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Report of the Comptroller and Auditor General of India for the year ended March 2014

Union Government (Defence Services)
Air Force
No. 38 of 2015

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PREFACE

This Report for the year ended March 2014 has been prepared for submission to the President under Article 151 of the Constitution. The Report relates mainly to matters arising from test audit of the financial transactions and operational performance relating to Indian Air Force. The issues relevant to Indian Air Force arising from audit of records of the Ministry of Defence, Defence Research and Development Organisation, Military Engineer Service and Hindustan Aeronautics Limited are also part of this Report.

The Report includes 15 paragraphs including audits reviews on 'AA', 'C' aircraft, 'DD' aircraft, Operational Works in IAF, Mission Mode Projects of DRDO, Estate management in HAL and Investment in JV Companies by HAL.

The issues mentioned in the Report are among those which came to notice in the course of audit during 2013-14 as well as those which came to notice during earlier years, but could not be included in the previous Reports. Wherever necessary, information subsequent to March 2014 has also been included.

OVERVIEW

The total expenditure of the Defence Services during the year 2013-14 was ₹2,09,788 crore. Of this the Indian Air Force (IAF) spent ₹58,745 crore which was 28 *per cent* of the total expenditure on the Defence Services. The major portion of expenditure of IAF was capital in nature, constituting 65.68 *per cent* of their total expenditure.

This Report contains major findings arising from the test audit of transactions of IAF, Defence Research and Development Organisation, Hindustan Aeronautical Limited and related records of the Ministry of Defence. Highlights of findings included in the Report are as under:

I Operation and maintenance of 'AA'

The Ministry of Defence concluded a contract (March 2004) for procurement of three 'AA' and its sub-systems at a cost of 1108 MUSD (₹5,042 crore).

There was sub-optimal utilisation of operational capabilities of 'AA' in terms of flying task achieved mainly due to un-serviceability of 'AA'. Besides, scope for increasing operational efficiency of 'AA' aircraft was restricted due to absence of training to aircrew on air to air refuelling (AAR) and non-acquisition of additional land for extension of runway length at AF Station 'S-3'.

There was delay in installation of Ground Exploitation Station (GES) at intended location ('S-1') due to lack of due diligence in planning of work services. There was shortage of aircrew which may impact the operations of the 'AA' aircraft during hostilities.

No long term arrangement existed for repair and maintenance of 'AA' which was being managed with interim maintenance services contract. Supply of defective Automatic Test Equipment for Communication System, non-supply of 'I' level facility for Identification of Friend or Foe (IFF) system and short provisioning of stores / rotables had adversely affected the serviceability of 'AA'.

Certain infrastructure facilities were not synchronised with the induction of 'AA' as there was delay in completion of work services for modified hangars, independent storage facility and separate training-cum-accommodation centre at AF Station 'S-3', which affected smooth functioning of 'AA'.

(Paragraph 2.1)

II Operational works in IAF

Operational works are undertaken to meet the temporary requirement of operational necessity, and hence have significant role in operational preparedness of IAF. ₹90.35 crore was spent by IAF on operational works during 2010-11 to 2013-14. Audit found inclusion of ineligible works in Annual Operational Works Plans (AOWPs) and undefined timelines for all stages of operational works *viz.* delays in declaring operational works area, approval of AOWPs, award of contracts and execution of operational works.

(Paragraph 2.2)

III Operation and maintenance of 'C' aircraft

In order to maintain a credible level of deterrence, Indian Air Force (IAF) procured 'C' aircraft from 1996 onwards. Shortfalls in performance of aircraft and airborne system as received from Original Equipment Manufacturer (OEM) / Bharat Electronics Limited (BEL) were yet (August 2015) to be resolved. Setting up of service support centres was inordinately delayed for want of required systems/equipment. Serviceability of aircraft fleet was also low. Manpower for 'C' aircraft squadron was not sanctioned even after 19 years of its induction.

(Paragraph 2.3)

IV Upgradation and maintenance of 'DD' aircraft

The up-gradation programme undertaken by IAF was neither completely successful nor comprehensive. IAF selected unproven 'BB' radar for use in Air Defence and ground attack role. Performance of radar had not been satisfactory due to various inadequacies in its air to ground range mode and beyond visual range capability. Due to unsuitability / deficiency of critical airborne electronic warfare (EW) systems the aircraft fleet was vulnerable to EW threats. There was low serviceability and high percentage of Aircraft on Ground (AOG) due to non availability of spares which resulted in shortfall in flying efforts. There was overall shortage of operational and technical manpower at operating units which affected operation and maintenance of aircraft.

The 'D' level facility created at HAL was limited to diagnostic and repair and therefore, dependence on OEM continued for major repair/overhaul of upgraded system involving long duration of time which affected the fleet serviceability.

(Paragraph 2.4)

V Inappropriate procurement of tent based medical shelter

Tent Based Medical Shelter (TBMS) which were planned to be light weight and meant for immediate and temporary deployment for medical relief in disaster area could not be utilized, as critical medical equipment were deleted and housing package including staff accommodation, flooring, hospital furniture, etc., were added to initial scope, which made it heavier. Resultantly user Rapid Action Medical Team (RAMT) found it difficult to transport and deploy. Thus, even after spending ₹10 crore on procurement of TBMS for providing assistance during disasters, the nation was deprived of its intended benefits due to its heavy weight.

(Paragraph 2.5)

VI Excess procurement of Speech Secrecy equipment

Excess procurement of 127 speech secrecy equipment by IAF, resulted in avoidable expenditure of ₹4 crore.

(Paragraph 2.6)

VII Procurement of Intelligence system

Incorrect identification / delayed evaluation of the identified aircraft platform by IAF resulted in delay in installation of state-of-the-art intelligence system. Further, the system acquired after twelve years of 'in principle approval' and after incurring expenditure of ₹88.70 crore remained afflicted with software issues, raising concerns on its performance as envisaged. Annual Maintenance Contract (AMC) for the system was yet (May 2015) to be concluded post expiry of warranty (December 2014).

(Paragraph 2.7)

VIII Arbitrary planning in the resurfacing of extended portion of runways

Resurfacing of newly extended portion of runways within three years of previous resurfacing without identifying any defect / deterioration was arbitrary which indicated lack of due diligence in taking up the work and therefore resulted in injudicious expenditure of ₹1.48 crore. It was also done without getting the approval from Competent Financial Authority *i.e.* MoD.

(Paragraph 2.8)

IX Procurement of compressor working fluid

Failure on the part of Air HQ in not ordering staggered supply of compressor working fluid worth ₹2.52 crore led to expiry of its shelf life.

(Paragraph 2.9)

X Inordinate Delay in commissioning of Low Level Transportable Radar

The critical requirement of Air Defence Surveillance envisaged (1998) to be met by IAF through 37 Low Level Transportable Radars (LLTR) was not met for past 17 years due to inordinate delay in supply of 19 LLTRs despite incurring expenditure of ₹454.48 crore. None of the first LLTR has been commissioned so far (June 2015), thereby compromising the Air Defence surveillance capability to detect hostile low level ingress.

(Paragraph 2.10)

XI Savings at the instance of Audit

Air HQ / Ministry reduced the requirements at the instance of Audit which resulted in corresponding reduction of one set of ordered equipment/spares for the crashed 'E' aircraft leading to savings of ₹11.45 crore.

(Paragraph 2.11)

XII Execution of Mission Mode projects and delivery of systems by DRDO

Audit examination of 14 Mission Mode projects carried out by DRDO Laboratories revealed that all the projects failed to achieve their timelines and their probable date of completion (PDC) were extended many times. In five projects there were cost overruns as well.

Further, although Operational Requirements / Qualitative Requirements / Broad Technical Requirements of IAF existed in all projects, the requirements of IAF were met to their

satisfaction only in one completed project *viz.*, project 'Rohini'. In the same project the technology was also transferred leading to its productionisation by BEL and final induction into IAF. The systems developed in other closed projects were yet to be accepted by IAF.

The delays can be attributed to inadequate monitoring by different committees as well as to change of requirements by IAF (three projects). Lack of harmonisation (where multiple agencies were involved) was also noticed in two projects.

The projects were therefore not carried out in spirit of Mission Mode which adversely affected Air Defence plans of IAF.

(Paragraph 3.1)

XIII Estate management in Hindustan Aeronautics Limited (HAL), Bengaluru

Discrepancies were noticed in the extent of holdings of HAL as per the Compendium of land holdings of HAL, Award Copies and Record of Rights of Tenancy and Crops Certificate (RTC).

HAL did not have the award copies for 402 acres and 3836 guntas (220 survey numbers) of land in Bengaluru Complex with market value of ₹1,499.53 crore. There was no indenture for 265 acres and 17 guntas (March 2015) of land at Nasik though the same was in possession of HAL.

HAL had acquired 10 acres and 19 guntas of land despite existence of slums in Bangaluru and as HAL could not evict the slums, land remained under encroachment. In Koraput, out of 3,121.15 acres of land held by the division, 50.21 acres were under encroachment by local villagers for over 25 years.

HAL did not execute the lease deed in respect of 552.41 acres of land leased to other organisations and Sale Deed was not executed in 13 cases where the land was sold.

HAL had not framed a comprehensive land use policy covering long term development plans both for functional and non-functional needs *vis-à-vis* adequacy of the existing facilities and suitability of vacant land available with it in the context of development of civilian infrastructure surrounding it.

(Paragraph 4.1)

XIV Investment in Joint Venture Companies by HAL

Against total investment of ₹225.14 crore in 11 JVCs, HAL has already made provision for diminution in the value of investment amounting to ₹49.90 crore made in five JVCs in its annual accounts for the year 2013-14.

BAeHAL, formed as an Export Oriented Unit, made domestic sales upto 63 *per cent* of total sales during the period from 2004-05 to 2013-14 in violation of Foreign Trade Policy 2004-09 and 2009-14.

HETL (*i.e.* a JVC) was formed with the purpose of development and manufacture of 3D technology based products for airborne use, without assessing the relevance of the technology, market demand, technical and financial details of the JV partners as stipulated in DPE guidelines. As such, the JVC was not able to successfully execute the orders placed on it for crucial projects of HAL.

HALBIT, formed for marketing, designing and integrating airborne avionics products and systems, was entrusted with development of hardware for a time-bound programme like DARIN-III though the JVC did not have any previous experience in the field. Consequently, the DARIN-III programme was delayed due to delay in supplies by the JVC.

Investment in HATSOFF without obtaining firm commitment from the Defence Services resulted in non achievement of the intended benefits by the JVC besides additional expenditure of ₹10.93 crore to HAL due to not ascertaining the actual cost of aircraft data licence.

IRAL, formed for undertaking supply of aviation equipment, providing services for repair and overhaul and ensuring technical and engineering support for exploitation of the aviation equipment and other related activities in India and abroad except former Republics of USSR, engaged only in trading activities and HAL was the major customer.

(Paragraph 4.2)

XV Acceptance of contract for DARIN-III with fixed delivery schedule led to liquidated damages

Acceptance of a fixed delivery schedule without freezing of standard of preparation (SOP) and not working through change orders resulted in liability of ₹7.19 crore towards liquidated damages as on March 2014 and has potential to cause further losses to HAL with the progress of the contract. This decision of HAL was against its financial interests.

(Paragraph 4.3)

CHAPTER I: INTRODUCTION

1.1 About the Report

The Report relates to matters arising from the audit of the financial transactions of Indian Air Force (IAF) and relevant records relating to IAF of the following organisations.

- Ministry of Defence (MoD)
- Defence Research and Development Organisation (DRDO) and its laboratories dedicated primarily to IAF
- Hindustan Aeronautics Limited (HAL)
- Defence Accounts Department dealing with IAF
- Military Engineer Services (MES) dealing with IAF

Office of the Principal Director of Audit, Air Force [PDA (AF)], New Delhi, along with its two branch offices at Bengaluru and Dehradun, is responsible for audit of Air Force and other related organisations**.** Hindustan Aeronautical Limited (HAL) is audited by the Principal Director of Commercial Audit & Ex-officio Member Audit Board IV, Bengaluru.

There are broadly three distinct types of audit: Financial Audit, Compliance Audit and Performance Audit.

Financial Audit is the review of financial statements of an entity that seeks to obtain an assurance that the financial statements are free from material misstatements and present a true and fair picture of its affairs.

Compliance Audit scrutinises transactions relating to expenditure, receipts, assets and liabilities of the audited entities to ascertain whether the provisions of the applicable laws, rules, regulations, various orders and instructions issued by the competent authorities are being complied with.

Performance Audit is an in-depth examination of a programme, function, operation or the management system of entity to assess whether the entity is achieving economy, efficiency and effectiveness in the employment of available resources.

This Report contains findings pertaining to capital and revenue expenditure, installation / upgradation of aircraft and systems and performance of work services. Total financial value of cases commented upon in this Report is ₹7686.35 crore.

1.2 Authority for audit

Article 149 of the Constitution of India, the Comptroller and Auditor General's (Duties, Powers and Conditions of Service) Act, 1971 and Regulations of Audit and Accounts 2007, give authority for audit and detailed methodology of audit and its reporting.

1.3 Planning and conduct of audit

Audit is prioritised through an analysis and evaluation of risks so as to assess their criticality in key operating units. Expenditure incurred, operational significance, past audit results and strength of internal control are amongst the main factors which determine the severity of the risks.

