noted that the ADA advanced building of two prototypes (PVs) from Full Scale Engineering Development (FSED) Phase-II to FSED Phase-I with the intention of accelerating the development process of LCA. However, the decision failed to yield the desired results as all the major objectives of FSED Phase-I were not achieved and were carried forward to FSED Phase-II. Resultantly, prototypes were rendered deficient of critical onboard systems. As per the Action Taken Reply of the Ministry, if these two prototypes were not advanced, it would have taken more time to prove the core technologies with only two prototypes (TD1 & TD2) which would have had an adverse impact on the LCA programme. The Ministry have also submitted

that except for the development of critical on board systems like MMR, RWR, etc., and demonstration on ground rigs, all the major objectives of FSED Phase I were achieved and as such there was no deficiency in these prototypes. The Committee, however, do not agree with the contention of the Ministry that there were no deficiencies since the critical systems like Multi Mode Radar (MMR) and Radar Warning Receiver (RWR) which were initially planned to be integrated on these aircraft could not be developed. The Committee, had in their original report, while opining that the decision to advance prototypes resulted in diversion of Limited Series Production (LSP) aircraft meant for the use of IAF, desired to be apprised of the details of the expenditure incurred on development of the prototypes, which had deficiencies. However, the Ministry has not furnished the details of expenditure incurred and has only stated that LSP aircraft would be handed over to IAF, as per mutually agreed plan, at the conclusion of FSED Phase 2 programme. The Committee, while taking exception to the Ministry's silence on their recommendation, desire that the requisite details may be furnished within a month of the presentation of this Report.

(Recommendation Para No. 3)

11. *The Committee had observed that the ADA could not complete flight testing activities for FOC during the currency of the consultancy contract (March 2009 to January 2013) with M/S European Aeronautic Defence and Space (EADS) comprising of two phases to be done along with the achievement of IOC and Final Operational Clearance (FOC) respectively, at a cost Rs.127.65 crore and had to go in for a second consultancy contract costing Rs.30.34 crore (August 2014) for completing the activities. The Committee noted with serious concern from the reply of the ADA that recommendations of the consultant could not be implemented during the period of contract as IOC schedules were shifted because of major snags, ejection related issues etc. and another contract was concluded with same firm for two tasks which should have been completed under the first contract itself. The Committee opined that the money spent on first consultancy was rendered wasteful as the ADA could not complete flight testing activities and subsequent induction of aircraft and had to close the contract without implementing the recommendations. The Committee admonished the ADA for not doing proper homework before engagement of consultants resulting in non-implementation of the task-wise recommendations of the consultant during the currency of the first contract, huge delays in meeting the IOC/FOC schedules and wasteful expenditure incurred on the first consultancy contract.*

12. The Ministry in their Action Taken Note submitted as under:

- "Flight testing was commenced by the design team. This task was being attempted for the first time in the country for a 4+ generation aircraft. However, IAF had experienced Flight Test Pilots and Engineers. Some bottlenecks were encountered during the flight testing and the overall effort appeared to be very

large. The complexities involved came to light after some flight testing. Hence EADS Consultancy was sought for Flight Test optimization towards achieving IOC/FOC at this stage in Flight Testing.

EADS Consultancy was sought for Flight Test optimization to achieve IOC/FOC. This was because this task was being attempted for the first time in the country. As a result, estimate of the flight test effort required for achieving IOC/FOC was an under estimate. It was only after the consultancy that this activity was completely understood. It is worth noting that consultancy got delayed by more than an year, because Boeing freezed the contracting procedure for more than an year before backing out due to Govt. clearance issues.

Grounding of aircraft once due to pipeline butting, second time due to ejection seat clearance, for 6 months due to safety critical Mods implementation further delayed the schedules. As a result even though most of the recommendations were implemented they could not be flight tested in time. Subsequently IOC was achieved by flight testing based on the EADS recommendations.

The extension of the Consultancy was to seek their help during flight testing of some high risk activities like High AoA Envelope Expansion, Automatic Low Speed Recovery, Stores Separation of FOC stores. EADS recommendations were already available from the first Consultancy for these tasks.

The current Consultancy was primarily a risk mitigation plan for support during flight tests and accelerating the same. In addition, it caters to some of the issues identified in Post-IOC and FOC stores identified beyond 2009.

It is to be noted that Consultancy itself was delayed by about 18 months due to US Govt. restrictions. If it had started as planned, IOC/FOC could have been achieved much earlier.

Also the fact remains that LSP6 can be handed over to the user as a FOC Production standard LSP aircraft (with appropriate instrumentation) due to the inputs from the Consultancy. Without the Consultancy, LSP6 would have been consumed as a dedicated High AoA Test vehicle."

13. While vetting the Action Taken Reply of the Ministry, Audit commented as under:

"Due to major snags in development of aircraft, ADA could not derive the required benefit from the first consultancy contract which necessitated avoidable expenditure on conclusion of another contract to complete the activities planned under the first contract. As regards LSP 6 aircraft, as per the commitment given to CCS, all the eight LSP aircraft were to be handed over to IAF and there was no question of the aircraft being consumed as a dedicated High AoA test vehicle. These aircrafts were not meant for flight testing."

14. The Ministry in their final reply submitted as under:

"In the first contract, all the recommendations of the consultant had been received and implementation of the same was in progress. This consultancy had three objectives, viz.

i. Identify design improvements to make the aircraft more reliable and to meet operational requirements for release to service,

ii. Identify testing techniques and procedures to improve efficiency of flight testing.

iii. Evolve an efficient flight test plan harmonizing all the flight test requirements.

The above objectives had been achieved as per the consultancy. Note that the objectives were common to both IOC and FOC and were a continuous process of implementation till the conclusion of the contract.

During the final stages of FOC, some of the more high risk and technically complex activities like high AoA expansion, Air to air refueling, Separation of aerodynamically complex stores like RTU bombs were being attempted for the first time in the country. It was felt that involvement of EADS during these flight tests would be beneficial for risk mitigation. In fact, high AoA envelope expansion from 24 deg AoA (for IOC) to 25 deg AoA (post IOC) had already been completed without assistance of EADS before phase 3 consultancy was in place. Hence this part of Phase 3 consultancy was only a limited support during flight testing. It is to be noted that in the earlier contract, an option clause had been provided for extension of Task 1 (i.e. high AoA envelope expansion) beyond the contract period of 42 months at an additional cost of 22000 Euros per quarter. This was because it was expected at the outset that this task could extend beyond 42 months being the most complex task . However, this option clause was not availed since most of the flight activities at the conclusion of the contract were focused towards IOC-2 certification. Subsequently, after FOC flight testing commenced, limited support for Task 1 was availed in the new contract.

In the first contract, all the recommendations of the consultant had been received and implementation of the same was in progress., etc. it should also be noted that air to air refueling was not a part of the earlier SOW. This was because ADA also had a contract with Cobham for integration of the air to air refueling probe with the aircraft. However, it became clear towards the end of the earlier consultancy that while Cobham would be able to help in aircraft integration, the actual fight testing to achieve air to air refueling was a very challenging activity. For this it was felt desirable to have a consultancy with an aircraft house (EADS) in addition to the consultancy with the probe manufacturer (Cobham). These new activities were identified in Phase 3 as new consultancy areas.

Also the fact remains that LSP6 can be handed over to the user as a FOC Production standard LSP aircraft (with appropriate instrumentation) due to the inputs from the Consultancy. Without the Consultancy, LSP6 would have been consumed as a dedicated High AoA Test vehicle."

15. As the ADA could not complete flight testing activities for FOC during the currency of the consultancy contract costing Rs.127.65 crore (March 2009 to January 2013) with M/S European Aeronautic Defence and Space (EADS) a second consultancy contract costing Rs.30.34 crore (August 2014) had to be entered into for completing the activities. The Committee had noted with concern that the ADA had not done proper homework before engaging the consultants which resulted in non-implementation of the task-wise recommendations during the currency of the first contract, huge delays in meeting the IOC/FOC schedules and in incurring ungainful expenditure. The Ministry, in their Action Taken Reply, have stated that in the first contract, all the recommendations of the consultant had been received and implementation of the same was in progress. Further, during the final stages of FOC, as some of the more high risk and technically complex activities like high AoA expansion, Air to air refueling, Separation of aerodynamically complex stores like RTU bombs were being attempted for the first time in the country, it was felt that involvement of EADS during these flight tests would be beneficial for risk mitigation. The Ministry has further stated that, after FOC flight testing commenced, limited support for Task 1 was also availed in the new contract. The Committee, acknowledge the submission of the Ministry that some high risk and technically complex activities were being attempted for the first time. Nevertheless, the Committee cannot also help noting that time bound implementation of the task wise recommendations of the consultant during the currency of the first contract itself by ADA could have avoided the expenditure incurred on another contract for completing the activities planned and already contracted for in the first phase. Taking in to account all the learning from the instant case, the Committee are hopeful that the ADA will focus their efforts on timely implementation so as to minimize the expenditure on such contracts in future. Also, while observing that one of the reasons for delay in executing the contract was due to adoption of latest technology in the development of the aircraft, the Committee recommend that all the current as well as future plans for designing and development of such aircraft should invariably consider the latest technology that has developed as on date as well as technologies that are being developed. The endeavour should be to have the latest cutting edge technology imbibed in the war machinery.

(Recommendation Para No. 4)

*16. The Committee had noted that the addition of new weapons by Air HQ for giving an operational edge to the LCA (March 1997, December 2009) necessitated design changes on the aircraft, coupled with specification of integrating *missile (December 2009) with Multi-Mode Radar/Helmet Mounted Display and Sight and identification (December 2009) of Beyond Visual Range Missiles delayed the achievement of IOC/FOC. The Committee note from the reply of the Air HQs that inclusion of newer weapons was necessitated due to systems/weapons becoming obsolete/ irrelevant in the backdrop of extended schedule of design and development of LCA. The Committee took serious note of the delays at each stage of the project that rendered the original specifications obsolete and new requirements and their integration delayed the programme, further. The Committee noted that while LCA programme was*

being monitored by multiple agencies/bodies like General Body, Governing Body, involving the representation of MoD, Ministry of Finance at the highest level, various committees at ADA/Hindustan Aeronautics Limited (HAL) and Empowered Committee chaired by Chief of Air Staff. The delays in completion of work packages seriously affected the LCA programme schedules which could not be contained due to lack of coordination at various levels and ineffective monitoring of the programme by all the agencies involved. The Committee were of the view that casual approach of the monitoring agencies in enforcing the timelines led to inexplicable delays of more than 30 years on an ambitious Defence project. The Committee exhorted the Ministry to fix realistic timelines, taking into account technological complexities, for completion of remaining works urgently and apprised the Committee thereof. The Committee also desired to be apprised of details of the recommendations made by various review committees and action taken thereon within six months of presentation of this report. Further, the Committee while opining that the committees at the highest level could not decipher routine ground level difficulties due to preoccupations and other constraints desired that a core team, fully responsible for day-to-day decision making, be constituted with dual responsibility of achieving goals within timelines and ensuring that the end product complies with the standards specified by the user group. The function of this core team might be separated from monitoring and guidance given by other committees by making it responsible for tracking the day to day progress, resolving cross functional issues and making decisions about course corrections in case of delays, excess expenditure or major alterations in specifications.

17. The Ministry in their Action Taken Reply to the above recommendation of the Committee submitted as under:

> "In any Military Fighter Programme, periodic upgrade of weapons is a normal process of development. Concurrent engineering and development model has been followed in the LCA programme. Introduction of new weapons is a part of continous upgradation. Therefore, while few new weapons are being integrated currently as part of FOC; IOC standard aircraft (with a set of cleared weapons) are being produced and delivered to IAF 45 Sqn for operations; 12 SP fighters have been delivered so far.
>
> The AHQ has specified changes in weapon suite for more than 10 occasions from Feb 1997 to Nov 2012. However, it may be brought out that new weapon integration is a continuous process occurring during the life cycle of the aircraft and Tejas system architecture is such as to facilitate this in a reasonably easy fashion.
>
> The continuous process of integration of newer and modern weapons has happened during the development of Tejas. As a result LCA is one of the few aircraft in Indian inventory to have capability of firing the most modern BVR

missiles. This process would have taken much longer for an aircraft already in service."

18. In their vetting comments on the Action Taken Reply of the Ministry, the Audit submitted as under:

"The contention of the Ministry that in any military fighter programme periodic upgrade of weapons is a normal process of development is not accepted.

IAF admitted the fact that inclusion of newer weapons was necessitated due to systems/ weapons becoming obsolete/ irrelevant in the backdrop of extended schedule of the LCA Programme. Monitoring bodies with participation from highest level of MoD, Ministry of Finance could not succeed in proper coordination from the various work centres which resulted in inordinate delay in execution of LCA programme."

19. In response, the Ministry in their Action Taken Reply submitted as under:

"Periodic up gradation of any military fleet and even military transport fleet is an operational necessity and is a process carried out in any Air force the world over. The service life of a fighter aircraft extends over three decades (and in some cases like the MIG- 21 to over five decades). In this period, military technology evolves by leaps and bounds, modernising quickly, pushing extant systems to obsolescence. Periodic up-gradation /mid life upgrades are carried out, to retain the fighting edge of a military fleet, vis a vis the adversary /military environment, with a view to keeping the fleet, "as contemporary as possible". Such up-gradations are generally carried out, in a phased manner, without affecting operational requirements, ie while a portion of the fleet is inducted for up-gradation, the remaining aircraft in the fleet are still available for operations in the Air force, to be rotated later for up-gradation.

Examples abound in the IAF of periodic up-gradations. Most of the IAF's fleet has been upgraded at some point in time. The IAF's Jaguar fleet has been upgraded periodically to DARIN -2 and then on to DARIN -3 versions, with improvements to its Avionics/ NAV & Weapon Attack System (NAVWAS). The MIG 27, Mirage - 2000, MiG 29 fleets have also seen up-gradations mainly in Avionics and Weapon Delivery systems. The MiG 21 BiS fleet was upgraded in Russia to the MiG -21 Bison with Sensor/ Weapon / Avionics upgrades (the aircraft was utilised recently in the POK operations by IAF). The IAF's transport fleet An-32 is on upgrade in Ukraine.

The USA origin General Dynamics F-16 aircraft, utilised by many NATO countries, including Pakistan was inducted in the early 1980s as F-16 A/ B (Block 1 and 2.) Periodic upgrades have been undertaken in Blocks, to the current F-16 E/F Block 60, in use with our adversary Pakistan. Upgrades have been to enhance several aspects of Avionics, Weaponry, Night and low light capability, precision munitions, Electronic warfare etc.

In a like manner, upgrades in the future for the LCA, will be a normal feature, and will need to be undertaken, to keep pace with new weapon systems integration, technology enhancements / Avionics upgrades etc.

There is good cohesion and co-ordination among different organisations like Defence Research Development Organisation (DRDO), Hindustan Aeronautical Limited (HAL) & Indian Air Force (IAF) and decisions are taken collectively with active participation by MoD & MoF."

20. In their Original Report, the Committee had noted that the addition of new weapons by Air HQ for giving an operational edge to the LCA (March 1997, December 2009) necessitated design changes in the aircraft. This, coupled with addition of new specifications delayed the achievement of IOC/FOC. The Committee also observed that the delays in completion of work packages seriously affected the LCA programme schedules which could not be contained due to lack of coordination and ineffective monitoring of the programme by the multiple agencies involved. The Committee had accordingly exhorted the Ministry to fix realistic timelines, taking into account technological complexities for completion of remaining works urgently and apprise the Committee thereof. Further, in addition to details of the recommendations made by various review committees and action taken thereon, the Committee desired that a core team, fully responsible for day-to-day decision making, be constituted with the dual responsibility of achieving goals within timelines and ensuring that the end product complies with the standards specified by the user group. The Committee note from the Action Taken Reply of the Ministry that periodic up-gradation /mid life upgrades are carried out, to retain the fighting edge of a military fleet, *vis-a-vis* the adversary/military environment, with a view to keeping the fleet, "as contemporary as possible". Nevertheless, as per the submission of the IAF, inclusion of newer weapons was necessitated due to systems/weapons becoming obsolete/ irrelevant in the backdrop of extended schedule of the LCA Programme. The Committee, in this regard, express the view that monitoring bodies with participation from the highest levels in Ministry of Defence and Ministry of Finance could not succeed in ensuring proper coordination from the various work centres, thereby contributing to the delay in execution of LCA programme. The Committee also note that the Ministry has not responded to the recommendation of the Committee regarding fixing realistic timelines, constituting a core team and furnishing details of the recommendations made by various review committees and action taken thereon. The Committee, therefore, while emphasizing that the present monitoring mechanism in the Ministry needs to be reviewed and strengthened, reiterate their earlier recommendation and desire that immediate action be taken in this regard.

(Recommendation Para No. 6)

21. As per the Audit Report, the Air Staff Requirement (ASR) envisaged a total requirement of 200 fighters and 20 trainer aircraft of LCA. The trainer variant of the LCA was to retain all attributes of the fighter variant except for the changes necessary to accommodate a second seat for imparting training to IAF pilots. The ASR had envisaged that the fighter and trainer aircraft should enter the IAF service by 1994. Further, a full mission flight simulator of the LCA single seater variant was to be developed and delivered in advance of production aircraft (1994) as part of training requirement. However, 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 Aeronautical Development Establishment (ADE) for pilot training, pending supply of a FMS by HAL at LCA operating base. The Committee noted from the reply of the Ministry that towards induction and acceptance of series production aircraft, IAF pilots were trained on high fidelity simulator, and, therefore, the non-availability of trainer was not a serious concern towards induction. However, AIR HQ had expressed in Empowered Committee (EC) meeting that availability of operational trainer aircraft was essential for pilot training. The Committee were appalled at the casual reply of the Ministry that non-availability of trainer was not a serious concern towards induction as the reply undermines the usefulness of trainer aircraft. Further, as per reply of the Ministry, the Trainer PV-6 aircraft had been built equivalent to production standard trainer being utilised for Squadron Pilot's (SP) training, besides being used for FOC tasks. However , Audit has stated that since build-standard document was planned to be released only by March 2018 , the Ministry's contention that Trainer PV6 aircraft had been built equivalent to production standard didn't hold true . The Committee while reproving the Ministry for such baseless replies desired to be apprised of the correct and updated details regarding development of trainer aircraft. Further, the Committee desired that trainer variant of LCA be productionized in a time bound manner, preferably along with the combat variant , so that the pilots get the requisite exposure and training for flying the LCA.

22. With regard to the aforesaid recommendation of the Committee, the Ministry in their Action Taken Reply submitted as under:

> "The Trainer Aircraft is spin-off of fighter variant. The critical system like Avionics, Flight Control, Sensors, Propulsion System, etc is same as fighter. Hence, delays attributed in realizing fighter aircraft has direct implication in achieving FOC of Trainer.
>
> Trainer PV6 aircraft has been built equivalent to Production standard Trainer and is being utilised for Squadron Pilot's training besides being used for FOC tasks. Also state of the art, full fledged high fidelity mission simulator has been built for the Squadron for Pilot training.
>
> IAF decided that there would be no IOC Trainers. Instead all 8 trainers should be in FOC standard. Production drawings of trainer would be only to FOC standards and hence no IOC standard trainer production drawings were formally released.

Production standard drawings of FOC Trainer are planned to be released by June 2019.

The project to develop and install LCA Full Mission Simulator at Air Force Station, Sulur was sanctioned as a turnkey project (including building infrastructure to house the simulator) by IAF to ADE, DRDO. The total cost of the project is Rs.211 Crores (FE: Rs.37.90 Crores).

IAF has mandated ADE and not HAL to develop the FMS at Airforce Station Sulur. Procurement of long lead, high value items has already been initiated and is in various stages of approval. Building is getting ready.

The design & development activities are being executed on fast-track by ADE with an aim to hand over the simulator to IAF by year 2020-21, as desired by IAF."

23. The Audit in their vetting remarks on the Action Taken Reply of the Ministry stated as under:

"ASR envisaged that both fighter and trainer variants of LCA should enter IAF service by 1994, which has not materialised till date.

The trainer aircraft is yet to achieve FOC and handed over to IAF in the production batch i.e. series production aircraft. IAF had expressed that availability of operational trainer aircraft was essential for pilot training. As production standard drawings of FOC trainer are planned to be released in June 2019, IAF is constrained to fly the fighter LCA without any available trainer aircraft. Even the Full Mission Simulator, which was to be provided in advance of the production aircraft as specified in the ASR, is yet to be set up at the LCA squadron in Sulur."

24. The Ministry in response to the audit observation stated as under:

"Build Standard document (Drawing Applicability List & Equipment SOP) for Tejas Trainer was released on 05th July 2019 and HAL has initiated production activities for Series Production of Trainer.

Trainer PV6 aircraft has been built equivalent to Production standard Trainer (except for incorporation of Air to Air Refueling) and is being utilised for Squadron Pilot's training besides being used for FOC tasks. Also state of the art full fledged high fidelity mission simulator has been built for the Squadron for Pilot training at ADE.

IAF has mandated ADE and not HAL to develop the Full Mission Simulator at Air Force Station, Sulur. Procurement of long lead, high value items has already been initiated and is in various stages of approval. Building is getting ready. Simulator is planned to be handed to IAF by year 2020-21, as desired by IAF."

25. The Committee had noted that the Air Staff Requirement (ASR) envisaged a total requirement of 200 fighters and 20 trainer aircraft of LCA and the trainer

variant of the LCA was to retain all attributes of the fighter variant except for the changes necessary to accommodate a second seat for imparting training to IAF pilots. The Committee, however, were apprised that towards induction and acceptance of series production aircraft, IAF pilots are trained on high fidelity simulator, and therefore, the non-availability of trainer is not a serious concern towards induction. While disapproving the Ministry's circumventing replies, the Committee had desired that trainer variant of LCA be productionized in a time bound manner, preferably along with the combat variant, so that the pilots get the requisite exposure and training for flying the LCA. The Committee are however, constrained to note from the Action Taken Reply of the Ministry that the Build Standard document (Drawing Applicability List & Equipment SOP) for Tejas Trainer had only been released on 05th July 2019 and that HAL had initiated production activities for Series Production of Trainer. Even the Full Mission Simulator, which was to be provided in advance of the production aircraft as specified in the ASR, is planned to be handed to IAF by the year 2020-21. The Committee are dismayed to note the considerable delay in production of trainer variant of LCA resulting in loss of requisite exposure and training to the pilots for flying the LCA. The Committee, therefore, while reiterating their earlier recommendation, desire that an action plan with due promptitude may be formulated to expedite the production. The Committee would like to be apprised of the status of handing over of the Full Mission Simulator to IAF.

(Recommendation Para No. 7)

26. The Committee noted that the LCA Project Definition Phase (PDP) Review Committee, which examined the work done at Project Definition Phase, had strongly recommended (September 1989) early establishment of a standing Liaison Group between Air HQ and ADA to ensure closer interaction between the design team and the user for better appreciation of mutual perception, including appropriate trade-offs in performance, weight, time frame, cost, technological complexity and operational considerations of LCA. However, no such liaison group was formed and active user (Air HQ) participation in the LCA Programme started only after a long delay of 17 years in November 2006. The Committee noted from the Action Taken Notes that due to non formation of liaison group, maintenance related issues were not pointed out during early stages of the design and development programme by the test crew as well as test engineers impacting design modes and timelines. The Committee were of the view that sound project management involves preparation of a detailed requirement specification document which is complete description of the system to be developed containing all interactions users will have with the system as well as non- functional requirements at the planning stage itself i.e. well before execution of the project. The Committee while noting with dismay the belated involvement of users in the project which eventually delayed achievement of IOC/FOC and wastage of tax payers money and resources opined that user involvement right from inception would have gone a long way in effective and efficient completion of the project. The Committee desired that the requirements as specified by the IAF for LCA MK-IA and LCA MK-II be understood and

incorporated urgently to avoid further delays in achieving the timelines.

Further, the Committee observed from the reply of the Ministry that AIR HQ felt that formation of Standing Liaison Group earlier than 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of design of aircraft. Since provisions for induction of weapon systems, RWRs, Pods etc have to be made in the design stage of the aircraft itself the Committee were not convinced with the plea of the Ministry that formation of Standing Liaison Group comprising IAF personnel earlier than 2007 would not have yielded fruitful results. The Committee while observing that change in scope and user specifications led to huge delays were shocked at the reluctance of IAF in actively involving itself during the design stage. The Committee, therefore, desired the Ministry to fix responsibility upon officers who failed to ensure involvement of IAF personnel in the initial years of design of the aircraft and see that such instances are not repeated in projects involving thousands of crores of rupees and country's security.

27. The Ministry in their Action Taken Reply to the aforesaid recommendation of the Committee stated as under:

> "Air HQ felt that formation of Standing Liaison Group earlier than 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of design of aircraft. However, Air HQ personnel were participating in major Program reviews. Also IAF pilots were involved right from the beginning in flight testing through National Flight Test Centre, which is a part of ADA.
>
> IAF Pilots were directly involved in the Flight test programme for Technology Development during FSED Phase 1 from the beginning for flight test related activities. Also, IAF participation has been ensured in all major reviews of LCA programme since the initial stages. Project Monitoring Team (PMT) of IAF was formed in 2007, for better involvement of IAF Personnel in LCA Programme activities.
>
> IAF feedback from time to time, has been taken in to account; during design and development phases of LCA AF MK1. IAF has ordered 20 MK1 aircraft in IOC standard, 20 additional MK1 aircraft to FOC standard. IAF has also initiated procurement of 83 more aircraft in MK1A standard. The shortcomings in LCA AF Mk1 vis-à-vis the ASR were due a lack of understanding of the complexities of incorporating 4th generation technologies. As a result, LCA AF Mk1 is comparable to any other 4^{th} generation aircraft in its class. LCA AF MK2 in its current configuration, is altogether a new aircraft in medium weight category and it is not just an upgrade of MK1."

28. The Audit in their vetting remarks to the Action Taken Reply of the Ministry submitted as under:

> "Ministry stated that the shortcomings in LCA AF Mk-1 vis-a-vis the ASR were due a lack of understanding of the complexities of incorporating 4th generation

technologies. As a result LCA AF Mk-1 is comparable to any other 4th generation aircraft 1n its class. LCA AF Mk-2 in its current configuration is altogether anew aircraft in medium weight category and However the fact remains that formation of the liaison group right from the early stages of the LCA programme, as recommended by PDP review committee in 1989, would have ensured close interaction between the design team and the user for better appreciation of mutual perception.