Audit findings of an entity / unit are communicated through Local Test Audit Reports / Statement of Cases. The response from the audited entity is considered which may result in either settlement of the audit observation or referral to the next audit cycle for compliance. Serious irregularities are processed as draft paragraphs for inclusion in the C&AG's Audit Reports which are submitted to the President of India under Article 151 of the Constitution of India, for laying them before each House of Parliament. Performance audits are done through a structured exercise by defining scope of audit, holding entry conference, sampling of units, exit conference, inclusion of feedback on draft report and issuance of final report.

1.4 Profile of audited entities

Indian Air Force was founded in October 1932. Its mission is defined by the Air Force Act of 1950 in the aerial battle space as: "Defence of India and every part

thereof including preparation for defence and all such acts as may be conducive in times of war to its prosecution and after its termination to effective demobilisation". It is headed by the Chief of the Air Staff. The overall administrative, operational, financial, technical maintenance and control of IAF rest with Air HQ. Indian Air Force has seven commands, of which five are operational and two functional commands (one Training Command and one Maintenance Command). Operational and maintenance units of IAF normally consist of wings and squadrons, signal units, base repair depots and equipment depots.

Military Engineer Services (MES) provides engineering support to the Services including IAF. It is one of the largest Government construction agencies with annual budget of approx. ₹9,000 crore. Engineer-in-Chief is the head of the MES.

Hindustan Aeronautics Limited (HAL), a Navratna company under the Ministry of Defence, is engaged in design, development, manufacture, upgrade, repair and overhaul of aircraft, helicopters, aero-engines, avionics and navigation system equipment and marine & industrial gas turbine engines for both military and civil applications. The management of HAL is vested in the Board of Directors headed by a Chairman & Managing Director assisted by Functional Directors (four), Government Directors (two) and Independent Directors (seven). The Company has 20 production units under five complexes (Bengaluru Complex, Design Complex and Helicopter Complex at Bengaluru, MiG Complex at Nashik and Accessories Complex at Lucknow) headed by Chief Executive Officers and 10 Research and Design Centers located at various places.

HAL is the main supplier of indigenous equipments to IAF. The turnover of HAL increased from ₹14,328 crore in 2012-13 to ₹15,135 crore in 2013-14 *i.e. by* 6 *per cent*.

The Defence Research and Development Organisation (DRDO) undertakes design and development of weapon systems and equipment in accordance with the expressed needs and the qualitative requirements given by the Services. It has 52 laboratories of which nine normally provide services to Air Force.

The Defence Accounts Department headed by the Controller General of Defence Accounts is responsible for accounting of defence services receipts and expenditure as well as defence pensions and also provides services in terms of financial advice.

1.5 Budget and Expenditure of Air Force

The Defence Budget is broadly categorised under Revenue and Capital expenditure. While Revenue expenditure includes pay and allowances, stores, transportation and work services, *etc.*, Capital expenditure covers expenditure on acquisition of new aircraft, weapons and ammunition, replacement of obsolete stores, construction work.

The defence expenditure increased from ₹1,87,469 crore in 2012-13 to ₹2,09,788 crore in 2013-14 *i.e.* by 11.91 *per cent*. The share of IAF in the total expenditure on Defence Services during 2013-14 was ₹58,745 crore *i.e.* 28 *per cent*.

1.5.1 Air Force Expenditure

The total expenditure incurred by IAF during 2009-2014 ranged between 22.81 to 28 *per cent* of the total defence expenditure. In the year 2013-14, the expenditure of IAF rose by 14.92 *per cent* from ₹51,118 crore to ₹58,745 crore, as compared to the previous year.

A broad summary of the expenditure of IAF is given in the Table below:

Table 1.1: Expenditure of IAF

(₹ in crore)

Year	Total	Percentage change over previous year	As a percentage of total Defence Expenditure	Revenue Expenditure	Capital Expenditure
2009-10	33,259	(+) 11.45	22.81	14,708	18,551
2010-11	38,782	(+) 16.60	24.43	15,179	23,603
2011-12	46,134	(+)18.96	26.23	17,322	28,812
2012-13	51,118	(+)10.80	27.26	18,138	32,980
2013-14	58,745	(+)14.92	28.00	20,160	38,585

Source: Year-wise Appropriation Accounts of Defence Services

1.5.2 Capital Expenditure

The Capital expenditure of IAF rose by nearly 107.99 *per cent* during five year period from 2009-10 to 2013-14. In absolute terms, Capital expenditure increased from ₹18,551 crore in 2009–10 to ₹38,585 crore in 2013-14.

The Capital expenditure of IAF was mainly incurred on acquisition of new aircraft and modernisation or up-gradation of the existing fleet. The average annual

distribution of expenditure over the different categories for the last five years (2009-10 to 2013-14) for IAF is depicted below in the Table below:

Table 1.2: Capital Expenditure of IAF

(₹ in crore)

Year	Aircraft and Aero-engine	Construction work	Other equipment	Others	Total
2009-10	12,097	905	5,317	232	18,551
2010-11	16,094	1,158	6,039	312	23,603
2011-12	20,274	1,153	6,788	597	28,812
2012-13	23,573	1,318	7,399	690	32,980
2013-14	29,069	1,304	7,761	451	38,585

Source : Year-wise Appropriation Accounts of Defence Services

During 2013-14 a significant portion (75.33 *per cent*) of capital expenditure was incurred on procurement of aircraft and aero engine. About 20 *per cent* was spent on other equipment and 3.37 *per cent* was spent on construction activities.

1.5.3 Revenue Expenditure

During 2009-10 to 2013-14, Revenue expenditure of IAF increased by 37.06 *per cent* from ₹14,708 crore in 2009-10 to ₹20,160 crore in 2013-14. The Revenue expenditure of IAF was mainly incurred on pay and allowances, stores and special project. The distribution of expenditure over different categories of revenue expenditure for last five years is depicted below.

Table 1.3: Revenue Expenditure of IAF

(₹ in crore)

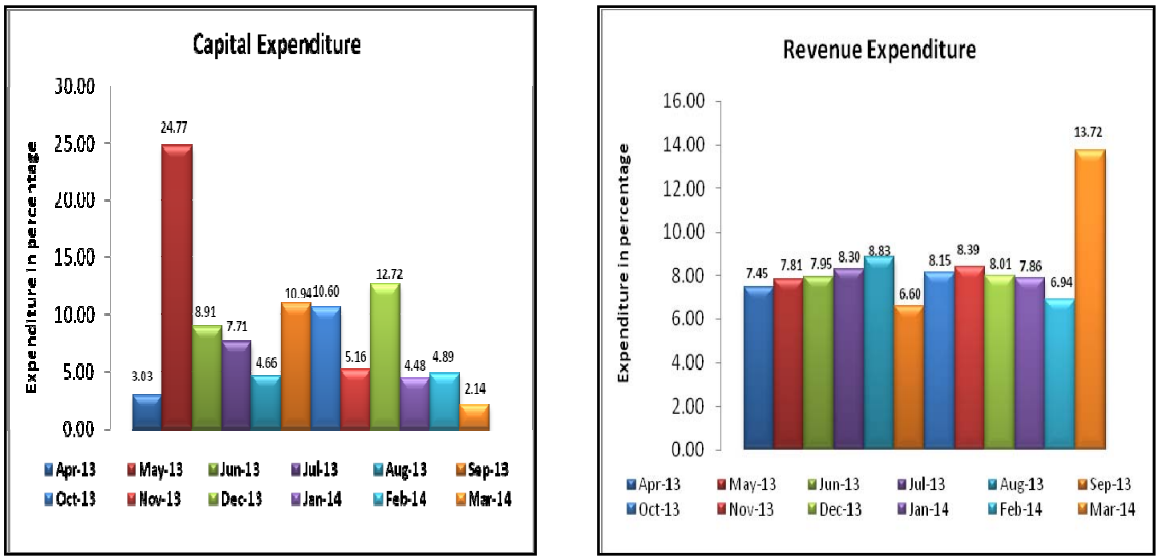
Year	Pay and allowances	Stores and special project	Works	Transport	Others	Total
2009-10	6,971 (47%)	5,640 (38%)	1,560 (11%)	358 (3%)	179 (1%)	**14,708**
2010-11	6,856 (45%)	5,775 (38%)	1,692 (11%)	620 (4%)	236 (2%)	**15,179**
2011-12	7,532 (44%)	6,931 (40%)	1,800 (10%)	763 (4%)	296 (2%)	**17,322**
2012-13	8,378 (46%)	7,038 (39%)	1,775 (10%)	611 (3%)	336 (2%)	**18,138**
2013-14	9,464 (47%)	7,779 (39%)	1,912 (9%)	661 (3%)	344 (2%)	**20,160**

Source: Year-wise Appropriation Accounts of Defence Services

1.5.4 Flow of Expenditure during the year

Audit examined flow of capital and revenue[1] expenditure during 2013-14 which is depicted as below.

Figure 1.1: Flow of Expenditure during 2013-14



Source: CGDA letter no. Mech/EDP/326/NewComp dated 15th September 2015

Scrutiny of flow of expenditure revealed that the Revenue expenditure of IAF in March 2014 was 13.72 *per cent*, which was within the limit of 15 *per cent* prescribed by Ministry of Finance vide OM No. 7(1)/E.coord/2014 dated 29th October 2014.

1.5.5 Revenue Receipts of Indian Air Force

The details of receipts and recoveries pertaining to the Indian Air Force during the five years ending 2013-14 for the services that they provided to other organisations/ departments are given in the Table below:

Table 1.4: Revenue Receipts of IAF

(₹ in crore)

Year	Receipt and Recoveries
2009-10	468.13
2010-11	592.92
2011-12	619.38
2012-13	605.26
2013-14	700.00

Source: Defence Service Estimates for respective year

[1] Revenue expenditure of IAF for the month of March 2014 is inclusive of ₹9.72 crore incurred by the Ministry of Information and Broadcasting on behalf of the Ministry of Defence.

1.5.6 Appropriation and Expenditure

The summarised position of Appropriation and Expenditure during 2011-12 to 2013-14 in respect of the Air Force is reflected in the Table below:

Table 1.5: Appropriation and Expenditure

(₹ in crore)

AIR FORCE									
	2011-12			2012-13			2013-14		
	Final Grant	Actual Expend-iture	Total Excess/ Savings (+) / (-)	Final Grant	Actual Expend-iture	Total Excess/ Savings (+) / (-)	Final Grant	Actual Expend-iture	Total Excess/ Savings (+) / (-)
REVENUE									
Voted	16,753.53	17,321.43	(+)567.90	18,322.87	18,122.50	(-)200.37	19929.17	20115.89	(+)186.72
Charged	3.23	0.58	(-)2.65	6.18	15.54	(+)9.36	54.10	44.37	(-)9.73
CAPITAL									
Voted	28,253.82	28,766.24	(+)512.42	32,729.64	32,976.34	(+)246.70	38677.62	38584	(-)93.62
Charged	51.36	45.84	(-)5.52	5.70	3.77	(-)1.93	1.70	1.39	(-)0.31
Total	**45,061.94**	**46,134.09**	**(+)1,072.15**	**51,064.39**	**51,118.15**	(+)**53.76**	**58662.59**	**58745.65**	**(+)83.06**

Source: Appropriation Accounts of Defence Services for each year

An analysis of the Appropriation Accounts, Defence Services for each of the three years has been included in the Report of the Comptroller and Auditor General of India for the relevant years, Union Government – Accounts of the Union Government.

1.6 Response to Audit

1.6.1 Response of MoD to Draft Audit Paragraphs

On the recommendations of the Public Accounts Committee (PAC), the Ministry of Finance (Department of Expenditure) issued directions to all the Ministries in June 1960 to send their response to the Draft Audit Paragraphs proposed for inclusion in the Report of the Comptroller and Auditor General of India within six weeks.

The Draft Paragraphs proposed for inclusion in this Report were forwarded to the Secretary, Ministry of Defence through demi-official letters drawing attention to audit findings and requesting a response within six weeks.

Despite the instructions of the Ministry of Finance, MoD's replies to ten Paragraphs out of 15 Paragraphs included in this Report were not received. Thus, the response of the Ministry could not be included in respect of these paragraphs.

1.6.2 Action Taken Notes (ATNs) on Audit Paragraphs of earlier Reports

With a view to enforce accountability of the executive in respect of all issues dealt with in various Audit Reports, PAC desired that Action Taken Notes on all paragraphs pertaining to the Audit Reports for the year ended 31st March 1996 onwards be submitted to them, duly vetted by Audit, within four months from the laying of the Report in Parliament.

Status of outstanding ATNs on audit paragraphs relating to the Air Force and HAL as on 30th September 2015 is as under (details in **Annexure-I**) :

Table 1.6: Status of ATN

Status of ATN	IAF	HAL
Audit Paragraphs/Report on which ATN have not been submitted by the Ministry even for the first time	5	4
Audit Paragraphs/Report on which revised ATN are awaited	12	8

CHAPTER II: AIR FORCE

2.1 Operation and maintenance of 'AA'

The Ministry of Defence concluded a contract (March 2004) for procurement of three 'AA' and its sub-systems at a cost of 1108 MUSD (₹5,042 crore).
There was sub-optimal utilisation of operational capabilities of 'AA' in terms of flying task achieved mainly due to un-serviceability of 'AA'. Besides, scope for increasing operational efficiency of 'AA' aircraft was restricted due to absence of training to aircrew on air to air refuelling (AAR) and non-acquisition of additional land for extension of runway length at AF Station 'S-3'.
There was delay in installation of Ground Exploitation Station (GES) at intended location ('S-1') due to lack of due diligence in planning of work services. There was shortage of aircrew which may impact the operations of the 'AA' aircraft during hostilities. No long-term arrangement existed for repair and maintenance of 'AA' which was being managed with interim maintenance services contract. Supply of defective Automatic Test Equipment for Communication System, the non-supply of 'I' level facility for Identification of Friend or Foe (IFF) system and short provisioning of stores / rotables had adversely affected the serviceability of 'AA'.
Certain infrastructure facilities were not synchronised with the induction of 'AA' as there was delay in completion of work services for modified hangars, independent storage facility and separate training-cum-accommodation centre at AF Station 'S-3', which affected smooth functioning of 'AA'.