This would have resolved many issues related to LCA Mk-I's shortfalls."

29. In response to the above said audit observation, the Ministry in their Action Taken Reply have stated as under:

"The shortfalls in LCA compared to the ASRs were not due to lack of coordination between the design and user agencies. They were mainly due to the technological complexities of incorporating 4th generation features. These became evident only after realization of the aircraft.

Air HQ felt that formation of Standing Liaison Group earlier than 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of design of aircraft. However, Air HQ personnel were participating in major Program reviews. Also IAF pilots were involved even before beginning of flight testing through National Flight Test Centre, (formed in 1994) which is a part of ADA.

IAF participation has been ensured in all major reviews of LCA programme since the initial stages. Project Monitoring Team (PMT) of IAF was formed in 2007, for better involvement of IAF Personnel in LCA Programme activities.

IAF feedback from time to time has been taken in to account; during design and development phases of LCA AF Mk-1."

30. The Committee had noted that despite the recommendation of the LCA Project Definition Phase (PDP) Review Committee for early establishment of a standing Liaison Group between Air HQ and ADA for ensuring closer interaction between the design team and the user and thereby leading to better appreciation of mutual perception, including appropriate trade-offs in performance, weight, time frame, cost, technological complexity and operational considerations of LCA, no such liaison group was formed and the active participation of Air Headquarters (user) in the LCA Programme started only in November 2006 i.e. after a long delay of 17 years. Questioned on reasons for such a long delay in forming the Liaison Group, the Ministry had in reply stated that formation of Standing Liaison Group before 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of the design of the aircraft. The Committee are amazed to note that the Ministry, in their Action Taken Replies, have now submitted that participation of IAF has been ensured in all major reviews of LCA programme since the initial stages. The Committee, while

expressing dismay at the divergent replies being submitted by the Ministry cannot help noting that delayed involvement of IAF contributed to the change in scope and user specifications, thereby leading to extension of timelines. The Committee, upon considering the facts of the matter, are of the opinion that user involvement right from the stage of project inception, would have possibly resulted in effective and efficient completion of the project. The Committee express their displeasure on the fact that the Ministry has not looked into and identified the reasons for the failure to ensure involvement of IAF personnel in the initial years of the designing the aircraft and fixing responsibility on those responsible for the lapse. The Committee, therefore, reiterate the need for fixing responsibility for the failure, and ensuring that such instances are not repeated, particularly in case of projects involving huge outlays and more importantly, concern the country's security.

CHAPTER II

OBSERVATIONS/RECOMMENDATIONS WHICH HAVE BEEN ACCEPTED BY THE GOVERNMENT

Observation/Recommendation

The Committee note that Light Combat Aircraft (LCA) programme was initially sanctioned in 1983 with a development schedule of eight to ten years against Indian Air Force (IAF's) requirement of induction by 1994. However, the project schedules slipped, mainly on account of design changes necessitated due to change in weapon requirements, non-availability of Kaveri engine, delay in completion of work packages by the work centres, etc. The Committee observe that LCA achieved Initial Operational Clearance (IOC), as late as, in December 2013 with 53 concessions/permanent waivers that reduced its operational employability considerably. Notably, the project is still in progress. The Performance Audit (PA) No. 17 of 2015 covered issues relating to Design, Development, Manufacture and Induction of Light Combat Aircraft (Air Force) 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. The Committee find that delays in execution of LCA project with respect to project definition, deficiencies in planning and financial management were commented upon by the Audit in Para 50 of Report No. 3 of 1989. Further, delay in execution of Phase-I of LCA project which included development of Multi Mode Radar, Flight control system, Digital Electronic Engine Control, integration of Kaveri engine on LCA, etc and consequent up-gradation of MiG-Bis aircraft, import of Su-30 MKI aircraft to cover the shortfall in fighter aircraft, were highlighted in Para 28 of the Report No. 8 of 1999. The Committee also note that the inordinate delay in fructification of Kaveri engine and cost overrun of the programme was pointed out by the Audit in Paragraph 5.1 of the Report No 16 of 2010-11 of the C&AG of India, Union Government, Defence Services (Air Force and Navy) for the year ended March 2009. The Committee's examination of the subject revealed that inspite of being pointed out by the Audit in 1999 and again in 2010-11, several shortcomings persist and accordingly they made observations/recommendations on the issues relating to the Ministry of Defence/Aeronautical Development Agency (ADA) as detailed in the succeeding paragraphs.

(Para 1)

Action Taken by the Ministry

- The Programme of indigenous development of Light Combat Aircraft (LCA) had been initiated in August 1983 with the Government sanction of an interim

development cost of Rs. 560.00 crores. There was no Technology base in the country.

- This sanction was to initiate the programme and carry out Project Definition Phase (PDP). After completing the Project Definition Phase, the report was submitted to Government and proposal to build 07 prototypes was made.
- The Government of India split the programme into Technology Development Phase and Operational Vehicle Development Phase.
- The Full Scale Engineering Development Programme Phase 1 (LCA FSED Phase 1) was sanctioned in June 1993 at a cost of Rs. 2188 crores (including the interim sanction of Rs. 560 crores given in 1983). This is only to develop Technologies & demonstration, not Operational Vehicles with the requisite Sensors and Weapons.
- Further, Government sanctioned LCA prototyping and full development only in 2001. For any comparison with International Programmes, this can be treated as the beginning of Operational Vehicle development. The IOC and FOC Tasks for induction of Aircraft into service was also defined only in FSED Phase-II sanction in 2001.
- IOC of LCA was achieved in 2013. FOC (Final Operation Clearance) obtained in Feb 2019.

- Maiden flight of first Series Production Tejas aircraft (SP1) of IOC configuration occurred on 30th Sept 2014.

- Tejas (SP1 & SP2) was inducted into Indian Air Force (IAF) as 45th Squadron on 01st July 2016 at Bangalore.

- Total Twelve Tejas aircraft (SP1, SP2, SP3, SP4, SP5, SP6, SP7, SP8, SP9, SP10, SP11 & SP12) built to IOC configuration have been inducted into IAF as 45th Squadron. Further SP aircraft will be delivered progressively by HAL to IAF for induction.

- It may be noted that LCA development took 20 years starting from 1993 including Technology Development which is comparable with the contemporary programmes like JAS-39, Euro fighter & JF-17. These Programme are backed up by existing design and development infrastructure.

- The issue of Kaveri Engine has been delinked temporarily from Tejas Programme, since the Kaveri Engine is in development stage.

- MMR co-development with ELTA with the indigenously developed Antenna Platform and antenna, sub-systems is completed and integrated on LCA.

Vetting Comments of the Audit

Statement made by Ministry that the LCA Programme was initiated in August 1983 with the Government sanction of an interim development cost of

Rs. 560 crore is not accepted No such mention was made in the Govt. sanction that the sanctioned cost was interim development cost.

Further Action taken by the Ministry

The LCA Development Programme was approved in July 1983 at an estimated cost of Rs. 560 crores (1982-83 price level). The twin objectives of the Programme were to meet the requirement of the Indian Air Force for replacement of MiG 21 series aircraft in the 90s and to bridge the gap in indigenous design and development capability in the aeronautical field. The estimate of Rs 560 Crores at the 1982-83 level was derived in the conceptual stage of the project; it was based on parametric estimation techniques and discussions with foreign aerospace firms. It was not possible at that stage to work out the cost precisely; CCPA was, therefore, informed that more specific estimates would be available as the programme developed.

This indicates that Rs. 560 crores was sanctioned for initiating LCA Development Programme.

Following Feasibility Studies (1983-85) and Pre-Definition Activities (1985-87), the Project Definition Phase (PDP) was taken up in July 1987 and completed in December 1988.

At the end of PDP, the basic aircraft configuration, system architecture and system/sub-system specifications were finalised. Work packages, work sharing plans between organisations, infrastructure augmentation as well as project time and cost estimates for development leading to Initial Operational Clearance (IOC) and Final Operational Clearance (FOC) were worked out in detail.

In June 1993 Govt. of India sanctioned full fledged Programme i.e., LCA FSED Phase-1 at a cost of Rs. 2188 crores including Rs. 560 crores of initial sanction amount.

Further Vetting Comments of the Audit

Ministry's statement that the LCA development took 20 years starting from 1993 including Technology Development comparable with the contemporary programmes like JAS-39, EURO fighter & JF-17 is not accepted by audit, considering the fact that the programme started in 1983 and still ongoing. As the LCA Mk-I did not meet the ASR of IAF, LCA Mk-II was sanctioned in order to meet the ASR. LCA development could be considered as completed only when LCA Mk-II achieves FOC. Thus, in spite of lapse of over three and a half decade, LCA programme is yet to be completed.

Further Action taken by the Ministry

- The Full Scale Engineering Development Programme Phase 1 (LCA FSED Phase 1) was sanctioned in June 1993 at a cost of Rs. 2188 crores (including the interim

sanction of Rs. 560 crores given in 1983). This is only to develop Technologies & demonstration, not Operational Vehicles with the requisite Sensors and Weapons.

- Further, Government sanctioned LCA prototyping and full development only in 2001. For any comparison with International Programmes, this can be treated as the beginning of Operational Vehicle development. The IOC and FOC Tasks for induction of Aircraft into service was also defined only in FSED Phase-II sanction in 2001.
- IOC of LCA was achieved in 2013. FOC (Final Operation Clearance) obtained in Feb 2019.

- It may be noted that LCA development took 20 years starting from 1993 including Technology Development which is comparable with the contemporary programmes like JAS-39, Euro fighter & JF-17. These Programmes are backed up by existing design and development infrastructure.

- It may be noted that LCA AF Mk-1 meets most of the requirements of ASR except few concessions. After completing the development, it is now understood that no 4th Generation aircraft can meet some of the ASR requirements and IAF has given the concessions based on this understanding.
- LCA AF MK2 in its latest configuration has evolved into an altogether new military fighter in Medium Weight category and has entirely new PSQR requirements.

Observation / Recommendation:

The Committee observe that the ADA could not complete flight testing activities for FOC during the currency of the consultancy contract (March 2009 to January 2013) with M/S European Aeronautic Defence and Space (EADS) comprising of two phases to be done along with the achievement of IOC and Final Operational Clearance (FOC) respectively, at a cost Rs.127.65 crore and had to go in for a second consultancy contract costing Rs.30.34 crore (August 2014) for completing the activities. The committee note with serious concern from the reply of the ADA that recommendations of the consultant could not be implemented during the period of contract as IOC schedules were shifted because of major snags, ejection related issues etc. and another contract was concluded with same firm for two tasks which should have been completed under the first contract itself. The Committee opine that the money spent on first consultancy was rendered wasteful as the ADA could not complete flight testing activities and subsequent induction of aircraft and had to close the contract without implementing the recommendations. The Committee admonish the ADA for not doing proper homework before engagement of consultants resulting in non-implementation of the task-wise recommendations of the consultant during the currency of the first contract, huge delays in meeting the IOC/FOC schedules and wasteful expenditure incurred on the first consultancy contract. **(Para 3)**

Action Taken by the Ministry

Flight testing was commenced by the design team. This task was being attempted for the first time in the country for a 4+ generation aircraft. However, IAF had experienced Flight Test Pilots and Engineers. Some bottlenecks were encountered during the flight testing and the overall effort appeared to be very large. The complexities involved came to light after some flight testing. Hence EADS Consultancy

was sought for Flight Test optimization towards achieving IOC/FOC at this stage in Flight Testing.

EADS Consultancy was sought for Flight Test optimization to achieve IOC/FOC. This was because this task was being attempted for the first time in the country. As a result, estimate of the flight test effort required for achieving IOC/FOC was an under estimate. It was only after the consultancy that this activity was completely understood. It is worth noting that consultancy got delayed by more than an year, because Boeing freezed the contracting procedure for more than an year before backing out due to Govt. clearance issues.

Grounding of aircraft once due to pipeline butting, second time due to ejection seat clearance, for 6 months due to safety critical Mods implementation further delayed the schedules. As a result even though most of the recommendations were implemented they could not be flight tested in time. Subsequently IOC was achieved by flight testing based on the EADS recommendations.

The extension of the Consultancy was to seek their help during flight testing of some high risk activities like High AoA Envelope Expansion, Automatic Low Speed Recovery, Stores Separation of FOC stores. EADS recommendations were already available from the first Consultancy for these tasks.

The current Consultancy was primarily a risk mitigation plan for support during flight tests and accelerating the same. In addition, it caters to some of the issues identified in Post-IOC and FOC stores identified beyond 2009.

It is to be noted that Consultancy itself was delayed by about 18 months due to US Govt. restrictions. If it had started as planned, IOC/FOC could have been achieved much earlier.

Also the fact remains that LSP6 can be handed over to the user as a FOC Production standard LSP aircraft (with appropriate instrumentation) due to the inputs from the Consultancy. Without the Consultancy, LSP6 would have been consumed as a dedicated High AoA Test vehicle.

Vetting Comments of the Audit

Due to major snags in development of aircraft, ADA could not derive the required benefit from the first consultancy contract which necessitated avoidable expenditure on conclusion of another contract to complete the activities planned under the first contract. As regards LSP 6 aircraft, as per the commitment given to CCS, all the eight LSP aircraft were to be handed over to IAF and there was no question of the aircraft being consumed as a dedicated High AoA test vehicle. These aircrafts were not meant for flight testing.

Further Action Taken by the Ministry

a. In the first contract, all the recommendations of the consultant had been received and implementation of the same was in progress. This consultancy had three objectives, viz.

i. Identify design improvements to make the aircraft more reliable and to meet operational requirements for release to service,
ii. Identify testing techniques and procedures to improve efficiency of flight testing.
iii. Evolve an efficient flight test plan harmonizing all the flight test requirements.

b. The above objectives had been achieved as per the consultancy. Note that the objectives were common to both IOC and FOC and were a continuous process of implementation till the conclusion of the contract.

c. During the final stages of FOC, some of the more high risk and technically complex activities like high AoA expansion, Air to air refueling, Separation of aerodynamically complex stores like RTU bombs were being attempted for the first time in the country. It was felt that involvement of EADS during these flight tests would be beneficial for risk mitigation. In fact, high AoA envelope expansion from 24 deg AoA (for IOC) to 25 deg AoA (post IOC) had already been completed without assistance of EADS before phase 3 consultancy was in place. Hence this part of Phase 3 consultancy was only a limited support during flight testing. It is to be noted that in the earlier contract, an option clause had been provided for extension of Task 1 (i.e. high AoA envelope expansion) beyond the contract period of 42 months at an additional cost of 22000 Euros per quarter. This was because it was expected at the outset that this task could extend beyond 42 months being the most complex task . However, this option clause was not availed since most of the flight activities at the conclusion of the contract were focused towards IOC-2 certification. Subsequently, after FOC flight testing commenced, limited support for Task 1 was availed in the new contract.

d. Towards end of IOC-2 some new critical issues involving disciplines not included in the original consultancy came up. Examples of these are: Improvements to crew escape system, New stores like RTU (250/450/practice) bombs which were added in late 2012 and were aerodynamically complex, improvement to wing lightening protection, belly landing clearance, etc. it should also be noted that air to air refueling was not a part of the earlier SOW. This was because ADA also had a contract with Cobham for integration of the air to air refueling probe with the aircraft. However, it became clear towards the end of the earlier consultancy that while Cobham would be able to help in aircraft integration, the actual fight testing to achieve air to air refueling was a very challenging activity. For this it was felt desirable to have a consultancy with an aircraft house (EADS) in addition to the consultancy with the probe manufacturer (Cobham). These new activities were identified in Phase 3 as new consultancy areas.

e. Also the fact remains that LSP6 can be handed over to the user as a FOC Production standard LSP aircraft (with appropriate instrumentation) due to the inputs from the Consultancy. Without the Consultancy, LSP6 would have been consumed as a dedicated High AoA Test vehicle.

Observation / Recommendation:

The Committee observe that LCA Mark (MK)-1, which achieved Initial Operational Configuration (December 2013) had significant shortfalls (53 permanent waivers/concessions) in meeting the Air Staff Requirement (ASR) resulting in

reduced operational capabilities and survivability, limiting its operational employability. The Committee note from the reply of the ADA that 20 out of 53 concessions that were accorded by Air (Headquarter) HQ/IAF at the time of IOC were permanent waivers being technologically unachievable and remaining 33 were not safety critical and had insignificant impact on the combat performance of the Aircraft. However, as per the reply of IAF, the concessions/permanent waivers would adversely impact the operational preparedness and the 33 temporary concessions would affect LCA's combat potential. Resultantly, the IAF would be constrained to use the LCA MK-1 with reduced operational capabilities. The Committee note the apprehensions expressed by Air HQ, as early as in 1989 that aircraft planned to be developed by ADA would be deficient in crucial parameters, volume and weight adversely affecting its performance and find that the same have not been overcome in LCA MKI developed by ADA.

The Committee further note that LCA Mk-1 is deficient in Electronic Warfare (EW) 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 (CMDS) fitted on the aircraft are having performance issues, which are yet to be overcome. The Committee observe from the reply of the IAF that EW suite draws more power and requires lot of real estate in fighter aircraft and an internal SPJ shall be integrated on LCA Air Force (AF) MK-II. Further, a podded active jammer is planned in MK-IA to meet the EW capabilities.

The Committee are disappointed to note that even after almost three decades , the ADA has not been able to develop the indigenous aircraft as per requirements of IAF in terms of combat potential and serviceability and opine that non fulfilling of requirements of the users has rendered investment of both time and money in the project, so far, infructuous. The Committee desire to be apprised of the total costs incurred on the project till date and the estimated costs until the FOC is achieved. The Committee expect that development of LCA Mk-II being done by ADA will overcome the shortcomings in LCA MK I and desire that the same may be done within fixed timelines to restore confidence in the LCA project.

(Para 5)

Action Taken by the Ministry

- LCA is 4th generation aircraft and is comparable to any other contemporary aircraft in its class e.g. JAS39, Gripen. At the time of ASR, designers did not have any experience of developing 4th generation technologies. However, as 4th generation technologies were understood later and incorporated,

- 20 Permanent Waivers were Technologically unachievable. Out of 33 Temporary concessions, only 8 were applicable to IOC and all of them have been closed.

- The combat potential of IOC Aircraft is complied with the ASR and Permanent Waivers given by AHQ letter dated Dec 2013. The majority of the serviceability requirements are addressed in Mk-1 aircraft and the further improvements are planned in Mk-1 A.

- LCA Tejas is not integrated with active self protection Jammers. It can be noted that major fighters of air force fleet like MIG 21BIS, MIG 29, Su 30 etc are not equipped with any EW

systems. Russian combat doctrine has jammers escorting fighters. Fighters don't carry any EW suite as EW suite draws more power and requires lot of real estate in fighter aircraft.

- Total sanction for LCA AF Mk-1 Programme is Rs. 9616.48 Crores and Cumulative Expenditure as on 31st Mar 2019 is Rs. 8889.48 Crores.

- IAF has ordered 20 LCAs in IOC configuration; 20 more in FOC standard and 83 additional aircraft in MK1A standard. LCA AF MK2 in its latest configuration has evolved into an altogether new military fighter in Medium Weight category and it is expected to meet new ASR performance requirements. Lessons learnt from LCA AF Mk-1 Programme will be implemented during the execution of LCA AF Mk-2 Programme to contain delays.

Vetting Comments of the Audit

Though it has been stated that LCA is 4th generation aircraft compared to any other contemporary aircraft in its class, however the LCA Mk-1 did not meet the ASR and apprehensions expressed by Air HQ as early as in 1989 that the aircraft would be deficient in crucial parameters came to be true, in view of the concessions/permanent waivers granted. Moreover, IAF admitted that the concessions/permanent waivers would adversely impact the LCA's combat potential and IAF would be constrained to use the aircraft with reduced operational capabilities.

LCA MK2 Programme is futuristic & is yet to be commenced.

Further Action Taken by the Ministry

- LCA is 4th generation aircraft and is comparable to any other contemporary aircraft in its class e.g. JAS39, Gripen. At the time of ASR, designers did not have any experience of developing 4th generation technologies. However, as 4th generation technologies were understood later and incorporated, the achievable performance of a 4th generation aircraft was understood.

- 20 Permanent Waivers were Technologically unachievable. Out of 33 Temporary concessions, only 8 were applicable to IOC and all of them have been closed.

- The combat potential of IOC Aircraft is complied with the ASR and Permanent Waivers given by AHQ letter dated Dec 2013. The majority of the serviceability requirements are addressed in Mk-1 aircraft and the further improvements are planned in the 83 Mk-1 A aircraft under order from IAF. It is to be noted that the Mk1A aircraft has the same performance as the Mk1 aircraft, albeit with some internal improvements.

- LCA MK2 Programme has already been initiated as development of a Medium Weight Fighter.

Observation / Recommendation

The Committee find that Government of India had emphasized (June 1993) increasing the indigenous content of LCA while sanctioning Full Scale Engineering Development (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 only (January 2015). The Committee note from the reply of the Ministry that indigenisation of the all-electronic components in India was not practical due to the lack of infrastructure of manufacturing and such huge investments are not part of LCA

programme and the total indigenisation content of 70% in LCA as claimed by ADA is valid. Further, the Ministry stated that no country aims at 100% indigenous content and only indigenous contents of all strategic equipment is enhanced. The Committee observe that the prototype version of LCA was to be developed with a proven imported engine, while the production version of LCA was to use indigenous engine. However, the Committee find that Gas Turbine Research Establishment (GTRE), could not develop Kaveri engine as per the LCA schedule and specifications. The Committee are constrained to note that even after incurring an expenditure of more than Rs.2000 crore on this project, indigenous development capability for LCA propulsion had not been successful and resultantly, LCA has been made perennially dependant on GE imported aero engines throughout its service life. The Committee while opining that GTRE has failed miserably in its attempt to develop an indigenous engine desire that since GTRE has been entrusted with development of strategic equipment it may be upgraded from merely a lab under DRDO to a fully autonomous organisation empowered to take decisions on its own capable of attracting and recruiting best talents in the field. Similarly, a review of the functioning and achievements of DRDO and HAL may also be carried out to suggest ways to improve their working.

The Committee also note that the LCA programme suffered major setbacks in the indigenous development of Multi-Mode Radar, Self-Protection Jammer, etc.; development of Jet Fuel Starter, though achieved indigenously, had unresolved performance issues and the proposal for indigenous development of 109 LRUs has been pending for approval since February 2014. The Committee are dismayed to note that even after more than twenty five years after the Government of India shifted the focus on maximising the indigenous development, only a few fully indigenised components/systems could be developed. The Committee are of the view that with the IAF placing such bulk orders involving thousands of crores of rupees for supply of aircraft, 100% indigenisation of the components/systems has to be encouraged. The Committee are of the considered opinion that a clear roadmap be developed to ensure that indigenous components/systems are maximized before productionization of LCA MK-IA and LCA MK-II. Further, setting targets against which the performance can be evaluated, positively impacts the efficiency and efficacy. Given that India has abundant brain power and is a shining star in the field of space with indigenously developed technology, the Committee desire that adequate financial support and encouragement from the Government of India be provided so that indigenisation of components/engine/systems be earnestly developed with the help of committed research and development.

(Para 8)

Action Taken by the Ministry

LCA development Programme was sanctioned to primarily to design and develop an indigenous aircraft with available indigenous and foreign technologies wherever necessary. New technologies were first proven using proven bought out LRUs. Subsequently after proving the technologies, the task of indigenization of LRUs was taken up and sufficient progress has been made.

It is submitted that the focus to realise fully functional, Indigenously designed aircraft which has been successfully achieved. In the process of Development, large amount of indigenisation has been done. After proving full functionality (Final Operational Clearance), complete stock of further indigenisation requirements has been taken and roadmap has been prepared.

179 out of 344 Line Replaceable Units (LRUs) have been indigenized, integrated and flight tested on LCA. Further detailed plan for indigenization of 109 LRUs generated. The proposal is under financial scrutiny. These newly developed LRUs will be incorporated in LCA Mk 1A / Mk 2 Programme.

Detailed costing on LCA (Tejas) aircraft has been worked out by HAL, which is the Production centre for Tejas. It may be noted that, the Total cost of the Aircraft is Rs. 172.49 Cr (@ 2015 Price Level) and Total Indigenous content is 62% taking indigenous Material cost, LRUs cost and Manufacturing Cost.

Vetting Comments of the Audit

Even though ADA claimed that the indigenous content of LCA was 70 per cent, HAL has assessed the indigenous content as 62 per cent which contradicts ADA's claim. Moreover, LCA will be perennially dependent on imported aero engine throughout its service life as Kaveri engine could not be developed by GTRE even after spending over '2000 crore. Other crucial systems such as MMR, Self-Protection Jammer could not be developed indigenously and the indigenous Jet Fuel Starter had performance issues. Thus, indigenisation of crucial components during the course of development of LCA was largely unsuccessful.

Further Action Taken by the Ministry

- The major spinoff of LCA has been the development of 4th generation design capabilities indigenously in the country, e.g. aerodynamic design, composites, fly by wire, digital avionics, etc. These technologies are critical for any future aircraft development. These critical technologies are now 100% indigenously available to the country.

- Indigenous content of LCA is 70 per cent at overall equipment level (as claimed by ADA) and 62 per cent by overall aircraft cost (as assessed by HAL).

  HAL has assessed the indigenous content as 62 per cent based on aircraft Production cost. i.e., Total cost of the Aircraft is Rs. 172.49 Cr (@ 2015 Price Level) and Total Indigenous content is 62% taking indigenous Material cost, LRUs cost and Manufacturing Cost.

- The LCA AF Mk -1 is presently powered by the GE 404 IN 20 (of USA origin). This was the chosen engine for the LCA, around which the Airframe and system architecture has been designed, integrated and flown to achieve IOC and FOC. The issue of Kaveri Engine has been delinked temporarily from Tejas Programme.

  Kaveri engine development is the only indigenous military gas turbine engine development programme of the country. This will constitute the basis for all future fighter engine development programmes in the country. The Kaveri programme is an ab-initio efforts, without any such precursor programme and hence the additional time taken in development. The lack of manufacturing and testing infrastructure in India has also contributed to these delays.