2.1.1 Introduction

'AA' provides air and surface surveillance within a given airspace. It provides early warning on attacks by enemy aircraft within its surveillance volume. The 'AA' is capable of operating as an Airborne Autonomous

Command & Control Centre for conducting offensive and defensive air operations.

Ministry of Defence (the Ministry) procured (March 2004) three 'AA' and its sub-systems at a cost of 1,108 MUSD[1] (₹5,042 crore)[2]. 'AA' is divided into two segments *i.e.* Airborne Segment and Ground Segment. Airborne Segment, called 'AA' aircraft, is a Mission System Avionics (MSA[3]) mounted on modified 'A' aircraft[4] (platform). The MSA helps in gathering signal intelligence of adversaries and in determining location of the emitters. Collected data is analyzed on board and transmitted to ground stations. The system on ground called Ground Exploitation Station (GES) receives and processes data collected by MSA.

All the three 'AA' aircraft were inducted in Indian Air Force (IAF) between May 2009 and March 2011 and six GES were installed between September 2009 and February 2012 at six units of IAF. The Ministry established (June 2007) 'Sq-7' Squadron (operating unit) at AF Station, 'S-3' to operate 'AA'. 'Sq-7' Squadron at 'S-3', under functional control of Air Headquarters (HQ) and administrative control of 'W-2' Wing, through HQ Central Air Command (CAC) is responsible for execution of operational task as assigned, maintenance of the 'AA' aircraft, operational training and management of all associated activities.

Audit was conducted to see whether 'AA' was optimally utilised since 'AA' is a high value national asset which could be a deciding factor in conflict situation. Audit consisted of test check of records relating to 'AA' maintained at the Air HQ and operating units covering period from 2011-12 to 2013-14.

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1 Million US Dollar

2 1 USD= ₹45.50

3 MSA, developed by vendor (M/s 'V-1'), comprises of Primary Radar, Secondary Surveillance Radar, Electronic Support Measure, Communication Support Measure, Mission Communication System, Data Link, Hybrid Navigation System, Mission Computer System and Operator Work Stations.

4 Modified aircraft is newly manufactured 'A' aircraft with re-engining and structural modifications for installation of MSA, as per tripartite agreement between the Governments of India (IAF), Israel and Russian Federation.

Records beyond these years were also scrutinized wherever considered necessary.

Statement of Case (SoC) issued (November 2014) to Air HQ was replied in January 2015. The draft audit report was also issued to the Ministry in January 2015. This report has suitably incorporated replies from Air HQ. Based on further examination, revised draft was issued to the Ministry (July 2015); the Ministry's reply to initial draft report or revised draft report was awaited (September 2015).

Audit findings are discussed in following paragraphs.

2.1.2 Operations

2.1.2.1 Shortfall in Flying Task

As per Policy Page[5] of 'Sq-7' Squadron issued by the Ministry (June 2007), the operating unit was to operate 1500 flying hours per annum with all three 'AA' aircraft. Air HQ informed (May 2015) that monthly flying task for 'AA' operating unit is assigned based on training and other special requirements projected monthly by various Commands HQ, which is then deliberated and prioritised at Directorate of Airborne Sensors and Networking (ASAN).

Against the established task stipulated in Policy Page, year-wise details of flying task planned and flying task achieved in terms of flying hours are as given below:-

[5] Policy page issued by Government of India, Ministry of Defence defines the role and task to be performed by a Unit and manpower sanctioned for its functioning.

Table 2.1: Flying Task Planned and Achieved

Year	Task Planned	Actual flying	Shortfalls in Percentage, against	
			Flying Task Planned	Annual task of 1500 flying hours
	(Hours)	(Hours)	(%)	(%)
2011-12	895	855	4	43
2012-13	1088	926	15	38
2013-14	844	766	9	49
Total	**2827**	**2547**	**10**	**43**

Thus, on an average there was 43 *per cent* shortfall against the established task of 1500 flying hours per annum. Even the reduced task planned was not achieved in any of the years.

Regarding fixing of lower flying task plan against the established task fixed for the Squadron, Air HQ stated (January 2015) that task planned for 'AA' aircraft was based on its 75 *per cent* availability whereas its actual availability had only been approximately 66 *per cent*, which had resulted in lower task planned. Further, Air HQ attributed (January 2015) the shortfall in flying task to low availability of aircraft due to un-serviceability of any one or more sub-systems of 'AA' just prior to mission launch, non-availability of participant force[6] and the environmental factors such as bad weather, bird activity, *etc*.

Air HQ replies may be seen in view of the following:

- 1500 hours[7] fixed by the Ministry were not qualified with any constraints and were not subject to any condition. Lower availability of 'AA' aircraft

[6] 'AA' aircraft do not always fly in isolation like other fleets of IAF. Missions are carried out with participants of fighter aircraft from other Squadrons.

[7] The basis of fixation of 1500 flying hours per annum specified in the Policy Page was requested from Air HQ (March 2015), but the details of working out the figure of 1500 flying hours per annum was not made available to Audit. In absence of this, Audit is constrained to consider that task of fixation of flying hours was without conditions.

in initial years itself is also a reason of concern, specially for a costly national asset with limited life.

- Further, the task planned for 2011-12 and 2013-14 was less than even 66 *per cent* (990 hours[8]) of assigned task of 1500 flying hours as contended by Air HQ.
- Non-achievement of flying task due to non-availability of participating forces indicated inadequate co-ordination between 'Sq-7' Squadron and the participating units of IAF.

Fact thus remains that the task planned and achieved was far below the task of 1500 flying hours per annum assigned to 'Sq-7' Squadron in its Policy Page, which resulted into sub-optimal utilisation of 'AA' in its initial years itself and consequently, IAF has been unable to fully exploit the intended benefits from the valuable national asset. As both 'AA' technology and aircraft have limited and defined life, shortfall in assigned task especially in its initial years is a cause of concern.

2.1.2.2 Non-exploitation of Air to Air Refueling (AAR) capability in 'AA' aircraft

As per Tripartite Agreement (October 2003) between the Governments of India, Israel and Russian Federation, newly manufactured 'A' aircraft was to be structurally modified with PS-90A engines by Russian agencies and equipped with Israel made Mission System Avionics (MSA). As per the scope of work, M/s 'V-1', the prime vendor had the responsibility of training of the Indian Aircrew, MSA operators and maintenance personnel as required.

The contract (March 2004) for 'AA' provided structural modifications for 'AA' aircraft which included modifications relating to Air to Air Refuelling (AAR) *viz.* wing air refuelling installations, air refuelling boom and in-flight refuelling probe capability. Total cost of all structural modifications for three

[8] 1500x66/100

'AA' aircraft (including AAR capability) and integrated logistic support (ILS) was 143.75 MUSD (₹654.06 crore).

Through audit of records at Air HQ it emerged (June 2014) that AAR could significantly enhance the time on task[9] and is essential due to limitation on maximum permissible take-off weight during summer months leading to reduced fuel capacity of the aircraft at higher ambient temperatures. Further, whenever extended stay of 'AA' aircraft is required in an Area of Responsibility (AOR) far away from a base or deployment of 'AA' aircraft is demanded in a different AOR, the AAR allows effective operation of 'AA' aircraft by eliminating delay associated with landing for refuelling. In addition, aerial refuelling conserves airframe hours and engine life cycles (consumed at each take-off) and reduces ratio of sorties to flying hours thereby reduces exposure to hazards associated with take-off and landing phases. AAR therefore enhances operational efficiency of 'AA' aircraft.

Audit, however, observed (June 2014) that AAR capability, provided through modifications in 'A' aircraft, could not be exploited operationally so far as no AAR training was provided to aircrew of 'AA' aircraft by the OEM[10] for this purpose.

Air HQ stated (October 2014) that AAR training was not part of 'AA' contract. However, on persuasion by IAF, M/s 'V-1' agreed to impart training after prolonged discussions and the training was likely to be conducted in November 2014. As regards the status of AAR training, Air HQ intimated (May 2015) that the approval of Ministry had been obtained for training of two pilots and two flight engineers in Russia and the training was being conducted by the OEM in May/June 2015.

The reply confirms that even though 'AA' aircraft was modified to have capability of AAR, the Ministry did not ensure provision of AAR training with other commensurate training as provided in the contract (March 2004). In fact, the conclusion of contract without a provision of AAR training essential

[9] Time on task is the period during which 'AA' aircraft is in the air to perform its mission.
[10] Original Equipment Manufacturer

for exploiting the vital AAR capability was a serious oversight lapse resulting in non-realisation of full potential of 'AA' aircraft so far (July 2015) since its induction in May 2009 thereby restricting efficacy of defensive and offensive operations of IAF. Air HQ response on the Audit query (July 2015) on the status of AAR training to aircrew of 'AA' by the OEM, was also awaited (September 2015).

2.1.2.3 Restriction in operation of 'AA' aircraft due to shortage in runway length

The contract for acquisition of 'AA' was concluded in March 2004 with the scheduled induction of first 'AA' at 'Sq-7' Squadron (Operating unit) in November 2007. The Operating unit initiated a Statement of Case 'SoC' (July 2005) for extension of runway at Air Force Station (AFS) 'S-3' as the All-Up Weight (AUW) of 'AA' aircraft was 195 tonnes, which required a runway length of over 15000 feet *vis-à-vis* the existing 9000 feet, for its unhindered operation.

The SoC (July 2005) incorporated a requirement for acquisition of 253.67 acres of private land, also indicating that the action for the same had been initiated in May 2004 to enable extension of runway over 15000 feet. The SoC (July 2005) also proposed to start extension, with available Defence land first, for extension of runway to a length of 10500 feet as a viable option and as an immediate interim measure for operation of 'AA' at AF Station, 'S-3'.

Audit noticed (July 2014) from the SoC (July 2005) that AF Station 'S-3' is also a base for 'B' fleet, which provides air to air refuelling (AAR) to fighter fleets and has maximum AUW of 210 tonnes. For the AUW of 210 tonnes, the SoC (July 2005) stated that the minimum length of runway required at various temperatures as 11480 feet (15°C), 11874 feet (20°C), 12464 feet (25°C), 13120 feet (30°C), 13940 feet (35°C), and 15022 feet (40°C), Further, as per the SoC (July 2005), the AUW of 'B'/'AA' aircraft on a runway length of 10500 feet was assessed at 199 tonnes, 194 tonnes and 183 tonnes at 20°C,

30°C and 40°C respectively, as the payload capacity of the aircraft reduces with the increase in temperature given the length of runway and that the mean airfield temperature at 'S-3' airfield is 36°C during April-September and 22°C from October-March.

Audit observed[11] that temperature at Air Force Station 'S-3' was more than 30°C for 236 days and more than 40°C for 48 days, in a year. Therefore, the maximum AUW of 'AA' aircraft was getting adversely affected for major part of year because of restricted runway length.

Audit further noticed (July 2014) that the work services for extension of runway to 10500 feet, was sanctioned in September 2006 under Para 11[12] of Defence Works Procedure (DWP) -1986 and completed in March 2009 at a cost of ₹20.38 crore just before induction (May 2009) of first 'AA' aircraft. Audit also noticed (October 2014) that the length of runway remained at 10500 feet and it was not extended to the desired runway of over 15000 feet.

Audit pointed out (November 2014) the issue of delay in acquisition of additional land and its impact on the operation of 'B'/'AA' aircraft. Air HQ stated (January 2015) that 'AA' aircraft, being a more recent acquisition with more powerful engines, operated with its full payload on the existing runway while 'B' operated with limited payload (maximum up to 180 tonnes).

The reply is not acceptable as the case for runway extension was initiated (July 2005) after award of the contract (March 2004) for 'AA' aircraft, when IAF was already aware of the configuration of engines. Thus, the requirement for a runway length of over 15000 feet was, accordingly, projected (July 2005) by IAF for the unhindered operation of 'AA'.

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[11] Data furnished to Audit under Air Force Station, 'S-3' letters No. 4W/813/2/1/Met dated 22 June 2015 and even No. dated 24 August 2015.

[12] Under Para 11 of DWP- 1986-any local Commander may order the commencement of works in unexpected circumstances arising from unforeseen operational necessity or urgent medical grounds, natural disasters which make it imperative to short-circuit normal procedure and when reference to appropriate Competent Financial Authority would entail dangerous delay.

Air HQ further informed (June 2015) that the case for acquisition of land initiated in May 2004, was closed following direction (September 2006) of the Chief of Air Staff (CAS) for a review and since the proposal for acquisition of land was a time consuming process and not very cost effective, the same was dropped.