In the nutshell, LCA will be flying with imported aero engine. However, the expertise gained in the development of Kaveri engine is being utilized in the development of a Kaveri derivative dry engine for application in Indian Unmanned Combat Air Vehicle (IUCAV)

- Performance issues with Jet Fuel Starter (JFS) have been resolved.

- Multi Mode Radar - MMR (Mechanically Scanned Array – with moving antenna) co-development with M/s ELTA, Israel with the indigenously developed Antenna Platform and antenna, sub-systems has been completed and integrated on LCA AF MK1 IOC Aircraft and the same will be used for FOC standard aircraft. Indigenously developed AESA (Active Electronically Scanned Array) Radar is currently installed on Tejas LSP2 aircraft. Ground based testing on the Aircraft, followed by flight testing of AESA Radar is under progress since from May 2018. During initial phase of flight testing of AESA Radar, the results are encouraging. Further flight testing is under progress for complete evaluation of AESA Radar and is planned for fitment on LCA AF Mk-2.

Observation / Recommendation

The Committee note that due to huge delays in development and induction of LCA, forming of two LCA squadrons could not materialize, IAF had to up-grade MiG-BIS, MiG-29, Mirage-2000 and Jaguar aircraft at a cost of Rs.20,037 crore, phasing out of MiG-21 had to be revised and IAF is operating with 35 squadrons as against 42 squadrons sanctioned out of which squadrons for MiG-21 aircraft and MiG-27 aircraft would retire over the next ten years. The Committee are disappointed to note that the failure of HAL/ADA and Ministry of Defence (MoD) to provide the required number of aircraft has adversely affected the combat potential of the IAF resulting in security threat to the country. The Committee note with serious concern that due to lack of R&D in the aviation sector the country has to shell out thousands of crores of rupees for procurement of both combat as well as civil aircraft from foreign countries. It is needless to mention that at times of war it would be difficult for the nation to procure combat aircraft from unfriendly countries. The HAL, ADA and its work stations are miserably failing in its R&D to have the much needed technology in the aviation sector. The Committee while noting the temporary measures taken by the IAF to maintain the operational preparedness and to overcome the drawdown of squadron strength exhort the Ministry to take urgent steps to expedite development of LCA to cater to the needs of the IAF so as to restrict imports of fighter aircraft of this class and ensure self-reliance of the country in the long run. The Committee desire to be apprised of the schedule for induction of aircraft for overcoming depleting squadron strength of IAF.

(Para 9)

Action Taken by the Ministry

- Initial Operational Clearance (IOC) for Tejas Mk I obtained on 20 Dec 13. Maiden flight of first Series Production Tejas aircraft (SP1) of IOC configuration occurred on 30th Sept 2014.

- Development activities and flight testing to achieve Final Operational Clearance (FOC) with Beyond Visual Range, Air to Air missiles and Air to Air refueling completed. FOC obtained in Feb 2019

- FOC build standard drawings for fighter aircraft released on 31st Dec 2018. Production initiated

- At present, IAF has placed orders on HAL for procurement of 40 Tejas Mk 1 aircraft (20 IOC std and 20 FOC std). Aircraft buildup in progress.

- Tejas (SP1 & SP2) was inducted into Indian Air Force (IAF) as 45th Squadron on 01st July 2016 at Bangalore.

- Total Twelve Tejas aircraft (SP1, SP2, SP3, SP4, SP5, SP6, SP7, SP8, SP9, SP10, SP11 & SP12) built to IOC configuration have been inducted into IAF as 45th Squadron. Further SP aircraft will be delivered progressively by HAL to IAF for induction.

- The delivery of sixteen LCA fighters in IOC would be completed by July 2019. The second FOC sqn is likely to be formed in last quarter of 2019 and delivery of the fighters in FOC configuration is likely to be completed by Mar 2021.

- LCA Mk-1A delivery is planned to commence from To + 3 years with To being the date of signing of contract. Assuming contract is signed by end Oct 2019, LCA Mk-1A aircraft delivery and induction is likely to commence by 2022-23. A total of 83 LCA Mk-1A are planned to be inducted.

- There is good cohesion and co-ordination among Defence Research Development Organisation (DRDO), Hindustan Aeronautical Limited (HAL) & Indian Air Force (IAF) and decisions are taken collectively.

Vetting Comments of the Audit:

(i) The Tejas Squadrons consisting of sixteen LCA SP aircraft which have been delivered to IAF are of IOC standards which do not meet IAF operational need. FOC aircraft aircrafts are yet to be productionised.

Further Action Taken by the Ministry

a) Initial Operational Cleared aircraft, delivered to IAFs No. 45 Squadron are operationally viable with the weapons cleared in both Air to Air and Air to Ground roles. To reiterate from Para 10, IOC LCA AF MK1 are cleared for operations with Close Combat Missiles in Air to Air role and in Air to Ground role with conventional bombs (1000 lbs) in conventional modes of attack as well as precision mode of attack with Laser Guided 1000 lbs bombs (LGBs). All sensors associated with these weapons are operational. All navigation sensors are operational.

b) The aircraft, in IOC standard, has already been operationally exploited in IAF live exercises. Over 2500 sorties have been flown by the IAF Squadron, since induction of LCA, all accident free.

c) Most of the capabilities built into FOC aircraft can be incorporated in the IOC aircraft as well (except for Air to Air Refueling)

- Finalised build standard document (Drawing Applicability list & Equipment SOP) for FOC Block of Fighter aircraft was released on 31 Dec 2018 to HAL Tejas Division to enable Series Production of FOC standard LCA Fighter.

- Production of FOC Standard Series Production (SP) aircraft has commenced. Delivery of FOC SP aircraft by HAL is expected to commence from last quarter of 2019.

- Build Standard document for Tejas Trainer was released on 05th July 2019 and HAL has initiated production activities for Series Production of Trainer.

Further Vetting Comments of the Audit

(ii) "LCA MK-1A contract is yet to be cancelled. Thus as of now fulfilment of operational need by arresting drawdown squadron strength by Tejas Production is far drawn conclusion."

Further Action Taken by the Ministry

"LCA MK-1A contract is yet to be concluded".

Defence Acquisition Council (DAC) accorded Acceptance of Necessity (AoN) for 83 LCA Mk-1A aircraft at a cost of ~Rs. 50,000 Crores on 08th Nov 2016 which is the single largest approval for a DRDO developed system. Subsequently, Request for Proposal (RFP) was issued by IAF in 2017. A detailed proposal in this regard has been submitted to the customer. Cost Negotiation Committee has completed its proceedings.

Observation / Recommendation

The Committee observe that the LCA project was sanctioned in 1983 to provide replacement aircraft for MiG-21 series which were to complete their technical life and were to be phased out in 1990s. As specified in ASR (Air Staff Requirement) specified in 1985, the LCA was to be inducted into IAF by 1994. The Committee note that the Departmentally related Standing Committee on Defence in their Seventh report, thirteenth Lok Sabha had desired the Ministry of Defence to come out with a fixed and irrevocable date of induction of LCA. The Committee had hoped that all possible steps would be taken to put the LCA on the production line at the earliest possible after reviewing at the prototype stage so that it can be inducted into IAF during the 10th Plan period i.e. by 2007. The Committee note that despite repeated observations of the Audit and the Parliamentary Committee on Defence on the delays in the project, the situation has not been improved much. The Committee are aghast to note that, as on 31 July, 2018, IAF has only got 9 out of the 200 fighter and 20 trainer aircraft envisaged in ASR. These 6 aircraft have been productionised after only an Initial Operational Clearance (IOC) and are not combat ready, as yet. The Committee are perturbed to note that the Final Operational Clearance (FOC) has still not been achieved by the LCA even after more than 5 years of IOC. The ADA/HAL have also not been able to provide IAF with even a single production standard trainer aircraft till date. Further, since HAL could not augment its capacity in line with the demand of the IAF, the IAF will have to depend on imported aircraft for a longer time, given its dwindling squadron strength. The Committee are disappointed at the progress of the project as even after three and a half decades, the country has not been able to get its first combat ready indigenous fighter aircraft. The Committee opine that these delays have, besides increasing the costs, limited the combat potential of the IAF. The Committee exhort the Ministry to actively monitor the project to ensure that FOC is achieved within its timeline, capacity is increased as soon as possible, much needed trainer aircraft are supplied to IAF, better coordination is ensured and costs are optimised.

(Para 10)

Action Taken by the Ministry

- Initial Operational Clearance (IOC) for Tejas Mk I obtained on 20 Dec 13. Maiden flight of first Series Production Tejas aircraft (SP1) of IOC configuration occurred on 30th Sept 2014.
- Development activities and flight testing to achieve Final Operational Clearance (FOC) with Beyond Visual Range, Air to Air missiles and Air to Air refueling completed. FOC obtained in Feb 2019
- FOC build standard drawings for fighter aircraft released on 31st Dec 2018. Production initiated.
- Production standard drawings of FOC Trainer are planned to be released by June 2019.
- At present, IAF has placed orders on HAL for procurement of 40 Tejas Mk 1 aircraft (20 IOC std and 20 FOC std). Aircraft buildup in progress.
- Tejas (SP1 & SP2) was inducted into Indian Air Force (IAF) as 45th Squadron on 01st July 2016 at Bangalore.
- Total Twelve Tejas aircraft (SP1, SP2, SP3, SP4, SP5, SP6, SP7, SP8, SP9, SP10, SP11 & SP12) built to IOC configuration have been inducted into IAF as 45th Squadron. Further SP aircraft will be delivered progressively by HAL to IAF for induction.
- There is good cohesion and co-ordination among Defence Research Development Organisation (DRDO), Hindustan Aeronautical Limited (HAL) & Indian Air Force (IAF) and decisions are taken collectively.
- The Trainer Aircraft is spin-off of fighter variant. The critical system like Avionics, Flight Control, Sensors, Propulsion System, etc is same as fighter. Hence, delays attributed in realizing fighter aircraft has direct implication in achieving FOC of Trainer.
- Trainer PV6 aircraft has been built equivalent to Production standard Trainer and is being utilised for Squadron Pilot's training besides being used for FOC tasks. Also state of the art, full fledged high fidelity mission simulator has been built for the Squadron for Pilot training.
- IAF decided that there would be no IOC Trainers. Instead all 8 trainers should be in FOC standard. Production drawings of trainer would be only to FOC standards and hence no IOC standard trainer production drawings were formally released.
- Production standard drawings of FOC Trainer are planned to be released by June 2019.
- The project to develop and install LCA Full Mission Simulator at Air Force Station, Sulur was sanctioned as a turnkey project (including building infrastructure to house the simulator) by IAF to ADE, DRDO. The total cost of the project is Rs.211 Crores (FE: Rs.37.90 Crores).
- IAF has mandated ADE and not HAL to develop the FMS at Airforce Station Sulur. Procurement of long lead, high value items has already been initiated and is in various stages of approval. Building is getting ready.
- The design & development activities are being executed on fast-track by ADE with an aim to hand over the simulator to IAF by year 2020-21, as desired by IAF.

- It may be noted that LCA development took 20 years starting from 1993 including Technology Development which is comparable with the contemporary programmes like JAS-39, Euro fighter & Rafale. These Programme are backed up by existing design and development infrastructure.

- **The following measures have been taken to ensure the earliest completion of the LCA (LCA AF Mk-1) Programme:**

  1. Phased development approach for LCA development was changed to Concurrent Development approach.

  2. Following reviews are held continuously to avoid further delay:

     - Daily reviews at LCA Assembly hanger,
     - Weekly Review in ADA,
     - Special Review Committees have been set up by Honourable Raksha Mantri to review the Progress of the programme regularly;
       - ✓ Every month by Deputy Chief of Air Staff.
       - ✓ Quarterly review by Empowered Committee, Chaired by Chief of Air Staff.
     - Half yearly review by Governing Body chaired by Secy, Dept. Defence R&D.
     - Annual Review by General Body chaired by Honourable Raksha Mantri.

  3. Formation of Project Monitoring Team (PMT) with Air Force officers at ADA.

  4. Formation of Quick Reaction Teams (QRT) to resolve design/production issues.

  5. LCA Programme Review by Director General (DG) – ADA held at regular intervals.

  6. Review of LCA Programme with Honourable Raksha Mantri was held continuously to monitor the progress.

  7. Development of alternate sources/work centres for support of LCA programme requirements.

  8. Co-development strategy with foreign vendor for Techno critical Multi Mode Radar development has been implemented.

  9. The programme is rescheduled to suit the Induction Programme of Indian Air Force.

- **Further, ADA/DRDO HQs has drawn detailed guidelines for initiating and undertaking new projects, for monitoring of projects ensuring time bound successful completion of the projects. The following aspects have been considered;**

  - Estimation of realistic timelines of various project activities.
  - Implementation of effective in-built monitoring mechanism.
  - Obtaining prior approval of sanctioning authority for major deviations in complex technology projects to avoid delays.

- Involvement of users/customers from the beginning of the projects.

Vetting Comments of the Audit

(I) "The Ministry has admitted that IOC aircraft are devoid of critical system like Avionics, Flight control sensors, Propulsion system which would be available in FOC standard aircraft.

Further Action Taken by the Ministry

Initial Operational Cleared (IOC) LCA are well capable of undertaking Operational Roles for the IAF both Air to Air / Air to Ground and Multi Role (ie Air to Air and Air to Ground or vice versa in the same mission.

At no point in time, has ADA as a Design Agency, ever contended that Initial Operationally Cleared Aircraft (IOC standard), are devoid of critical systems like Avionics, Flight Control systems, Sensor, Propulsion system etc. Nor has ADA made such a mention in any forum.

IOC standard aircraft have been inducted into No. 45 Squadron IAF, based at Sulur. A Squadron strength has already been inducted. The aircraft are being exploited operationally by IAF Squadron Pilots. The aircraft has participated in major IAF Exercises (operationally live) both Air to Ground and Air to Air roles – IAF Exercise Gaganshakthi (April/.May 2018) and Vayushakthi (Feb/Mar 2019) are testament to the roles undertaken.

Avionics / Flight Controls / Propulsion/Sensors are already proven and operationally exploitable in IOC standard.

Essential Difference (IOC & FOC standard aircraft)

IOC Standard aircraft, made the platform operational with Close Combat Missiles and Conventional Air to Ground bombs, in use with the IAF. FOC standard aircraft for which drawings have already been handed over to the HAL (the manufacturer), added specific capabilities to operations by the aircraft. These in main are :

- Air to Air Refuelling
- Air to Air Beyond Visual Range Missile Capability
- Air to Ground Bombs of high speed low drag variety.

These capabilities add to the punch in operational exploitation by the IAF. These capabilities (Air to Air Refuelling & BVR missile) are force multipliers and provide Air Superiority capability on the lines of Mirage 2000/Su30 MK-1. Software version addition/changes are made to the avionics/sensors to accommodate the additional capabilities.

Further Vetting Comments by Audit

(ii) "The drawings of FOC were planned for June 2019. Thus there would be further delays in achievement of fully operational combat ready indigenise aircraft."

Further Action Taken by the Ministry

- Finalised build standard document (Drawing Applicability list & Equipment SOP) for FOC Block of fighter aircraft was released on 31 Dec 2018 to HAL Tejas Division to enable Series Production of FOC standard LCA Fighter.

- Production of FOC Standard Series Production (SP) aircraft has commenced. Delivery of FOC SP aircraft by HAL is expected to commence from last quarter of 2019.

- Build Standard document for Tejas Trainer was released on 05th July 2019 and HAL has initiated production activities for Series Production of Trainer.

Observation / Recommendation

The Committee note that air operations by any Air Force involve employment of air assets by themselves or in concert with other assets which are a part of the overall strategy in case of a war. They observe that development of LCA was to arrest the falling number of fighter aircraft due to the ageing and obsolete MiG-21 and MiG-27 fleet and to maintain minimum squadron strength of the Indian Air Force. However, the project was plagued with various technical issues resulting in timelines being extended due to which the Government had issued Request for Information (RFI) under the framework of the Defence Procurement Procedure (DPP), 2016 to global vendors for the procurement of other combat aircrafts such as the American F-16 Block 70 and Globemaster C-17, Russian Sukhoi Su-30 and Su-35, European Eurofighter Typhoon, Swedish Gripen-E, French Rafale etc. The Committee while noting that Light Combat Aircraft (LCA) are effective for combat missions requiring light strikes and other interdiction roles opine that a multi role combat aircraft is still required to effectively counter any aerial threats during war or peace time to maintain overall security of the nation as evident from the inventories of the air forces of the developed nations like USA and Russia. The Committee are of the view that it is high time that indigenous development and production of other combat aircraft such as aerial refuelling, bombers, transport, unmanned aerial vehicles (UAVs) electronic warfare, airborne early warning and control system may be initiated so that the bouquet of air assets in the Indian Air Force's inventory may be complete and dependence on combat aircraft of foreign origin may lessen and eventually brought down to nil. While signing contracts with foreign vendors, it should be ensured that transfer of technology permeates within the Indian production and manufacturing sector thereby giving a boost to indigenous production.

Further, the Committee recommend that more emphasis should be laid on the indigenous research and development (R&D) of complex military technologies by involving premier institutions like IITs, IISc, etc., and private sector, creating dedicated agencies, supported by a think-tank, for development of critical components and providing adequate funds so that these institutions may develop cutting edge technologies which is eventually passed on to defence production sector to make the country self sufficient and reliant.

Also, the Committee recommend that while developing and producing next Generation Fighter Aircraft, the negotiations be made for full-scale transfer of technology (ToT), including the fighter's source codes, full system and software control and the establishment of a production assembly line in the country, so that the country's own engineers get a hands-on experience of learning the art of constructing and designing a plane by paving way for future indigenous manufacture and production.

(Para 11)

Action Taken by the Ministry

- With the development of LCA a complete ecosystem for combat aircraft development has been established in the country. Indigenous design capabilities in the areas of Fly by Wire Control, Advanced Digital Avionics, Composite Structures Design, Aerodynamic Design of Complex Unstable Vehicles, etc have been matured and proven through extensive flight tests. Using this expertise already programmes have been launched for medium weight combat aircraft for replacing platforms like Mirage, Mig29 and Jaguar. In parallel, a program for a Fifth Generation Aircraft has also been launched to meet the future needs of the IAF. With these developments, IAF will become completely self sufficient for combat aircraft. DRDO has also initiated programs for developing UAVs like Rustom. Also the indigenous AWACS developed by DRDO has already been inducted and performed very well during Balakot. Efforts are also on by CSIR-NAL to design a Civil Aircraft in the country. The points made by PAC are noted and other platforms indicated will also be initiated with IAF.

- The hall mark of LCA development programme has been the thrust on indigenous development involving indian industries . Development of LCA is spearheaded by ADA with Hindustan Aeronautics Limited (HAL), a Public Sector Undertaking (PSU) under the Ministry of Defence, GoI as the principal partner. LCA Programme involves more than 40 scientific/technical disciplines. Nearly 100 major Work Centres and 300 smaller Work Centres spread across the country including DRDO laboratories, Council of Scientific and Industrial Research (CSIR) laboratories, Public/Private Sector Undertakings, educational institutes (IISc, IITs including Jadhavpur University), Certification Agencies, IAF / IN establishments, Indian Space Research Organisation (ISRO) and Ordnance Factories are actively participating in the LCA Programme. The investments made in LCA Programme have significantly contributed to the development of infrastructure within the country besides developing core-advanced technologies incorporated in LCA.

- The observations by PAC are noted for compliance in future co-developments with foreign entities. However, it is to be noted that for LCA, all the key technologies like Flight Controls, Avionics are developed indigenously and all source codes are available and we have full control over the software.

Vetting Comments of the Audit

"No comments."

Further Action Taken by the Ministry

Noted.

Observation / Recommendation

The Committee are constrained to observe that the Ministry have failed to ensure proper coordination among its own different wings, like ADA, HAL and IAF, to develop our indigenous combat worthy LCA aircraft which ultimately resulted in half hearted approach on country's security and incurring huge expenditure for procurement of fighter aircraft from foreign countries. The Committee, therefore, exhort the Ministry to imbibe the success stories of our own committed space scientists who are working steadfastly to achieve their targets.

(Para 12)

Action Taken by the Ministry

❖ With regard to LCA Programme

- **The following measures have been taken to ensure the earliest completion of the LCA (LCA AF Mk-1) Programme:**

1. Phased development approach for LCA development was changed to Concurrent Development approach.
2. Following reviews are held continuously to avoid further delay:
    - Daily reviews at LCA Assembly hanger,
    - Weekly Review in ADA,
    - Special Review Committees have been set up by Honourable Raksha Mantri to review the Progress of the programme regularly;
        - ✓ Every month by Deputy Chief of Air Staff.
        - ✓ Quarterly review by Empowered Committee, Chaired by Chief of Air Staff.
    - Half yearly review by Governing Body chaired by Secy, Dept. Defence R&D.
    - Annual Review by General Body chaired by Honourable Raksha Mantri.
3. Formation of Project Monitoring Team (PMT) with Air Force officers at ADA.
4. Formation of Quick Reaction Teams (QRT) to resolve design/production issues.
5. LCA Programme Review by Director General (DG) – ADA held at regular intervals.
6. Review of LCA Programme with Honourable Raksha Mantri was held continuously to monitor the progress.
7. Development of alternate sources/work centres for support of LCA programme requirements.
8. Co-development strategy with foreign vendor for Techno critical Multi Mode Radar development has been implemented.
9. The programme is rescheduled to suit the Induction Programme of Indian Air Force.

- **Measures instituted to enhance flying effort:**

With a view to enhancing the quantum of flying carried out, brainstorming sessions was held with all stake holders and following measures were instituted.

- ➢ Daily evening meetings are rigidly held with all stakeholders present (and chaired by the Programme Director along with PD(FT)) to plan the next and days activities. Reasons for not achieving the current days programme are analyzed thread bare and corrective actions defined.
- ➢ Daily morning meetings are held in the HAL Main factory (chaired by GM, ARDC, HAL) to review aircraft preparedness for the current day's flying (based on the

previous days plan) as also review snags on aircraft, measures to overcome, review bottlenecks, resources, logistics.

- Procedural delays were analyzed and in discussion with CEMILAC (but consistent with framework of rules laid down) and unnecessary processes in paperwork/routines were optimized. Aircraft preparedness delays were reduced by following Real Time Monitoring based aircraft readiness.
- Downtime of aircraft due to post sortie snags were reduced by quickening the response time of designers to snags. Designers at a responsible level are required to be present at the daily meetings to react to their snags.
- Flight test review groups meetings are held more frequently to plan test points, review test points covered already and determine the optimum test points for every sortie.
- To reduce aircraft downtime due to non availability of spares at the right time and place, a spare management team has been formed to track consumption patterns, unserviceable spares and flag/forecast/bottlenecks for the near future. They participate in the daily meetings.
- Flying, as far as possible is commenced early in the day (0900 hrs) so as to provide as best a chance for a turn around as possible, to enhance quantum of flying in a day.
- Major aircraft assets have been transferred to core agency HAL (ARDC), instead of the earlier HAL (LCA TD). A single agency handling (most) of the aircraft ensures focus and single point of contact/address.
- Regular flying is planned only on weekdays. Aircraft maintenance is taken up on weekends. In exceptional cases where weekly quantum of flying is not achieved in the week, flying is undertaken on weekends.
- Completion of sortie data debriefs of sorties of previous day are insisted upon latest before 0900 hrs the next day.
- Need for schedule clearance by RCMA before every sortie (of same type and within a certain framework) has obviated with block clearances agreed upon after discussions.

With all the above measures a record of 610 sorties were flown in 2018 leading to completion of FOC.

- **Further, ADA/DRDO HQs has drawn detailed guidelines for initiating and undertaking new projects, for monitoring of projects ensuring time bound successful completion of the projects. The following aspects have been considered;**

  - Estimation of realistic timelines of various project activities.
  - Implementation of effective in-built monitoring mechanism.
  - Obtaining prior approval of sanctioning authority for major deviations in complex technology projects to avoid delays.
  - Involvement of users/customers from the beginning of the projects.

- There is good cohesion and co-ordination among Defence Research Development Organisation (DRDO), Hindustan Aeronautical Limited (HAL) & Indian Air Force (IAF) and decisions are taken collectively.

Vetting Comments of the Audit

"The measures taken vis-a-vis outcome would be further watched in audit."

Further Action Taken by the Ministry

No comments.

CHAPTER III

OBSERVATIONS/RECOMMENDATIONS WHICH THE COMMITTEE DO NOT DESIRE TO PURSUE IN VIEW OF THE REPLIES RECEIVED FROM THE GOVERNMENT

-NIL-

CHAPTER IV

OBSERVATIONS/RECOMMENDATIONS IN RESPECT OF WHICH REPLIES OF THE GOVERNMENT HAVE NOT BEEN ACCEPTED BY THE COMMITTEE AND WHICH REQUIRE REITERATION

Observation and Recommendation

The Committee note that the ADA advanced building of two prototypes (PVs) from Full Scale Engineering Development (FSED) Phase-II to FSED Phase-I on the ground of accelerating the development process of LCA, however, the decision failed to yield the desired results. The FSED Phase-I was closed in March 2004 after a delay of six years and without completing all the activities which were carried forward to FSED Phase-II. Further, building of PVs was completed three to eleven years beyond scheduled date delaying IOC from December 2005 to December 2013. The Committee find that all the major objectives of FSED Phase-I i.e. 42 work packages pertaining to development of Multi-Mode Radar, Flight Control System, Actuators, Digital Flight Control Computer, Jet Fuel Starter, Drop Tanks, etc. were not achieved and were carried forward to FSED Phase-II and resultantly, prototypes were rendered deficient of critical onboard systems {Multi-Mode Radar (MMR), Self-protection Jammer (SPJ), Radar Warning Receiver (RWR)} which eventually led to using the Limited Series Production (LSP) aircraft (meant for IAF use) towards flight testing/evaluation of the critical on board systems, in contravention of the commitment given to the GoI while obtaining sanction (November 2001) for building of these aircraft. The Committee note from the reply of the Ministry that the timelines in respect of critical on-board systems like MMR, RWR etc. initially planned to be integrated on Prototype Version (PV)-1 & Prototype Version (PV)-2, based on schedules provided by the work centres , could not be met by the work centres due to technological complexities. The Committee reproach the ADA for taking decisions that lacked scientific basis by advancing building of prototypes overlooking the fact that neither the critical technologies were developed by then nor the Technology Demonstrators flight tested for specified 210 hours. The Committee while noting that the decision resulted in deficient prototypes further leading to diversion of LSP towards flight testing, desire to be apprised of the details of the expenditure incurred on deficient aircraft.