The reply regarding cost effectiveness of land acquisition needs to be seen against overall cost of 'AA' project being in excess of ₹5,000 crore, the ageing of three 'AA' inducted in IAF between May 2009 and March 2011, and the impact of ageing on AUW carrying capability of 'AA' given availability of less than optimal runway.

The fact remains that non-extension of the runway length to over 15000 feet, has limited the operations of 'AA' to an individual mission of seven and a half hours without landing. This operation/ air time is further constrained due to higher temperature at the 'Sq-7' Squadron /Air Force Station, 'S-3', for major part of the year. Further, as 'B' aircraft would provide air-to-air refueling to 'AA' in future as discussed in *paragraph 2.1.2.2*, the limited payload restriction on 'B' due to short runway length at AF Station 'S-3' has the potential to impede the operation of 'AA'.

2.1.2.4 Delay in work services for installation of GES at 'S-1'

Ground Exploitation Station (GES) facilitates in establishing data and voice link and exchange of operational data with 'AA' aircraft. Audit observed (July 2014 to September 2014) that GES was installed and operationalised at six units[13] between September 2009 and February 2012. The location of one of these GES initially planned for installation at 'S-22' by September 2009, was however changed (February 2009) to 'S-4' on technical grounds and subsequently (July 2010) to 'S-1' in view of operational necessity.

[13] 'S-6', 'S-3', 'S-7' 'S-8', 'S-1' (temporarily installed at 'S-5') and 'S-9'.

It was further observed in Audit that the GES for 'S-1' was received at 'S-5' in April 2011 and was installed (February 2012) at 'S-5' on temporary basis to make it operational and avail the maximum warranty period. The administrative approval (AA) for the work services at 'S-1' was accorded in November 2011 at a cost of ₹3.07 crore, six months after receipt of the GES. The PDC of 102 weeks *i.e*. by November 2013 specified in the AA had lapsed and the work was in progress.

Air HQ, in reply, stated (June 2015) that due to additional requirements projected by OEM subsequent to their visit in June 2014, a revised administrative approval had been issued in April 2015 for ₹3.67 crore with PDC revised to July 2015 and the progress of the work services was 82 *per cent* (June 2015).

The fact remains that there has been a lack of urgency in planning /execution of work services at 'S-1', leading to delay of over four years (till June 2015) in installation of the GES since its receipt (April 2011). Thus, operational requirement (July 2010) for the GES at 'S-1' was still (June 2015) to be realised.

2.1.2.5 Shortage of aircrew

Ministry issued (June 2007) the Policy Page prescribing the sanctioned establishment of aircrew (*i.e.* pilots, navigators and flight engineers) of the 'Sq-7' Squadron for 'AA' at AF Station 'S-3'. Periodic reviews are carried out to determine the minimum manpower requirement, which is termed as 'To Be Manned (TBM)'[14].

Audit noticed (July 2014) from the QFTRs[15] of the Squadron that the actual strength of aircrew was less than the sanctioned strength during 2011-12 to 2013-14 as given below:-

[14] TBM is the minimum level of manpower necessary to run an organisation.
[15] Quarterly Flying Training Returns

Table 2.2: Shortage of aircrew

		2011-12			2012-13			2013-14		
Aircrew	**Establish-ment**	**Average Strength**	**Deficiency**		**Average Strength**	**Deficiency**		**Average Strength**	**Deficiency**	
	Nos.	**Nos.**	**Nos.**	**%**	**Nos.**	**Nos.**	**%**	**Nos.**	**Nos.**	**%**
Pilots	12	8.25	3.75	31.25	7	5	41.66	6.25	5.75	47.92
Navigators	6	4.5	1.5	25	4	2	33.33	4	2.0	33.33
Flight Engineer	**7**	6	1.0	14.29	6	1	14.29	6.25	0.75	10.71

As seen from the Table, the shortfall ranged between 31.25 *per cent* and 47.92 *per cent* in respect of pilots and between 25 *per cent* and 33.33 *per cent* in respect of navigators. Further, shortfall in Pilots and Navigators showed increasing trend over 2011-12 to 2013-14.

Audit enquired (July 2014), the reasons for the deficiency in strength of aircrew and its impact on operation of 'AA' aircraft. Air HQ, in reply, stated (January 2015) that there had not been any significant impact of shortfall in aircrew strength during peacetime operations as the available strength allowed two sets of crew under normal circumstances and two missions could be undertaken on a daily basis; however, it would have an impact during hostilities in view of the increased tasking. The reply was silent on reasons for deficiency and also as to how the shortfall in aircrew would be met in case urgency erupts as a result of hostilities. Air HQ also stated (22 January 2015) that as per their records the average number of pilots at 'Sq-7' Squadron 'S-3' was 11.5 in 2011-12, 11.25 in 2012-13 and 10.75 in 2013-14 against the established strength of 12 during these years, after considering pilots from fighter stream which were not reflected in actual strength of the Squadron. Regarding short strength of navigators, Air HQ stated (January 2015) that the average number of strength of 4 to 4.5 is in line with the approved TBM level of 4 numbers.

The reply is not in sync with the Policy Page of 'Sq-7' Squadron which does not prescribe that the establishment of 12 pilots will include the pilots from fighter stream. Thus, Air HQ reply (January 2015) is neither buttressed by the Policy Page nor by the role of the fighter pilot *vis-a-vis* a system meant for air and surface surveillance.

2.1.3 Maintenance

Maintenance in IAF for 'AA' comprises of following:

- Ist line servicing ('O' level maintenance),
- IInd line servicing ('I' level maintenance), and
- IIIrd & IVth line servicing ('D' level maintenance).

'O' level maintenance is performed at the aircraft flight line parking area and include fault detection and isolation down to Line Replaceable Unit (LRU)[16] level, removal and replacement of faulty LRU, and forwarding the faulty LRU to 'I' level for further testing and repair. 'I' level maintenance is performed at the airbase laboratory/shop and includes fault detection and isolation of faulty Shop Replaceable Unit (SRU)[17] within LRU using appropriate test equipment. 'D' level maintenance consists of repair or overhaul of repairable SRUs, which is carried out either by vendor or Base Repair Depot (BRD) of IAF. Annual Maintenance Contracts (AMCs) are also entered to ensure serviceability of sub-systems of 'AA'.

2.1.3.1 Maintenance of 'AA'

Audit evaluated maintenance of 'AA' and observed as follows:

(a) 'AA' - MSA[18]: The Cabinet Committee on Security (CCS) approved (January 2004) comprehensive AMC for MSA for a period of two years at a cost of 10.6 MUSD (₹48.23 crore) per annum and thereafter limited AMC

[16] LRU is a modular component of a device that is designed to be replaced at an operating location.
[17] Shop Replaceable Unit is sub-part of line replaceable unit (LRU).
[18] 'AA' Mission System Avionics *i.e.* system mounted on aircraft

(other than critical items) at an annual cost of 8.5 MUSD (₹38.67 crore) along with setting up of 'D' Level facility at a cost of 15.5 MUSD (₹70.52 crore) for critical items, like Transmit/Receive (TR) units and Radio Transmission sets.

The contract (March 2004) for 'AA', however, provided only for an option for 'D' level maintenance facility' and AMC in respect of MSA and the option was to be exercised no later than the end of the warranty for first 'AA'. This was significant departure from the maintenance arrangement approved by the CCS. Further, it was also noticed that the option provided in the contract was not exercised by IAF, validity of which expired in December 2011.

(b) 'AA' - aircraft (platform): The CCS approved (January 2004) aircraft maintenance (*i.e.* unit and base level repair) up to 300 hours as per Integrated Logistic Support (ILS) offered within the final price by the vendor. Further maintenance beyond 300 hours, for certain uncommon items between the 'AA' aircraft and the already held 'A' platform with IAF, was to be provided by the vendor free of charge for expenditure up to one MUSD and for expenditure exceeding one MUSD, the same was to be decided by mutual consultations between IAF and the vendor.

The contract (March 2004) provided for ILS for aircraft maintenance up to 300 hours and kept a clause for maintenance of uncommon items of aircraft as per CCS approval. However, separate arrangement for maintenance of uncommon items of the 'AA' aircraft beyond 300 hours as per CCS approval, was not made by MoD/IAF, as complete details on Russian equipment and systems were not made available by the Russian side till contract finalization.

Complexities of the 'AA' programme, non-commonality of the major systems[19] of the 'AA' aircraft platform with the existing 'A' aircraft, operating experience of 'AA', *etc*., necessitated search for alternate maintenance arrangements as discussed in succeeding paragraphs:

[19] Major systems such as Auxillary Power Unit (APU), Electrical system, Communication system, weather radar, liquid coolant system *etc.*

Long Term Maintenance Agreement (LTMA): As informed (July 2015) by Air HQ to Audit that during warranty period of the first aircraft, IAF proposed to the Ministry for two separate maintenance contracts for 'AA'-MSA (July 2009) and 'AA'-aircraft (September 2009) respectively. Ministry advised (January 2010) to set up the 'D' level facility for MSA. However, taking into account the issue of multiplicity of vendors (OEMs from four countries), the Ministry advised (February 2010) to explore the feasibility of a comprehensive maintenance agreement. Thereafter, Air HQ moved (September 2010) a case for LTMA covering complete 'AA' (MSA and aircraft). The Raksha Mantri accorded 'in principal' approval for the LTMA on 12 December 2011. However, the LTMA was not finalised and the CCS was not informed of the non-implementation of its approved maintenance arrangement till date (July 2015).

Interim Maintenance Services (IMS) contract: As maintenance arrangements approved by the CCS were not implemented by Ministry/Air HQ and alternate maintenance arrangement proposed as LTMA was also not finalised, the serviceability of 'AA' was met by IAF through ILS spares since the expiry of warranty period of first 'AA' in December 2011. However, as an interim measure, an IMS contract for maintenance of 'AA' (aircraft and MSA) was concluded with M/s 'V-1' on 19 September 2013, for a period of one year at an annual cost of 98 MUSD (₹607 crore). The IMS contract was extendable by six months. As informed by Air HQ in July 2015, the LTMA could not be concluded and therefore the IMS contract had been extended till March 2016.

Thus, cost of repair and maintenance which as per CCS note was ₹50 crore (approx.) per annum for MSA, became ₹607 crore (approx.) per annum under IMS contract.

Air HQ stated (July 2015) that cost (98 MUSD per annum) of IMS included maintenance of entire platform, MSA, ATE, Mission Support Segment (MSS), Mission Support Facility (MSF) and six GES spread across India at dispersed

locations. Air HQ further stated that IMS provided OEM specialist cover, repair of all failed items, supply of consumables of all scheduled and unscheduled activity, and routine health checks of the entire fleet.

Air HQ reply may be viewed in the light of CCS approved (January 2004) arrangements according to which:

- the AMC was to cover all sub-systems of MSA, other than those items for which D level maintenance facility would be established by M/s 'V-1';
- MSS, MSF and GES are sub-systems of MSA and were included in the cost (750 MUSD) of 'AA'-MSA approved by the CCS. ATEs were supplied as part of 'AA'-MSA and 'AA'-aircraft and no separate cost was provided for the same;
- repair of all failed items**,** replacement of consumables and specialist cover for MSA was also the part of AMC approved by the CCS and included in the option clause of the contract for 'AA';
- for platform, maintenance was to be arranged separately for uncommon items only.

Thus, there was departure from maintenance arrangements as approved by the CCS. Further, LTMA which was alternatively proposed for not implementing arrangements as approved by the CCS, was also not concluded in spite of its in-principle approval by the RM in December 2011. An interim arrangement through IMS contract was being followed since September 2013.

2.1.3.2 Unserviceable Automatic Test Equipment (ATE)

Communication Automatic Test Equipment (ATE) [20] is the test equipment used for 'I' level maintenance of communication system *i.e.* to test and isolate

[20] ATE is a computer controlled system, consisting of rack mounted Standard Test Equipment and dedicated test equipment. The ATE provides a convenient maintenance tool for LRU troubleshooting and testing at the required level.

fault in LRUs of the communication system up to SRU level. The cost of communication system for which Communication ATE was procured under the contract (March 2004) for 'AA' was 43.4 MUSD (₹197.47 crore[21]).

Audit noticed (May 2014) that Communication ATE installed (March 2011) at 'Sq-7' Squadron 'S-3' was unserviceable since inception as out of 130 LRUs tested[22], 94 LRUs did not match the ATE test pattern, though LRUs were serviceable.

Air HQ stated (May 2014) that the vendor (M/s 'V-1') had suggested that the test limits of the ATE checks were stringent and needed to be redefined in consultation with the OEM (M/s 'V-4') to make the ATE serviceable. As such the ATE was not capable of testing and isolating the fault up to SRU level in LRUs of communication system of 'AA'. Air HQ further stated (June 2014) that un-serviceability of LRUs of the communication system was being ascertained in the aircraft by change of SRUs, and that complete LRU needed to be sent for repair as it was not often possible to isolate the fault up to SRU level without the 'I' level maintenance facility.

In response to an audit enquiry (March 2015) on current status of the ATE, Air HQ stated (May 2015) that M/s 'V-1' had intimated that a contract had been signed by them with M/s 'V-4' and the Communication ATE was likely to be made compatible by August 2015. Air HQ also informed (May 2015) that eight LRUs of communication system were repaired by OEM since induction of 'AA' (after warranty period) at a total cost of 19,37,640 USD (₹11.63 crore[23]) and 15 LRUs were lying unserviceable.