(Para 2)

Action Taken by the Ministry

The advance manufacture of two prototypes PV1&PV2 from FSED Phase 2 to FSED Phase 1 was undertaken based on the decisions given by General Body and Governing Body of ADA and later approved by CCS.

- Manufacture of Two Prototype Vehicles PV1 & PV2 was advanced from FSED Phase 2 to FSED Phase 1 programme was to expedite flight testing to prove core technologies like Open System Architecture based Avionics, Carbon Carbon composites, Composite Drop

Tanks etc to make sure that these technologies are matured and are available early in the programme to accelerate subsequent phase of realizing LCA as a potent weapon platform. If these two prototypes were not advanced, it would have taken more time to prove the core technologies with only two prototypes (TD1 & TD2) and would have had an adverse impact on the LCA programme. For example Open System Architecture based Avionics could be proven on PV2 early and has paved the way for realizing state of art advanced digital avionics suite and all glass cockpit. Similarly extensive use of carbon carbon composites resulted in weight savings leading to improvement in aircraft performance.

- The decision to advance prototype vehicles PV1 & PV2 in FSED Phase-I has given Technology edge for proving critical systems like Drop Tank Integration, Avionics Architecture Upgrades, Extensive use of Carbon-Carbon composites, Aircraft Performance and Envelope Expansion flight testing.

- The above technologies required extensive flight testing for maturity. It is to be noted that awaiting maturity of these technologies with only two TDs would have had resulted in further delays in the programme.

- Open System Architecture of obsolescence management of electronic and avionic system could be realised early on PV2 only because of the advancement of PV1 & PV2.

- The critical onboard systems like MMR, RWR, etc. were initially planned to be integrated on PV-1 & PV-2 based on schedules provided by the work-centres. However, timelines could not be met by the work-centres due to the technological complexities.

Critical technologies which were required for Prototype and subsequent Production of LCA Mk-1 were successfully developed indigenously and demonstrated. All the major objectives of FSED Phase I were achieved, except the development of critical on board systems like MMR, RWR, etc., and demonstration on ground rigs.

Development of MMR, RWR, etc., was carried out based on schedules provided by the work-centres. However, timelines could not be met by the work-centres due to the technological complexities.

As such there is no deficiency in these prototypes since the aircraft were built to the desired Standard of Preparation (SOP) for specific requirement.

Use of LSP aircrafts

- The LCA Programme has taken-up ab-initio development and realization of critical technologies/systems.

- This development and flight testing has been planned in concurrently on various LSP aircraft to achieve IOC & FOC goals quickly.

- During the course of development, *the changes in the critical system like communication system, Radar & Helmet Mounted Display System has forced SOP change staggered on different LSPs.*

- The LSP Programme allowed the changes of Missiles, Engine, Radar, Fuel System, Communication System etc., to be incorporated.

- Awaiting maturity of all the systems on PV series aircraft and completing IOC task involving around 2500 sorties with three numbers of PV series aircraft would have resulted in further delays.

As flight testing of LCA progressed, there was a need to modify wing and to integrate new weapons such as Derby BVR missile. This justifies the need for the LSPs for integration and flight testing. The plan for handing over the LSPs to IAF will be mutually worked out at the conclusion of FSED Phase 2 programme.

Vetting Comments of the Audit

"The contention of the Ministry that there is no deficiency in two Prototype Vehicle PV1 & PV2 since the aircraft were built to the desired Standard of Preparation (SOP) for specific requirement lacks merit as critical systems like MMR, RWR etc initially planned to be integrated on these aircraft could not be achieved. Moreover PV's were built after delays of ranging from three to eleven years and have not achieved stated objectives yet due to deficiency on prototype aircraft, LSP aircraft meant to be handed over to IAF were also used as additional prototypes for achieving IOC/FOC.

Further, FSED Phase-I was closed after six years delay without all the objectives being met and unfinished tasks were carried forward to FSED Phase- II."

Further Action taken by the Ministry

- The LCA Programme has taken-up ab-initio development and realization of critical technologies/ systems.
- This development and flight testing has been planned in concurrently on various LSP aircraft to achieve IOC & FOC goals quickly.
- During the course of development, the changes in the critical system like communication system, Radar & Helmet Mounted Display System has forced SOP change staggered on different LSPs.
- The LSP Programme allowed the changes of Missiles, Engine, Radar, Fuel System, Communication System etc., to be incorporated.
- Awaiting maturity of all the systems on PV series aircraft and completing IOC task involving around 2500 sorties with three numbers of PV series aircraft would have resulted in further delays.

As flight testing of LCA progressed, there was a need to modify wing and to integrate new weapons such as Derby BVR missile. This justifies the need for the LSPs for integration and flight testing. The plan for handing over the LSPs to IAF will be mutually worked out at the conclusion of FSED Phase 2 programme.

Critical technologies which were required for Prototype and subsequent Production of LCA Mk-1 were successfully developed indigenously and demonstrated. All the major objectives of FSED Phase I were achieved, except the development of critical on board systems like MMR, RWR, etc., and demonstration on ground rigs.

Development of MMR, RWR, etc., was carried out based on schedules provided by the work-centres. However, timelines could not be met by the work-centres due to the technological complexities.

As such there is no deficiency in these prototypes since the aircraft were built to the desired Standard Of Preparation (SOP) for specific requirement. Eventually all LSP aircraft will be handed over to IAF.

Comments of the Committee

Please see Paragraph No. 10 of Chapter I

Observation / Recommendation

The Committee note that the addition of new weapons by Air HQ for giving an operational edge to the LCA (March 1997, December 2009) necessitated design changes on the aircraft, coupled with specification of integrating * missile (December 2009) with Multi-Mode Radar/Helmet Mounted Display and Sight and identification (December 2009) of Beyond Visual Range Missiles delayed the achievement of IOC/FOC. The Committee note from the reply of the Air HQs that inclusion of newer weapons was necessitated due to systems/weapons becoming obsolete/ irrelevant in the backdrop of extended schedule of design and development of LCA. The Committee take serious note of the delays at each stage of the project that rendered the original specifications obsolete and new requirements and their integration delayed the programme, further. The Committee note that while LCA programme is being monitored by multiple agencies/bodies like General Body, Governing Body, involving the representation of MoD, Ministry of Finance at the highest level, various committees at ADA/Hindustan Aeronautics Limited (HAL) and Empowered Committee chaired by Chief of Air Staff. The delays in completion of work packages seriously affected the LCA programme schedules which could not be contained due to lack of coordination at various levels and ineffective monitoring of the programme by all the agencies involved. The Committee are of the view that casual approach of the monitoring agencies in enforcing the timelines led to inexplicable delays of more than 30 years on an ambitious Defence project. The Committee exhort the Ministry to fix realistic timelines, taking into account technological complexities, for completion of remaining works urgently and apprise the Committee thereof. The Committee also desire to be apprised of details of the recommendations made by various review committees and action taken thereon within six months of presentation of this report. Further, the Committee while opining that the committees at the highest level cannot decipher routine ground level difficulties due to preoccupations and other constraints desire that a core team, fully responsible for day-to-day decision making, be constituted with dual responsibility of achieving goals within timelines and ensuring that the end product complies with the standards specified by the user group. The function of this core team may be separated from monitoring and guidance given by other committees by making it responsible for tracking the day to day progress, resolving cross functional issues and making decisions about course corrections in case of delays, excess expenditure or major alterations in specifications.

(Para 4)

Action Taken by the Ministry

In any Military Fighter Programme, periodic upgrade of weapons is a normal process of development. Concurrent engineering and development model has been followed in the LCA programme. Introduction of new weapons is a part of continous upgradation. Therefore, while

few new weapons are being integrated currently as part of FOC; IOC standard aircraft (with a set of cleared weapons) are being produced and delivered to IAF 45 Sqn for operations; 12 SP fighters have been delivered so far.

The AHQ has specified changes in weapon suite for more than 10 occasions from Feb 1997 to Nov 2012. However, it may be brought out that new weapon integration is a continuous process occurring during the life cycle of the aircraft and Tejas system architecture is such as to facilitate this in a reasonably easy fashion.

The continuous process of integration of newer and modern weapons has happened during the development of Tejas. As a result LCA is one of the few aircraft in Indian inventory to have capability of firing the most modern BVR missiles. This process would have taken much longer for an aircraft already in service.

Vetting Comments of the Audit

"The contention of the Ministry that in any military fighter programme periodic upgrade of weapons is a normal process of development is not accepted.

IAF admitted the fact that inclusion of newer weapons was necessitated due to systems/ weapons becoming obsolete/ irrelevant in the backdrop of extended schedule of the LCA

Programme. Monitoring bodies with participation from highest level of MoD, Ministry of Finance could not succeed in proper coordination from the various work centres which resulted in inordinate delay in execution of LCA programme."

Further Action taken by the Ministry

- Periodic up gradation of any military fleet and even military transport fleet is an operational necessity and is a process carried out in any Air force the world over. The service life of a fighter aircraft extends over three decades (and in some cases like the MIG- 21 to over five decades). In this period, military technology evolves by leaps and bounds, modernising quickly, pushing extant systems to obsolescence. Periodic up-gradation /mid life upgrades are carried out, to retain the fighting edge of a military fleet, vis a vis the adversary /military environment, with a view to keeping the fleet, "as contemporary as possible". Such up-gradations are generally carried out, in a phased manner, without affecting operational requirements, ie while a portion of the fleet is inducted for up-gradation, the remaining aircraft in the fleet are still available for operations in the Air force, to be rotated later for up-gradation.

  Examples abound in the IAF of periodic up-gradations. Most of the IAF's fleet has been upgraded at some point in time. The IAF's Jaguar fleet has been upgraded periodically to DARIN -2 and then on to DARIN -3 versions, with improvements to its Avionics/ NAV & Weapon Attack System (NAVWAS). The MIG 27, Mirage -2000, MiG 29 fleets have also seen up-gradations mainly in Avionics and Weapon Delivery systems. The MiG 21 BiS fleet was upgraded in Russia to the MiG -21 Bison with Sensor/ Weapon / Avionics upgrades (the aircraft was utilised recently in the POK operations by IAF). The IAF's transport fleet An-32 is on upgrade in Ukraine.

  The USA origin General Dynamics F-16 aircraft, utilised by many NATO countries, including Pakistan was inducted in the early 1980s as F-16 A/ B (Block 1 and 2.) Periodic upgrades have been undertaken in Blocks, to the current F-16 E/F Block 60, in use with our adversary Pakistan. Upgrades have been to enhance several aspects of Avionics, Weaponry, Night and low light capability, precision munitions, Electronic warfare etc.

In a like manner, upgrades in the future for the LCA, will be a normal feature, and will need to be undertaken, to keep pace with new weapon systems integration, technology enhancements / Avionics upgrades etc.

- There is good cohesion and co-ordination among different organisations like Defence Research Development Organisation (DRDO), Hindustan Aeronautical Limited (HAL) & Indian Air Force (IAF) and decisions are taken collectively with active participation by MoD & MoF.

Comments of the Committee

Please see Paragraph No. 20 of Chapter I

Observation/Recommendation

As per the Audit Report, the Air Staff Requirement (ASR) envisaged a total requirement of 200 fighters and 20 trainer aircraft of LCA. The trainer variant of the LCA was to retain all attributes of the fighter variant except for the changes necessary to accommodate a second seat for imparting training to IAF pilots. The ASR had envisaged that the fighter and trainer aircraft should enter the IAF service by 1994. Further, a full mission flight simulator of the LCA single seater variant was to be developed and delivered in advance of production aircraft (1994) as part of training requirement. However, 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 Aeronautical Development Establishment (ADE) for pilot training, pending supply of a FMS by HAL at LCA operating base. The Committee note from the reply of the Ministry that towards induction and acceptance of series production aircraft, IAF pilots are trained on high fidelity simulator, and, therefore, the non-availability of trainer is not a serious concern towards induction. However, AIR HQ had expressed in Empowered Committee (EC) meeting that availability of operational trainer aircraft was essential for pilot training. The Committee are appalled at the casual reply of the Ministry that non-availability of trainer is not a serious concern towards induction as the reply undermines the usefulness of trainer aircraft. Further, as per reply of the Ministry, the Trainer PV-6 aircraft had been built equivalent to production standard trainer being utilised for Squadron Pilot's (SP) training, besides being used for FOC tasks. However , Audit has stated that since build-standard document was planned to be released only by March 2018 , the Ministry's contention that Trainer PV6 aircraft had been built equivalent to production standard didn't hold true . The Committee while reproving the Ministry for such baseless replies desire to be apprised of the correct and updated details regarding development of trainer aircraft. Further, the Committee desire that trainer variant of LCA be productionized in atime bound manner, preferably along with the combat variant , so that the pilots get the requisite exposure and training for flying the LCA.