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21 1 USD = ₹45.50

22 As intimated (May 2015) by Air HQ, most of the testing was carried out during acceptance of ILS spares and/or to facilitate the OEM in understanding the test wise exact threshold values and/or limits required for ATE modifications and not necessarily for un-serviceability.

23 1 USD = ₹ 60 on approximate basis

Thus, ATE since its installation (March 2011) at 'Sq-7' Squadron, had not been rectified so far (July 2015). Further, due to un-serviceability of the ATE, IAF had been dependent on OEM in determining the extent of fault in LRUs up to SRU level. Moreover, complete LRU had to be sent to OEM (M/s 'V-4') for testing and repair instead of defective SRU only for repair resulting in longer turn-around time (TAT)[24] in servicing, thereby entailing operational risks in maintenance of communication system.

2.1.3.3 'I' level maintenance support for IFF system

The Identification of Friend or Foe (IFF) system provides identification of enemy or friendly aircraft based on responses to interrogation, as well as determination of their positional and height data. The role of IFF system is to interrogate the various transponders in its coverage area.

The 'I' level maintenance facility for IFF system installed in 'AA' aircraft was to be set up by M/s 'V-1' as per the 'AA' contract (March 2004). The cost of IFF system under the contract (2004) was 22.2 MUSD[25] (₹122.10 crore).

Audit noticed (May 2014) that M/s 'V-1' had expressed (July 2013) inability to set up 'I' level maintenance facility for IFF system stating that manufacturer (sub vendor M/s 'V-3') had been demanding a very high price for design and manufacturing of special test equipment which was essential for setting up of its 'I' level facility. M/s 'V-1' instead had suggested lifetime support (30 years from the effective date of contract) for it and moved a contract amendment. However, the Ministry did not agree (July 2013) to the proposal and insisted upon supply of 'I' level facility as per the original contract.

Air HQ stated (March 2015) that a contract for 'I' level tester for IFF was likely to be signed between M/s 'V-1' (vendor) and M/s 'V-3' (OEM) and 'I' level maintenance facility was expected to be functional by August 2015.

Air HQ further stated (May 2015) that three IFF Interrogators which required testing since induction of 'AA', were tested and repaired by OEM without any

[24] Time period consumed from the date of sending unserviceable item /equipment from the unit to OEM and its receipt after repair.

[25] 1 USD = ₹45.50

charges being within the warranty period and there was one spare IFF Interrogator available in each aircraft that was used during the un-serviceability of IFF interrogators.

Thus 'I' level maintenance facility for IFF system had not been set up (July 2015) which was in violation of the contractual provisions. This had led to operational risks due to high turn-around-time involved as the complete LRU was required to be sent to OEM (M/s 'V-1') instead of SRU only for repair, besides the dependency on OEM in determining the extent of fault in LRU up to SRU level.

2.1.3.4 Inadequate provisioning of spares resulting in low serviceability of 'AA'

Spares are parts to replace components of an article of equipment specific to that article or that type of article. Spares which are capable of being repaired and reused are called rotables. Appropriate stock of spares is required for maintaining optimum serviceability of any equipment or system.

There were Integrated Logistic Support (ILS) spares to be supplied under the contract (2004) for 'AA'. Besides, Scale of Rotables of 'AA' was determined based on professional evaluation by OEM trained specialists and approved by Air HQ in the year 2010. The authorization and actual holdings of rotables for three years are tabulated below:-

Table 2.3 : Authorisation and Actual Holding of Spares

Year	Rotables Authorisation	Rotables Holding	Deficiency	
	Items (Nos.)	Items (Nos.)	Items (Nos.)	(%)
2011-12	1827	130	1697	92.88
2012-13	1827	826	1001	54.78
2013-14	1827	773	1054	57.69

Thus as against the approved Scale of Rotables, there had been acute deficiency in holding of rotables during 2011-12 to 2013-14.

In response to an audit enquiry (March 2015), Air HQ admitted (May 2015) that shortage of rotables affected the serviceability of 'AA' and one aircraft was on aircraft on ground (AOG) for want of rotables. Audit also observed (June 2014) that the inadequate provisioning of rotables / spares had adversely affected the serviceability of 'AA' as was evident from a letter written (May 2014) by the operating unit ('Sq-7' Squadron 'S-3') to Air HQ on critical issues of maintenance, which raised the concerns that:

- due to inadequate spares back-up, the squadron was facing difficulties in maintenance and servicing of aircraft.
- due to non-availability of spares at the 'X' Equipment Depot (ED) and non-commonality with 'A' / 'B' aircraft, the Squadron had to resort to the option of cannibalisation for serviceability of 'AA'.
- certain ILS spares (seven items of platform and 45 items of MSA) were yet to be delivered by vendor though these spares were critical for maintenance and required on priority.

Air HQ stated (July 2014) that the Scale of Rotables was under review and added that the operation and maintenance of 'AA' were being sustained through rotables (ILS spares) received against 'AA' contract (2004), procurement of additional requirement of rotables through subsequent contracts and the Interim Maintenance Services (IMS) contract.

The reply may be seen in view of admission (January 2015) of Air HQ that low serviceability was one of the factors which affected the 'AA' availability and its flying tasks as discussed in *para 2.1.2.1*.

Fact remains that Air Force authorities failed to arrange appropriate provisions of spares/rotables, thereby adversely affecting the serviceability of 'AA' aircraft.

2.1.3.5 Availability of infrastructure

Audit observed (May-July 2014) that the setting up of infrastructure was not synchronised with the procurement of 'AA' in following cases due to delays in sanctioning and execution of these projects.

(a) Delay in Modification of Hangars

Two existing hangars at 'S-3' were required to be modified to enable safe parking and maintenance of 'AA' aircraft. The modification work was, therefore, supposed to be completed before induction (May 2009) of the aircraft to ensure its safety.

The contract for acquisition of 'AA' was concluded in March 2004 and scheduled date of delivery of first 'AA' aircraft was November 2007. The work services for modification of two existing hangars were, however, sanctioned by Air Officer Commanding (AOC) AF Station 'S-3' in April 2007 under Para 11[26] of Defence Works Procedure-1986. The contract was concluded in March 2008 for ₹11.98 crore with probable date of completion (PDC) as April 2009. The work could only be completed in January 2011.

Meanwhile two of the 'AA' aircraft received at AF Station 'S-3' in May 2009 and March 2010 had to be parked in the open with a cloth blanking, despite the risk that parking of aircraft in the open could degrade radar performance by adversely impacting on radome[27] surface smoothness**.**

Audit noticed (May 2014) from the records at Air HQ that, in May 2010, AF Station 'S-3' was hit by a gale storm accompanied with rains and fabric covers of all four aero engines of one aircraft were ripped open and foreign objects including pieces of cover, bitumen pieces and small pebbles got ingested into aero engines. Out of these, one aero engine was cleared for operation on 20 August 2010 after removal of damage by foreign objects and

[26] Procedure for commencement of work under unexpected circumstances.
[27] The Radome is a primary structure on an aircraft, which houses the antenna.

other three aero engines were replaced by spare engines supplied under the 'AA' contract. This aircraft was thus not available for operations from 7 May to 25 August 2010. The damaged aero engines were made serviceable in February 2011 by the OEM under the warranty obligation.

Audit enquired (May 2014) the reasons for delay in sanctioning and execution of the work services for parking of 'AA' aircraft. Air HQ in reply stated (January 2015) that 'AA' parking outside the hangar was preferred during gale considering the possibility of aircraft being damaged by construction material itself as the hangars were under final stages of completion. The reply was silent about the reasons for delay in sanction and execution of the work services for modification of hangers.

Fact remains that the delay in modification of hangars was avoidable and resultantly one 'AA' aircraft remained grounded for more than three months. Moreover, the very purpose of execution of the work services under Para 11 of DWP could not fructify.

(b) Delay in setting up storage facility for 'AA' equipment

'X' Equipment Depot (ED) at AF Station 'S-3' was to store the equipment of the 'AA' aircraft. The modified aircraft platform, Radar dome and associated equipment required special infrastructure for storage purpose.

A Board of Officers (BOO) assembled in July 2005, to assess the requirement of work services for provision of storage facility for 'AA' equipment at AF Station 'S-3', recommended demolition of certain temporary buildings and erection of single storied air-conditioned building. The Board Proceedings (BPs) for sanctioning the work services were forwarded to HQ CAC in March 2006. Air HQ, however, sanctioned the work services in January 2009 for ₹2.68 crore with PDC of 120 weeks *i.e.* May 2011. A period of 34 months was, thus, taken in issue of administrative approval (AA) since the finalisation of BPs as against the prescribed timeframe of 28 weeks (seven months)

prescribed in the Defence Works Procedure (DWP) *i.e.* a delay of 27 months in according the AA .

Further, based on a proposal (May 2010) of Chief Engineer (AF) Allahabad, Air HQ issued corrigendum in February 2011 to the administrative approval based on Market Variation (MV) of December 2008 instead of March 2007 incorrectly adopted earlier, thereby revising the sanctioned cost to ₹3.21 crore with PDC as June 2013. Chief Engineer (AF) Allahabad concluded a contract in August 2011 for ₹2.57 crore with PDC of September 2012. The work was actually completed in March 2013.

The Equipment Depot (ED) had started receiving 'AA' spares since April 2009 onwards and the spares so received had to be accommodated in an old hangar along with the stores of other systems *viz.* 'A' / 'B', as an interim measure, because there was no independent storage available for sensitive 'AA' equipment. This had not only cramped the available store due to scarcity of space but also made the stores accessible to more than one storekeeper.

In response to audit observation (November 2014) on the impact of delay in completion of separate storage facility for 'AA', Air HQ stated (January 2015) that the spares of 'AA' were stored in available stores of the 'X' ED and necessary precautions were taken to ensure that no damage was caused to spares even though the space was limited.

Thus, there had been a delay of over three years in issue of administrative approval and issue of Corrigendum due to application of incorrect MV in preparation of the AEs, which delayed construction of storage space. As a result the independent storage accommodation was not available for 'AA' equipment for about four years (April 2009 to March 2013).

(c) Delay in setting up infrastructure for trainings activities related to 'AA'

Technical Type Training (TETTRA) school exists at AF Station 'S-3' for imparting training to operational and maintenance staff on 'A' / 'B' aircraft. With the induction of 'AA', the school was assigned (May 2009) additional responsibility to conduct training on 'AA' platform and 'Sq-7' Squadron was given the responsibility to impart training on Mission System Avionics (MSA). In May 2013, the responsibility for training on MSA of 'AA' was also shifted from 'Sq-7' Squadron to TETTRA school.

In order to make TETTRA school a quality oriented training institution for 'AA' and to provide training-cum-administrative accommodation in permanent structure, Board of Officers (BOO) was convened and BPs finalised (February-March 2006) and Administrative Approval (AA) accorded (January 2009) for ₹3.48 crore for the work services with PDC as July 2011. AA was revised (June 2010) to ₹3.80 crore as the lowest tendered amount was higher by more than 10 *per cent* of the sanctioned amount. Contract was awarded (June 2010) for ₹2.84 crore and the work was completed in September 2013, after a delay of more than two years from PDC.

Thus, there had been delays at every stage since finalisation of BPs in execution of work services for the independent training facilities for 'AA'.

Air HQ in reply stated (January 2015) that the training requirements of 'AA' were being met regularly through existing TETTRA school and training for 'AA' was never affected. Air HQ, however, did not furnish the reasons for delay in sanctioning/execution of the work services.

Air HQ reply may be seen in light of the fact that work services for creation of a dedicated training infrastructure were sanctioned (January 2009) for imparting quality training to operation and maintenance crew of 'AA' and

there was a delay of more than two years in completion (September 2013) of the work services against the PDC of July 2011.

2.1.4 Conclusion

There was sub-optimal utilisation of operational capabilities of 'AA' in terms of flying task achieved mainly due to un-serviceability of 'AA'. Besides, scope for increasing operational efficiency of 'AA' aircraft was restricted due to the non-imparting of training to aircrew on air to air refuelling (AAR) and non-acquisition of additional land for extension of runway length at AF Station 'S-3'.

There was delay in installation of Ground Exploitation Station at intended location ('S-1') due to lack of due diligence in planning of work services. There was shortage of aircrew which may impact the operations of the 'AA' aircraft during hostilities.

No long-term arrangement existed for maintenance of 'AA' which was being managed with interim maintenance services contract. Supply of defective Automatic Test Equipment for Communication System, the non-supply of 'I' level facility for IFF system and short provisioning of stores / rotables had adversely affected the serviceability of 'AA'.

Certain infrastructure facilities were not synchronised with the induction of 'AA' as there was delay in completion of work services for modified hangars, independent storage facility and separate training-cum-accommodation centre at AF Station 'S-3', which affected smooth functioning of 'AA'.

2.1.5 Recommendations

Audit recommendations arising out of audit analysis for appropriate paragraphs of this report are as under:

I. IAF may review utilization of 'AA' aircraft with a view to enhance its capacity utilization, so as to bring it at par with the established task

fixed by the Ministry; or the Ministry may suitably revise task in its Policy Page.

(Para 2.1.2.1)

II. Ministry/IAF may investigate reasons for non-inclusion of training in AAR in the contract (2004) for 'AA' and issue necessary instructions, so that in future the provisions of training required for operation of vital capabilities of an asset is not missed while concluding the contracts.

(Para 2.1.2.2)

III. Extension of Runway length at 'S-3' to over 15000 feet, by acquiring the additional land may be reviewed so as to meet the requirement of 'AA' and 'B' aircrafts to take-off with full payload.

(Para 2.1.2.3)

IV. Overall arrangement for maintenance of 'AA' be finalised as early as possible to ensure optimum availability thereof at optional cost. It may further be ensured that 'I' level facility is set up by OEM as per the contractual provisions so that dependency on OEM for testing of LRUs for isolation of fault up to SRU level and turn-around-time in servicing of LRU/SRU is minimised**.**

(Paras 2.1.3.1 to 2.1.3.3)

2.2 Operational works in IAF

Operational works are undertaken to meet the temporary requirement of operational necessity, and hence have significant role in operational preparedness of IAF. ₹90.35 crore was spent by IAF on operational works during 2010-11 to 2013-14. Audit found inclusion of ineligible works in Annual Operational Works Plans (AOWPs) and undefined timelines for all stages of operational works *viz.* delays in declaring operational works area, approval of AOWPs, award of contracts and execution of operational works.

2.2.1 Introduction

Operational works are works of temporary nature required for execution of operations in areas declared as 'operational works area' by competent

authority, as per 'Procedure for Operational Works', issued by the Ministry of Defence (MoD) in 1948. Further, operational works can be undertaken only in such areas as warranted by military situation, and are specifically declared as 'operational works area'.

Operational works are thus undertaken to meet the temporary requirement of operational necessity, considering the potential threats to the country's security, and hence have significant role in operational preparedness. Operational works areas are declared for a two year cycle by the Directorate General of Military Operations (DGMO), Integrated Headquarters of Ministry of Defence 'MoD' (Army) as per their operational requirement and tactical criteria. IAF follows declaration of area by DGMO for planning operational works. ₹90.35 crore was spent by Air Force (AF) on operational works during 2010-11 to 2013-14, covering two blocks of two years each.

2.2.2 Organisational Structure for Operational Works

At the apex level, at Air Headquarters (Air HQ), Directorate of Air Operations headed by Director General Air (Operations) is responsible for approval of Annual Operational Works Plan (AOWP). AOWP is initiated at the unit level and consolidated at the Command level. Directorate of Air Force Works which is headed by Assistant Chief of Air Staff, Air Force Works (ACAS, AF Works) is responsible for vetting the proposals of AOWP.

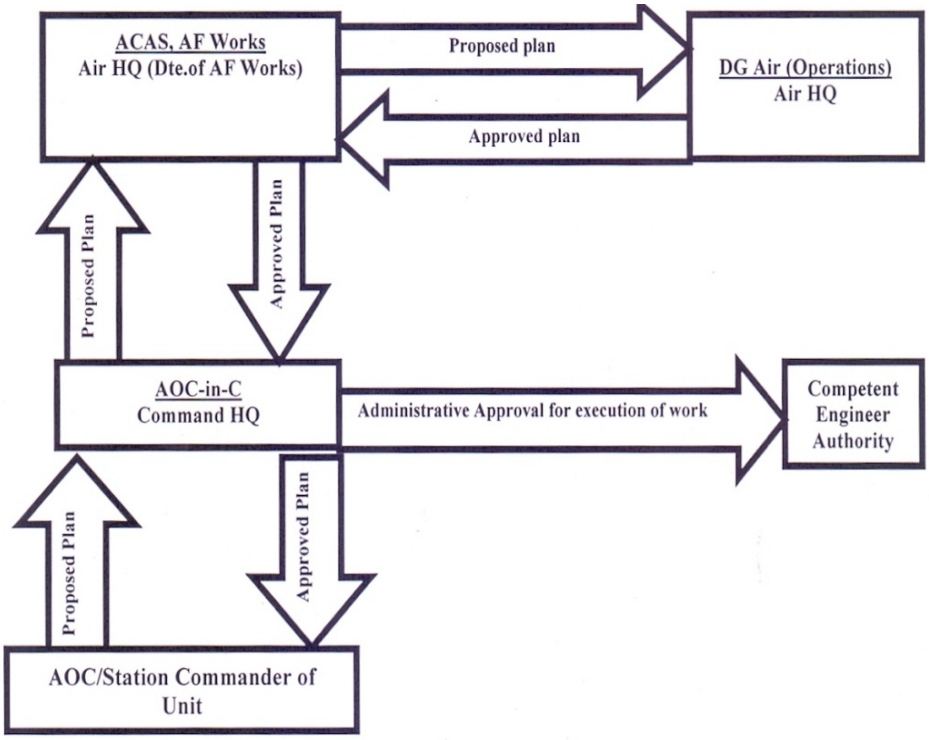
After approval by Air HQ, Air Officer Commanding-in-Chief (AO C-in-C) at Command level issues Administrative Approval (AA).

Competent Engineer Authorities of Military Engineer Services (MES)[28] are responsible for issue of Technical Sanctions and Garrison Engineers (GEs) working under the administrative control of the Chief Engineer (CE) / Commander Works Engineer (CWE) for execution of operational works.

[28] Most of the operational works are executed by MES, but it can be given to other agencies such as Border Roads Organisation, *etc*.

Various levels of Air Force authorities involved in approval of AOWP, issue of administrative approvals (AAs) and execution of operational work services are depicted in the flow diagram below:

Figure 2.1: Flow Diagram of Operational Works Approval



As per the 'Procedure for Operational Works', the MoD/GoI used to declare 'operational works area' for undertaking operational works. In September 2001, the Vice Chief of Army Staff was authorised by MoD as approving authority to declare operational works areas. In October 2002, the Vice Chief of Air Staff was authorized by MoD as approving authority to declare 'operational works area' for Air Force within the areas already declared as operational works area by Army HQ.

2.2.3 Audit Objectives

Audit covered the process relating to declaration of operational works area, identification of operational works, approval of annual operational works plan, sanction/AAs of operational works and execution of the works to see whether operational works were planned, sanctioned and executed in time and in accordance with Procedure for Operational Works issued by the MoD in 1948 and Management of Operational Works issued by Air HQ in June 1999.

2.2.4 Sources of Audit Criteria

The audit criteria used for benchmarking the audit findings were derived from:

- Procedure for Operational Works issued by the MoD in 1948
- Management of Operational Works issued by Air HQ in June 1999
- Annual Operational Works Plan (AOWP) and administrative approvals (AAs)/sanctions
- Regulations for MES, Defence Works Procedure (DWP) 2007, terms & conditions of the contracts

2.2.5 Audit Scope and Methodology

Audit reviewed performance relating to operational works for a period of four years from 2010-11 to 2013-14 covering two blocks of two years each. During this period, operational works areas were declared under Western Air Command (WAC), South Western Air Command (SWAC) and Eastern Air Command (EAC) by the Air HQ. 115 operational works were included in AOWP and 93 AAs involving ₹124.44 crore were accorded by WAC and SWAC for operational works in 13 Air Force (AF) units[29] during the same

[29] Seven units under WAC and six units under SWAC.

period. No operational works were proposed by EAC as their requirements were being met under North East Project[30].

Audit objectives, scope, criteria and methodology were discussed in an entry conference held on 4th August 2014 at Air HQ. Audit was conducted during August 2014 to November 2014 at Directorate of Operations and Directorate of AF Works at Air HQ; Command Works and Command Operations at HQ WAC and HQ SWAC; 13 AF units[31]; Chief Engineers (AF) at Udhampur and Gandhinagar and Garrison Engineers executing the operational works at AF units. Besides, nine operational works **(Annexure-IA)** for which administrative approvals (AAs) were accorded prior to year 2010-11 but not completed as of March 2014 were also included in audit.

An exit conference to discuss major audit findings with Air Force authorities[32] was held on 26 February 2015. Draft report after incorporating the views of the AF authorities expressed in the exit conference was issued to MoD in March 2015 and revised draft report in July 2015; reply was awaited (September 2015).

2.2.6 Audit findings

AOWP approved by Air HQ, administrative approvals (AAs) issued by the Commands, contracts concluded and works completed by the engineer authorities during the period yearly from 2010-11 to 2013-14 are given below:

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30 A separate project planned for works to be undertaken in AF bases in North Eastern part of the country.

31 'W-6' Wing (Wg), 'W-7' Wg, 'W-1' Wg, 'W-10' Wg, 'Y' Signal Unit (SU), 'R' Forward Base Support Unit (FBSU), 'W-8' Wg, 'W-14' Wg, 'W-11' Wg, 'W-12' Wg, 'P' FBSU, 'Q' FBSU and 'Z' SU.

32 Air Force (AF) authorities: Representatives of Air HQ (Directorate of AF Works and Directorate of Accounts) and Commands WAC/SWAC.

Table 2.4: Annual Operational Works Plan

Year	Command	Approved Annual Operational Works Plan		Administrative Approvals accorded		Administrative Approvals cancelled		Contracts concluded and works completed (till March 2015)	
		(Nos)	(₹ in Crore)	(Nos)	(₹in Crore)	(Nos)	(₹in Crore)	Concluded (Nos)	Completed (Nos)
2010-11	WAC	17	19.55	12+2**	21.74	1	0.64	13	6
	SWAC	7	13.85	7	10.76	Nil	Nil	7	7
2011-12	WAC	20	20.00	14	21.02	1	0.17	12	4
	SWAC	7	9.95	7	14.45	Nil	Nil	7	6
2012-13	WAC	23	20.35	19	19.97	2	3.03	16	4
	SWAC	9	18.60	7	12.57	Nil	Nil	7	6
2013-14	WAC	25	19.92	20	19.20	1	4.10	18	2
	SWAC	7	6.60	5	4.73	Nil	Nil	4	1
Total	**WAC**	**85**	**79.82**	**67#**	**81.93**	**5**	**7.94**	**56+3#**	**16**
	SWAC	**30**	**49.00**	**26**	**42.51**	**Nil**	**Nil**	**25**	**20**
Grand Total		**115***	**128.82**	**91*+2****	**124.44**	**5@**	**7.94**	**84*****	**36********

*24 (115-91) Operational works which were approved in the annual Plan, but administrative approvals (AAs) not accorded there-against within the financial year of Plan are discussed in Para 2.2.7.4.

**2 AAs were accorded by HQ WAC even though not included in approved plan as discussed in Para 2.2.8.1.

@Out of 93 (91+2) AAs, five administrative approvals accorded by HQ WAC were subsequently cancelled during the same financial year on various reasons such as unfavourable results of non-destructive testing (one case), non-requirement of work (two cases) and non-transfer of funds to Border Roads Organisation (two cases).

***Against 88 (93-5) AAs, the contracts were concluded for 84 operational works. The details for 4 operational works for which the contracts were not concluded by engineer authorities against the AAs are given in **Annexure-III** and also discussed in Para 2.2.9.2.

****Out of 88 AAs, five AAs were having PDCs beyond March 2015. Against the remaining 83 AAs for which operational works were to be completed by March 2015, 47 (83-36) operational works were not completed. Out of these incomplete works, the details of 45 operational works being executed by Military Engineer Services (MES) are given in **Annexure-IV** and also discussed in Para 2.2.9.3. The remaining two works were not completed by Border Roads Organisation (BRO).

Out of 62 (67-5) AAs accorded by HQ WAC, 3 AAs were meant for execution of operational works by BRO and remaining 59 AAs for execution by MES.

IAF had planned 115 operational works during 2010-11 to 2013-14 against which AAs were issued in 93 cases involving ₹124.44 crore. Further, against the 93 AAs, contracts were concluded by MES in 81 cases and work orders

issued by BRO in 3 cases but the works could be completed only in 36 cases by March 2015.

2.2.7 Planning for Operational Works

Audit findings on planning process for operational works are detailed in the following paragraphs:

2.2.7.1 Delay in declaration of operational works areas

As per MoD directives, from April 2002 onwards Army HQ declares 'operational works areas' for Army and, thereafter Air HQ declares 'operational works areas' for Air Force, within the areas already declared by Army HQ.

Army HQ declared 'operational works areas' for Forward category[33] in March 2010 and March 2012 for block of two years ending March 2012 and March 2014 respectively. Subsequently, Air HQ declared their own 'operational works areas' within the operational works areas declared by Army HQ, in July 2010 and October 2012 respectively, after calling for the list of AF units from the respective Commands falling under operational works areas. Thus, Air HQ took three months in 2010 (for 2010-12) and six months in 2012 (for 2012-14) from the date of declaration by Army HQ, to declare its operational works areas.

In view of the fact that operational works are undertaken to meet temporary operational requirement, planning and execution for operational works depends on initial declaration of operational works area and therefore any delay in the declaration of the same will have cascading effect. It was also seen that no timeline/period was prescribed by MoD/Air HQ for identification of AF units falling under the operational works areas declared by Army as well as for the declaration of operational works areas by Air HQ.

[33] Army HQ declared the areas under the states of Jammu & Kashmir, Punjab, Rajasthan, Gujarat, Himachal Pradesh, Uttarakhand and all north-eastern states except Assam as 'Forward category' for declaration of operational works areas. The state of Assam was only placed under 'Second category'.

In response to audit observation Directorate of Air Force Works stated (December 2014) that in normal course the entire process from identification of units to declaration of 'operational works areas' would take 3½ to 4 months. During exit conference (February 2015), AF authorities assured that 2-3 months period would be prescribed for declaration of the operational works areas.