(Para 6)

Action Taken by the Ministry

The Trainer Aircraft is spin-off of fighter variant. The critical system like Avionics, Flight Control, Sensors, Propulsion System, etc is same as fighter. Hence, delays attributed in realizing fighter aircraft has direct implication in achieving FOC of Trainer.

Trainer PV6 aircraft has been built equivalent to Production standard Trainer and is being utilised for Squadron Pilot's training besides being used for FOC tasks. Also state of the art, full fledged high fidelity mission simulator has been built for the Squadron for Pilot training.

IAF decided that there would be no IOC Trainers. Instead all 8 trainers should be in FOC standard. Production drawings of trainer would be only to FOC standards and hence no IOC standard trainer production drawings were formally released.

Production standard drawings of FOC Trainer are planned to be released by June 2019.

The project to develop and install LCA Full Mission Simulator at Air Force Station, Sulur was sanctioned as a turnkey project (including building infrastructure to house the simulator) by IAF to ADE, DRDO. The total cost of the project is Rs.211 Crores (FE: Rs.37.90 Crores).

IAF has mandated ADE and not HAL to develop the FMS at Airforce Station Sulur. Procurement of long lead, high value items has already been initiated and is in various stages of approval. Building is getting ready.

The design & development activities are being executed on fast-track by ADE with an aim to hand over the simulator to IAF by year 2020-21, as desired by IAF.

Vetting Comments of the Audit

"ASR envisaged that both fighter and trainer variants of LCA should enter IAF service by 1994, which has not materialised till date.

The trainer aircraft is yet to achieve FOC and handed over to IAF in the production batch i.e. series production aircraft. IAF had expressed that availability of operational trainer aircraft was essential for pilot training. As production standard drawings of FOC trainer are planned to be released in June 2019, IAF is constrained to fly the fighter LCA without any available trainer aircraft. Even the Full Mission Simulator, which was to be provided in advance of the production aircraft as specified in the ASR, is yet to be set up at the LCA squadron in Sulur."

Further Action Taken by the Ministry

Build Standard document (Drawing Applicability List & Equipment SOP) for Tejas Trainer was released on 05th July 2019 and HAL has initiated production activities for Series Production of Trainer.

Trainer PV6 aircraft has been built equivalent to Production standard Trainer (except for incorporation of Air to Air Refueling) and is being utilised for Squadron Pilot's training besides being used for FOC tasks. Also state of the art full fledged high fidelity mission simulator has been built for the Squadron for Pilot training at ADE.

IAF has mandated ADE and not HAL to develop the Full Mission Simulator at Air Force Station Sulur. Procurement of long lead, high value items has already been initiated and is in various stages of approval. Building is getting ready. Simulator is planned to be handed to IAF by year 2020-21, as desired by IAF.

Comments of the Committee

Please see Paragraph No. 25 of Chapter I

Observation/Recommendation

6. The Committee note that the LCA Project Definition Phase (PDP) Review Committee, which examined the work done at Project Definition Phase, had strongly recommended (September 1989) early establishment of a standing Liaison Group between Air HQ and ADA to ensure closer interaction between the design team and the user for better appreciation of mutual perception, including appropriate trade-offs in performance, weight, time frame, cost, technological complexity and operational considerations of LCA. However, no such liaison group was formed and active user (Air HQ) participation in the LCA Programme started only after a long delay of 17 years in November 2006. The Committee note from the Action Taken Notes that due to non formation of liaison group, maintenance related issues were not pointed out during early stages of the design and development programme by the test crew as well as test engineers impacting design modes and timelines. The Committee are of the view that sound project management involves preparation of a detailed requirement specification document which is complete description of the system to be developed containing all interactions users will have with the system as well as non functional requirements at the planning stage itself i.e. well before execution of the project. The Committee while noting with dismay the belated involvement of users in the project which eventually delayed achievement of IOC/FOC and wastage of tax payers money and resources opine that user involvement right from inception would have gone a long way in effective and efficient completion of the project. The Committee desire that the requirements as specified by the IAF for LCA MK-IA and LCA MK-II be understood and incorporated urgently to avoid further delays in achieving the timelines.

Further, the Committee observe from the reply of the Ministry that AIR HQ felt that formation of Standing Liaison Group earlier than 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of design of aircraft. Since provisions for induction of weapon systems, RWRs, Pods etc have to be made in the design stage of the aircraft itself the Committee are not convinced with the plea of the Ministry that formation of Standing Liaison Group comprising IAF personnel earlier than 2007 would not have yielded fruitful results. The Committee while observing that change in scope and user specifications led to huge delays are shocked at the reluctance of IAF in actively involving itself during the design stage. The Committee, therefore, desire the Ministry to fix responsibility upon officers who failed to ensure involvement of IAF personnel in the initial years of design of the aircraft and see that such instances are not repeated in projects involving thousands of crores of rupees and country's security.

(Para 7)

Action Taken by the Ministry

Air HQ felt that formation of Standing Liaison Group earlier than 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of design of aircraft. However, Air HQ personnel were participating in major Program reviews. Also IAF pilots were involved right from the beginning in flight testing through National Flight Test Centre, which is a part of ADA.

IAF Pilots were directly involved in the Flight test programme for Technology Development during FSED Phase 1 from the beginning for flight test related activities. Also, IAF participation has been ensured in all major reviews of LCA programme since the initial stages. Project Monitoring Team (PMT) of IAF was formed in 2007, for better involvement of IAF Personnel in LCA Programme activities.

IAF feedback from time to time, has been taken in to account; during design and development phases of LCA AF MK1. IAF has ordered 20 MK1 aircraft in IOC standard, 20 additional MK1 aircraft to FOC standard. IAF has also initiated procurement of 83 more aircraft in MK1A standard. The shortcomings in LCA AF Mk1 vis-à-vis the ASR were due a lack of understanding of the complexities of incorporating 4th generation technologies. As a result, LCA AF Mk1 is comparable to any other 4th generation aircraft in its class. LCA AF MK2 in its current configuration, is altogether a new aircraft in medium weight category and it is not just an upgrade of MK1.

Vetting Comments of the Audit

"Ministry stated that the shortcomings in LCA AF Mk-1 vis-a-vis the ASR were due a lack of understanding of the complexities of incorporating 4th generation technologies. As a result LCA AF Mk-1 is comparable to any other 4th generation aircraft 1n its class. LCA AF Mk-2 in its current configuration is altogether anew aircraft in medium weight category and However the fact remains that formation of the liaison group right from the early stages of the LCA programme, as recommended by PDP review committee in 1989, would have ensured close interaction between the design team and the user for better appreciation of mutual perception.

This would have resolved many issues related to LCA Mk-I's shortfalls."

Further Action Taken by the Ministry

- The shortfalls in LCA compared to the ASRs were not due to lack of coordination between the design and user agencies. They were mainly due to the technological complexities of incorporating 4th generation features. These became evident only after realization of the aircraft.
- Air HQ felt that formation of Standing Liaison Group earlier than 2007 would not have yielded fruitful results since expertise of IAF personnel was not in the area of design of aircraft. However, Air HQ personnel were participating in major Program reviews. Also IAF pilots were involved even before beginning of flight testing through National Flight Test Centre, (formed in 1994) which is a part of ADA.
- IAF participation has been ensured in all major reviews of LCA programme since the initial stages. Project Monitoring Team (PMT) of IAF was formed in 2007, for better involvement of IAF Personnel in LCA Programme activities.
- IAF feedback from time to time has been taken in to account; during design and development phases of LCA AF Mk-1.

Comments of the Committee

Please see Paragraph No. 30 of Chapter I

CHAPTER V

OBSERVATIONS/RECOMMENDATIONS IN RESPECT OF WHICH THE GOVERNMENT HAVE FURNISHED INTERIM REPLIES

-NIL-

NEW DELHI;
2 February, 2021
13 Magha, 1942 (Saka)

Adhir Ranjan Chowdhury
Chairperson
Public Accounts Committee

APPENDIX-

Confidential

MINUTES OF THE EIGHTH SITTING OF THE PUBLIC ACCOUNTS COMMITTEE (2020-21) HELD ON 1ST DECEMBER, 2020.

The Committee sat on Tuesday the 1st December 2020 from 1100 hrs. to 1415 hrs. in Committee Room 'D', Parliament House Annexe, New Delhi.

PRESENT

Shri Adhir Ranjan Chowdhury - Chairperson

MEMBERS

LOK SABHA

2. Shri T. R. Baalu
3. Shri Subhash Chandra Baheria
4. Shri Sudheer Gupta
5. Smt. Darshana Vikram Jardosh
6. Shri Bhartruhari Mahtab
7. Shri Jagdambika Pal
8. Shri Jayant Sinha
9. Shri Balashowry Vallabhaneni

RAJYA SABHA

10. Shri Rajeev Chandrasekhar
11. Shri C.M. Ramesh
12. Shri Bhupender Yadav

LOK SABHA SECRETARIAT

1. Shri T.G Chandrashekhar - Joint Secretary
2. Shri M.L.K. Raja - Director
3. Smt. Bharti S. Tuteja - Additional Director

REPRESENTATIVES OF THE OFFICE OF THE COMPTROLLER AND AUDITOR GENERAL OF INDIA

1. Smt. Praveen Mehta - Dy. C&AG
2. Shri Deepak Anurag - Director General
3. Shri Sanjay Kumar - Director General
4. Shri Amitabh Prasad - Principal Director
5. Shri S.V. Singh - Principal Director

REPRESENTATIVES OF INSTITUTE OF CHARTERED ACCOUNTANTS OF INDIA (ICAI)

1.	CA Atul Kumar Gupta	President
2.	CA Sushil Kumar Goyal	Vice-Chairman, GST & Indirect Taxes Committee of ICAI
3.	CA Smita Mishra	Secretary, GST & Indirect Taxes Committee of ICAI

REPRESENTATIVES OF CONFEDERATION OF INDIAN INDUSTRY (CII)

1.	Mr. Bipin Sapra	GST lead and member CII Taxation Committee
2.	Ms. Smritikona Dutta	Member, CII Taxation Committee (GST core Group)
3.	Mr. Ajmer Sig Bisla	CII Senior Advisor Indirect Taxes & GST

REPRESENTATIVES OF FEDERATION OF INDIAN CHAMBERS OF COMMERCE & INDUSTRY (FICCI)

1.	Mr. Dilip Chenoy	Secretary General
2.	Mr. Rajeev Dimri	Co-Chairman, Taxation Committee
3.	Ms. Ira Khanna	Additional Director-Tax, FICCI

2.	xxxx	xxxx	xxxx	xxxx.
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17.	xxxx	xxxx	xxxx	xxxx
18.	xxxx	xxxx	xxxx	xxxx
19.	xxxx	xxxx	xxxx	xxxx
20.	xxxx	xxxx	xxxx	xxxx

21. Then, the Committee took up the following reports of the Committee for consideration:

a) xxxx xxxx xxxx xxxx

b) xxxx xxxx xxxx xxxx "; and

c) Action taken by the Government on the Recommendations/Observations of the Committee contained in their 114th Report (16th Lok Sabha) on "Performance Audit of Design, Development, Manufacture and Induction of Light Combat Aircraft".

22. xxxx xxxx Minor changes were suggested in the last line of Para 30 in the third report mentioned at (c).

23. Accordingly, the existing last line in the Report mentioned at 'C' above, "The Committee, therefore, reiterate that the Ministry look into and identify the reasons for the failure to ensure involvement of IAF personnel in the initial years of designing of the aircraft, and ensure that such instances are not repeated, particularly in case of projects, involving huge outlays, and more importantly, concern the country's security" has been modified as under:

"The Committee express their displeasure on the fact that the Ministry has not looked into and identified the reasons for the failure to ensure involvement of IAF personnel in the initial years of the designing the aircraft and fixing responsibility on those responsible for the lapse. The Committee, therefore, reiterate the need for fixing responsibility for the failure, and ensuring that such instances are not repeated, particularly in case of projects involving huge outlays and more importantly, concern the country's security"

24. The Committee also authorized the Chairperson to finalise the aforesaid reports on the basis of factual verification and suggestions of the Members and present the same to the Hon'ble Speaker/ Parliament.

25. xxxx xxxx xxxx xxxx.

The Committee, then, adjourned.

APPENDIX-II

(Vide Paragraph 5 of Introduction)

ANALYSIS OF THE ACTION TAKEN BY THE GOVERNMENT ON THE OBSERVATIONS/RECOMMENDATIONS OF THE PUBLIC ACCOUNTS COMMITTEE CONTAINED IN THEIR ONE HUNDRED AND FOURTEENTH REPORT (SIXTEENTH LOK SABHA)

(i)	Total number of Observations/Recommendations	-	
(ii)	Observations/Recommendations of the Committee which have been accepted by the Government:	-	Total : 8 Percentage: 66.67%
	Para Nos. 1,3,5,8,9,10,11 and 12		
(iii)	Observations/Recommendations which the Committee do not desire to pursue in view of the reply of the Government:	-	Total : 0 Percentage:0
	NIL		
(iv)	Observations/Recommendations in respect of which replies of the Government have not been accepted by the Committee and which require reiteration:	-	Total : 4 Percentage: 33.33 %
	Para Nos. 2,4,6 and 7		
(v)	Observations/Recommendations in respect of which the Government have furnished interim replies/no replies:	-	Total : 0 Percentage: 0
	NIL		