2.2.7.2 Irregular identification of operational works

As per definition[34] Operational works are works of a temporary nature. Further, temporary works are meant for short term requirement having maximum life of five years from the date of completion of work, as per Defence Works Procedure (DWP), 2007. As against this, permanent nature of works are meant for long term requirement having life over five years, as per DWP 2007. A separate code under Revenue Head[35] has been kept for accounting purpose of operational works. Air HQ also instructed (June 2012) the Commands that works in the declared 'operational works areas' should be of urgent operational necessity.

It was observed that in 23 cases (out of 88 cases examined by Audit), work services of permanent nature valuing ₹36.58 crore **(Annexure-II)** were included by the AF units and recommended by the Commands in the AOWP during 2010-11 to 2013-14. Out of these 23 cases, in 19 cases involving ₹14.97 crore even Engineer Appreciations[36] (EA) were prepared for permanent works. These works *viz.* water supply for AF stations, construction of shed for housing of satellite communication (SATCOM) equipment, renovation of blast pens, infrastructure for special projects, *etc.*, with a life span of more than five years, were of permanent nature, and thus, were required to be done as capital works under Defence Works Procedure, 2007, after approval of the competent financial authority**.** Some of these important cases are highlighted below:

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34 Procedure for Operational Works, 1948 and Management of Operational Works, 1999.
35 Major Head 2078 Minor Head 111 Sub Head (a) 756/01.
36 Engineer Appreciation is a document about the work prepared by engineer authority for Board of Officers.

(a) Infrastructure for Special Project

The Cabinet Committee on Security (CCS) approved (March 2008) creation of infrastructure associated with procurement of 'CC'[37] system as capital work (of permanent nature) at a cost not exceeding ₹42 crore. Accordingly, work services for creation of infrastructure at six AF units[38] were sanctioned by the respective Competent Financial Authorities (CFA) as capital works between February 2010 and April 2012.

It was observed that in another AF unit *i.e.* 901 SU under HQ WAC, the same work services had been recommended (July 2010) by HQ WAC (although not proposed by the unit) and also approved (August 2010) by Air HQ in AOWP 2010-11 as an operational works. Accordingly, the work services were sanctioned (February 2011) at a cost of ₹6.84 crore and subsequently revised (November 2012) by HQ WAC at a total cost of ₹8.64 crore[39] under operational works which included special items of work valuing ₹4.95 crore, and also did not qualify for operational works as discussed in para 2.2.8.2. As the work of 'CC' system was a capital work of permanent nature, sanctioning of the same as operational works was irregular.

The Command HQ replied (September 2014) that certain works of permanent specification had been sanctioned for improvement of field defence, roads, operational and technical accommodations of the operational area units for which temporary specification work may not sustain at all.

The fact remains that works of permanent specifications were sanctioned in violation of Directives for sanction/regulation of operational works.

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37 Surface to Air 'GG' and 'HH' Air Defence System.

38 Three units ('W-5' Wg, 'W-4' Wg, 'X' SU) of HQ WAC, two units ('W-11' Wg, 'W-12' Wg) of HQ SWAC and one unit ('X' BRD) of HQ Maintenance Command.

39 This included Special items of work valued at ₹4.95 crore (for Building works-₹4.59 crore, EOT Crane-₹0.18 crore and DG Set-₹0.18 crore). Other major works were Site clearance-₹1.16 crore, Protective work-₹0.64 crore, Road/Path/Culvert- ₹0.97 crore, External Electric Supply- ₹0.48 crore and seven other works including contingencies-₹0.44 crore.

(b) Enhancement of Water Supply for AF Stations

(i) Air Force Station(AFS) 'S-18':

AFS 'S-18' was getting 5 to 5.5 lakh gallon per day (LGPD) water *vis-a-vis* 10 LGPD required and prescribed in the agreement with 'S-18' Municipal Corporation (JMC). A Board of Officers (BOO) at the AFS recommended (April 2010) augmentation of water supply at the station as operational works to achieve a permanent solution. The work services recommended (August 2010) by HQ SWAC were approved (August 2010) by Air HQ in AOWP 2010-11. Administrative approval was accorded (September 2010) by HQ SWAC for the above work services at an estimated cost of ₹6.67 crore which was revised (November 2013) to ₹7.33 crore.

It was also noticed (August 2014) that while approving (June 2011) AOWP 2011-12, Air HQ did not approve works relating to supply of Narmada water at AFS 'S-19', 'S-20' and 'S-2' on the grounds that the same were not covered under the Procedure for Operational Works, 1948.

Hence, approval of the work for augmentation of water supply at AFS 'S-18' in AOWP 2010-11 as operational works was irregular.

AF Station 'S-18' stated (October 2014) that the convening order from HQ SWAC for BOO for the said work was received as operational works.

The reply is not acceptable as works for only 'field water supply' are prescribed in Procedure for Operational Works (1948) and AF Stations are not field areas.

(ii) AF Station 'S-21'

Audit observed (September 2014) that AFS 'S-21' proposal (May 2010) of drinking water connection from Gujarat State Water and Sewage Board by using Narmada water as a permanent solution to water shortage at the AFS recommended (August 2010) by HQ SWAC, was approved (August 2010) by Air HQ in AOWP for 2010-11 as operational works. HQ SWAC accorded AA (September 2010) for the work at an estimated cost of ₹1.14 crore.

The AF Station replied (October 2014) that the work was permanent only to solve the basic problem and not the complete solution, and hence the work was taken up as operational works.

The reply is not acceptable as operational works being works of temporary nature were meant for operational necessity, and only 'field water supply' was eligible for the same, whereas AF Stations are not field areas.

(c) Renovation of Blast Pens

Audit observed (September 2014) that work services for renovation of blast pens[40] at AF Station 'S-2' proposed (August 2010) by HQ SWAC, were not approved (August 2010) by Air HQ for AOWP 2010-11 on the ground that the nature of work could not be categorised as operational works.

However, the same work services proposed (January 2011) again by HQ SWAC, were approved (June 2011) by Air HQ as operational works for AOWP 2011-12. AA for the work was accorded (December 2011) by HQ SWAC at an estimated cost of ₹4.50 crore.

HQ SWAC stated (September 2014) that the work had been sanctioned to meet the operational commitments at the earliest.

The reply is not acceptable as renovation of Blast Pens being a work of permanent specifications, does not qualify the criteria of temporary nature of works as prescribed under the Procedure for Operational Works (1948) or Management of Operational Works (June 1999). Moreover, if urgency was the only factor, the work could be executed under para 35 of Defence Works Procedure (DWP) 2007.

(d) Works for AFNET

HQ WAC proposal (May 2012) for operational work services for AFNET[41] at Op location of 'X' Transportable Radar Unit (TRU) at a cost of ₹47 lakh, was not approved (June 2012) by Air HQ for AOWP 2012-13, on grounds of it being of permanent nature.

[40] Blast pens are parking shelters with special protection for fighter planes
[41] Air Force Network

Audit also noticed from Air HQ directives issued (June 2012) to Commands that the works relating to AFNET were of capital nature and hence could not be sanctioned under operational works.

However it was noticed that HQ WAC changed (July 2012) the nomenclature of above work to 'Provision of Porta cabin at Op location of 'X' TRU' with the same cost and Air HQ approved (October 2012) the proposal as operational works *vis-a-vis* the AOWP 2012-13.

(e) Sheds for 'FF'

Work services for 'provision of sheds for FF'[42] at a Signal Unit (SU) under HQ WAC were approved by Air HQ (February 2013) as capital works under Annual Major Works Programme (AMWP) for the year 2012-13, but funds were not released. However, these work services were recommended (April 2013) as operational works by HQ WAC, and approved (July 2013) by Air HQ under AOWP for the year 2013-14. AA (January 2014) was given by HQ WAC at a cost of ₹14.90 lakh.

Thus, out of 93 operational works approved during 2010-11 to 2013-14, 23 works did not fall into category of 'operational works'. ₹36.58 crore were sanctioned for these ineligible works as against total sanction of ₹124.44 crore on all operational works during the same period.

During the exit conference, AF authorities explained (February 2015) that considering the specialized requirement in AF, temporary nature of works alone would not be useful and therefore it required works of lasting nature. It was also stated that they would frame a policy with the approval of MoD to undertake works of lasting nature under operational works.

The fact remains that AF authorities have not strictly adhered to the criterion of 'temporary nature of works' laid down under the Procedure for Operational Works (1948) and Management of Operational Works (June 1999).

2.2.7.3 Approval of Annual Operational Works Plan

Audit analysis of the process of AOWP revealed the following deficiencies at various levels:

[42] 'FF' is a Russian portable surface-to-air missile system

(a) No timelines prescribed for Annual Operational Works Plan

The controlling Commands in AF issue instructions in January/February each year, to the respective units to submit AOWP. Any planning process should normally be completed before commencement of the Plan period. No timelines are however prescribed by the MoD/Air HQ for submission and approval of the AOWP.

The details of time taken at various stages of AOWP are given below:

Table 2.5: Important dates in Operational Works Plans

Block years of declaration of Op works area	Date of declaration of Op works area by Army HQ	Date of declaration of Op works area by Air Force/ Time taken	Year of Op works plan	Date of forwarding of proposed plan by Commands		Date of approval of plan by Air HQ	Delays in months from April of that year
				WAC	SWAC		
2010-12	25/3/2010	12/07/2010 3 months	2010-11	19/07/2010	10/08/2010	25/08/2010	4
			2011-12	09/05/2011	03/01/2011	27/06/2011	3
2012-14	26/3/2012	01/10/2012 6 months	2012-13	16/07/2012[43]	04/01/2012 and 26/07/2012 (Revised)[44]	17/10/2012	6
			2013-14	29/04/2013	03/06/2013	15/07/2013	3

[43] Advance operational works plan submitted by HQ WAC under Air HQ instructions dated 19-06-2012.

[44] Advance operational works plan submitted by HQ SWAC under Air HQ instructions dated 24-07-2012.

Audit observed that:

a) There were delays of three to six months in approval of AOWP from April of the relevant years.

b) While delayed declaration of operational works areas may be one of the reasons for subsequent delay in approval, the delays occurring in second year of the block was incomprehensible.

c) AOWPs for block 2012-14 were submitted by Command HQ well in advance of declaration of operational works area, under instructions from Air HQ.

Thus there were delays in proposal/approval of operational works plans and there were no timelines prescribed for the same.

Accepting Audit observation on absence of timelines for submission and approval of AOWP, AF authorities stated (February 2015) during exit conference that the present policy and procedures would be reviewed and revised to ensure that operational works are planned in time and executed effectively.

(b) Approval of Annual Operational Works Plan by Air HQ without Board Proceedings (BPs)

As per Air HQ directives (June 1999), each unit has to prepare AOWP along with board proceedings[45] (BPs) and forward the same to their respective Commands for onward submission to Air HQ for approval.

Audit observed that BPs were being finalised by the units only after approval of the AOWP by Air HQ. Further, Directorate of AF Works (Air HQ) did not insist for BPs along with the proposed plan. Thus, there was a systemic failure which vitiated the entire process as significant number of ineligible works were approved in AOWP at Air HQ (as discussed in *paragraph 2.2.7.2*).

[45] Board Proceedings of a work contain recommendation of Board of Officers on the proposed work along with approximate estimate prepared by engineer authorities.

Air HQ stated (December 2014) that departmental directives were issued (June 1999) by it as guidelines to provide the detailed procedure on management of operational works. While practicing the same, it was realized that obtaining approval of BPs was time consuming and was against the basic spirit of the conduct of operational works. The deviation by AF authorities from the directives of June 1999 was therefore taken. During the exit conference, AF authorities assured (February 2015) that the present policy/procedures would be reviewed and revised.

The fact remains that Air HQ did not ensure adherence to its own directives (June 1999) which resulted in approval of ineligible works as operational works.

2.2.7.4 Non-issue of sanctions for operational works approved in plan

Audit was informed (September 2014) by HQ WAC that AF units in declared operational works area project their requirements of operational works through AOWP. The requirements thus projected are prioritised at Command/Air HQ level according to availability of funds and the left over works were carried forward to subsequent year proposal on 'roll on' basis till approval, if the requirement still exists.

Audit observed (September 2014) that AAs for 24 operational works approved in AOWPs were not accorded by the Commands. Details of these 24 operational works including the works rolled over to next year’s approved plan are given below:

Table 2.6: Rollover of Operational Works

Year	Number of works / estimated cost (in crore)	WAC		SWAC		Total	
		No. of works approved in Plan	No. of works for which AAs not accorded (rolled over in next year's approved plan)	No. of works approved in Plan	No. of works for which AAs not accorded (rolled over in next year's approved plan)	No. of works approved in Plan	No. of works for which AAs not accorded (rolled over in next year's approved plan)
2010-11	No. of works	17	5(4)	7	Nil (Nil)	24	5 (4)
	Estimated cost	19.55	4.46 (2.53)	13.85	Nil (Nil)	33.40	4.46 (2.53)
2011-12	No. of works	20	6 (Nil)	7	Nil (Nil)	27	6 (Nil)
	Estimated cost	20.00	5.62 (Nil)	9.95	Nil (Nil)	29.95	5.62 (Nil)
2012-13	No. of works	23	4 (Nil)	9	2 (Nil)	32	6 (Nil)
	Estimated cost	20.35	2.82 (Nil)	18.60	8.17 (Nil)	38.95	10.99 (Nil)
2013-14	No. of works	25	5 (Nil)	7	2 (Nil)	32	7 (Nil)
	Estimated cost	19.92	3.74 (Nil)	6.60	2.80 (Nil)	26.52	6.54 (Nil)
Total	No. of works	**85**	**20 (4)**	**30**	**4 (Nil)**	**115**	**24 (4)**
	Estimated cost	**79.82**	**16.64 (2.53)**	**49.00**	**10.97 (Nil)**	**128.82**	**27.61 (2.53)**

Thus out of 24 operational works for which AAs were not accorded, only four operational works were rolled over to next year's approved plan. Remaining 20 operational works were either cancelled or BPs were not finalised for various reasons such as inclusion of the same works in capital works plan (four cases), non-obtaining of 'no objection certificate' for availability of land from Army (one case), non-transfer of assets from BRO to MES (one case), operational reasons (two cases), *etc.* Two such instances, one of cancellation of work and another of non-finalisation of BPs, are discussed below:

- **Cancellation of Operational Work**: The work services relating to construction of traverses around missile preparation shed (MPS) at AFS 'S-10' were sanctioned (July 2012) by HQ SWAC for ₹26.94 lakh under 'Capital' works plan for the year 2012-13. However, the same work was also approved (October 2012) for ₹17 lakh by Air HQ in AOWP 2012-13 and, therefore, the operational work was cancelled.

- **Non Finalisation of BPs:** The work services in respect of power and water supply for operational cum training sites of MR SAM[46] for 'W-8' Wing were approved (October 2012) by Air HQ at a cost of ₹8 crore in AOWP 2012-13, but the BPs could not be finalised in that year.

To an audit observation (September 2014) on non-issue of AA for the above work, 'W-8' Wing replied (September 2014) that BPs were pending for want of clarifications on Facility Requirement Document from Air HQ. Further, HQ SWAC stated (August 2015) that work services for induction of MR SAM was a turn-key project and being executed by Defence Research and Development Organisation (DRDO) and external services such as road, water, electricity, sewage disposal are to be provided by AFS 'S-2'. The requirement of Board Proceedings could not materialise due to non- availability of requisite details of work service by DRDO.

Thus, there were operational works which were approved but not sanctioned for various reasons, raising doubts about their requirement as operational works.
AF Authorities stated (February 2015) in exit conference that the present policy and procedures would be reviewed and revised to ensure that operational works are planned and executed effectively.

The fact remains that out of 115 operational works approved by Air HQ, 20 operational works (*i.e.* 17 *per cent*) were not sanctioned, which is indicative of deficiencies in planning for temporary assets of urgent operational necessity.

2.2.8 Sanction of Operational Works by Commands

Audit findings on sanction of operational works are detailed in the following paragraphs:

[46] Medium Range Surface to Air Missile

2.2.8.1 Issue of Administrative Approvals (AA) by Command HQ without approval of Air HQ

As per directives issued (June 1999) by Air HQ, Command HQ can issue AA for operational works only after approval of the same under Annual Operational Works Plan (AOWP) by Air HQ.

It was observed (August 2014) that HQ WAC had accorded (November 2010 and January 2011) AAs valuing ₹230.23 lakh for two operational work services[47] which were not included in AOWP 2010-11 approved by Air HQ.

In response to audit observation, AF authorities stated (February 2015) in the exit conference that the matter would be reviewed and the reply provided to audit. The reply was awaited (September 2015).

2.2.8.2 Inclusion of Special Items of Works in Operational Works

Most of the work services in IAF are designated as 'authorised works', as for these works scales are authorised in regulations or by separate orders issued by MoD. Work services other than the authorised are referred to as 'special works'. Special works may be approved only when exceptional local conditions justify the necessity, as per Defence Works Procedure, 2007.

MoD (January 1948) and Air HQ (June 1999) directives are silent about inclusion of special items of works in the operational works. Audit, however, noticed that HQ WAC had written (January 2013) to the AF unit ('W-7' Wing) that, "No special items of works should be catered in operational works".

Audit observed that, during 2010-11 to 2013-14, HQ WAC and HQ SWAC accorded nine[48] AAs for operational works valuing ₹1720.57 lakh (₹1298.14 lakh under WAC + ₹422.43 lakh under SWAC) which contained

[47] Provision of four pre-fabricated shelters for accommodation at 'W-6' Wing; and Levelling and compacting of runway shoulders for fighter operations at 'W-10' Wing.

[48] Out of nine, five AAs were accorded by HQ WAC and four AAs by HQ SWAC.

special items of works[49] valuing ₹534.38 lakh (₹519.69 lakh under WAC + ₹14.69 lakh under SWAC). It was also noticed that the life of special items of works was more than five years.

Audit also found that since the BPs were neither submitted to Commands/ Air HQ by the AF units along with the operational works plan nor their submission insisted upon by the Air HQ for scrutiny prior to approval of AOWP, as mentioned earlier at *paragraph 2.2.7.3(b)*, inclusion of special items of works in AAs remained un-checked.

In response, HQ WAC stated (August 2014) that there was no restriction with respect to sanctioning of special works under operational works.

The reply of HQ WAC is contradictory to its own instructions issued (January 2013) earlier to one of its units. Further, Air HQ's approval of the AOWPs not supported by the BPs led to un-checked inclusion of special items of works in operational works. In the exit conference, AF authorities stated (February 2015) that the matter would be reviewed and the reply would be provided to audit. The reply was awaited (September 2015).

2.2.9 Execution of operational works

2.2.9.1 As per Air HQ directives (June 1999), operational works may be ordered for execution on any one of the following agencies:-

(a) Formation Engineers[50]

(b) Border Roads Organisation

(c) Military Engineer Services

(d) Other departmental construction agency like State Public Works Department and Central Public Works Department

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[49] Special items of works valuing ₹4.95 crore (Building works - ₹4.59 crore, EOT Crane-₹0.18 crore and DG Set - ₹0.18 crore) sanctioned for 'CC' project. Other special items of works were Water filtration plant-₹0.15 Crore, Furniture-₹0.05 crore, Air conditioners - ₹0.07 crore and additional items of low value-₹0.12 crore.

[50] Engineer Regiments affiliated to Division/Corps for providing Engineer support.

HQ WAC and HQ SWAC sanctioned[51] 88 operational works during 2010-11 to 2013-14 for execution by Military Engineer Services (MES); besides five operational works were entrusted for execution by Border Roads Organisation. Thus a significantly large number of works (95 *per cent*) were being given to MES.

2.2.9.2 Delay in conclusion of contracts by MES authorities

As per MoD instructions of April 1986, Chief Engineers should conclude the contracts (for other than married accommodation) within a period of 22 weeks from the date of receipt of AAs.

Review of the contracts concluded by MES *vis-a-vis* the operational works sanctioned under WAC and SWAC during the period covered in audit is discussed below:

(a) WAC

MES concluded 56 contracts till March 2015, against 59 AAs issued by WAC. An examination of 34 contracts details of which were provided to Audit, revealed that the contracts were concluded between four to 32 months since issue of AAs. Further, 25 of these contracts were concluded beyond stipulated period of 22 weeks *i.e.* five and a half months.

Audit also noticed that three[52] contracts for operational works sanctioned by WAC in 2011-12, 2012-13 and 2013-14 could not be concluded by MES due to delay in tender action and change in scope of work services.

Chief Engineer (AF) Udhampur stated (February 2015) that there was acute shortage of staff which led to the delay in preparation and finalization of drawings as well as conclusion of contracts.

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[51] 62 AAs accorded by HQ WAC and 26 AAs accorded by HQ SWAC.

[52] Work services relating to construction of four guard posts at an operational location, provision of overhead water tank filling facility for Crash Fire Tender and provision of hard standing for radar vehicle and room for AFNET at an operational location.

(b) SWAC

MES concluded 25 contracts till March 2015, against 26 AAs for operational works issued by SWAC during the period covered in audit. An examination of contracts revealed that the contracts were concluded between two to 10 months from Administrative Approval. Seven contracts were concluded beyond the stipulated period of 22 weeks.

The details of 4 AAs (three by WAC + one by SWAC) for which the contracts were not concluded by MES as of March 2015 are given in **Annexure-III**. The delay in conclusion of contracts would affect the timely execution of these operational works.

During exit conference, the AF authorities stated (February 2015) that there would be interaction with MES to minimize the time taken in conclusion of contracts and for difficult area, like Jammu & Kashmir, different procedures and/or management strategy would be explored and prescribed.

2.2.9.3 Delay in execution of operational works by MES

Army HQ issued instructions (January 1975) that execution time for operational works should not extend beyond two working seasons. No such instructions were, however, issued by Air HQ.

Audit observed that out of 56 operational works of WAC contracts of which were concluded by MES during the period covered in audit, 43 (76.8 *per cent*) operational works were not completed by March 2015. This was despite expiry of PDC specified in AAs, as per details given below:

Table 2.7: Operational Works not completed under WAC

Year	No. of operational works for which AAs (excluding cancelled AAs)were issued by HQ WAC	No. of contracts concluded	No. of operational works not completed and PDC specified in AAs, expired as on March 2015
2010-11	12	12	6
2011-12	12	11	8
2012-13	16	15	13
2013-14	19	18	16
Total	**59**	**56**	**43**

Audit also noticed that six operational work services[53] sanctioned in 2010-11 relating to WAC were not completed as of March 2015. In SWAC, Audit noticed that execution of two operational works[54] sanctioned in 2011-12 and 2013-14 were not completed as of March 2015.

The details of 45 operational works which were not completed by March 2015 despite expiry of PDC are given in **Annexure-IV**.

It was further observed that nine operational works amounting to ₹22.91 crore sanctioned by HQ WAC between 2003-04 and 2009-10 had not been completed as of March 2015 (**Annexure-IA**) due to reasons like land dispute, delay in approval of design, slow progress by the contractors, work stopped by the contractor, *etc*. On the delays in execution of operational works, HQ WAC wrote (July 2014) to MES authorities that inordinate delay in execution defies the very purpose of sanctioning operational works.

In response to an audit observation (September 2014) relating to delays in completion of works in respect of WAC, Chief Engineer (AF) Udhampur stated (February 2015) that the progress of works was slow on account of remoteness of places from established market, limited working season, extreme climatic conditions, non-availability of efficient working contractors and non-availability of skilled labourers. During exit conference, AF authorities further contended (February 2015) that there were difficulties in respect of operational works executed in difficult areas like Leh and Thoise.

The contention of AF authorities is not tenable as there was provision of higher percentage over Standard Schedule of Rates[55] (SSR) for these difficult

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[53] Operational work services for induction of 'CC', construction of FRP shelters, provision of pre-fab living in accommodation with bunk bed, pre-fab shelter for power plant and hard standing at Operational location.

[54] Work services relating to construction of tarmac at an operational location and fibre glass shelter for missile storage and fire fighting works.

[55] Percentage over Standard Schedule of Rates are fixed quarterly by the Zonal Chief Engineers

stations and the AAs were supposed to specify the PDC after taking into consideration these difficulties.

2.2.10 Conclusion

Operational works are undertaken to meet temporary requirements of operational necessity. Audit scrutiny of such works for 2010-11 to 2013-14 revealed that 26 *per cent* ineligible works were approved as operational works. Timelines of declaration of operational works areas and completion of operational works plan were not defined. Although Army HQ had issued instructions that execution of operational works should not extend beyond two seasons, similar orders were not issued by Air HQ.

There was systemic failure of getting Board Proceedings after the approval by Air HQ, rather at the time of submission of proposal. There were instances of taking divergent decisions on similar issues (approving water supply in two cases and denying in many others on the plea of non coverage of such works under 'operational works'), changing nomenclature of the work to approve subsequently.

A significant proportion of operational works were given to MES (95 *per cent*). There were delays at each stage of operational works, from declaration of area, planning, sanction, conclusion of contract and execution, resultantly out of 88 works sanctioned during 2010-11 to 2013-14 only 36 could be completed by March 2015.

Thus works which were required for operational necessity as warranted by military situation were not being planned and executed in an efficient way.

2.2.11 Recommendations

Audit makes following recommendations as a result of analysis.

I. Timelines for declaration of operational works area and submission and approval of AOWP need to be prescribed. Air HQ may also limit period of completion of operational works, as was done by Army HQ.

(Para 2.2.7.1, 2.2.7.3(a), 2.2.9.3)

II. Works of permanent nature should not be included under 'operational works'.

(Para 2.2.7.2)

III. Board Proceedings as one of the checks on actual requirement of operational works, should be part of proposal of operational works, before it is approved by Air HQ.

(Para 2.2.7.3 (b))

2.3 Operation and maintenance of 'C' aircraft

In order to maintain a credible level of deterrence, Indian Air Force (IAF) procured 'C' aircraft from 1996 onwards. Shortfalls in performance of aircraft and airborne system as received from OEM/BEL were yet (August 2015) to be resolved. Setting up of service support centres was inordinately delayed for want of required systems / equipment. Serviceability of aircraft fleet was also low. Manpower for 'C' aircraft squadron was not sanctioned even after 19 years of its induction.

2.3.1 Introduction

In order to maintain a credible level of deterrence, Indian Air Force (IAF) contracted with OEM[56] for import of 50 'C'[57] aircraft (1996-98) and subsequently (2006-2012) for 222 aircraft under license production from HAL[58]. Against 272 aircraft contracted with OEM/HAL, 204 aircraft were delivered (March 2015) to IAF. The issues relating to acquisition, licence manufacture, offset, establishment of repair facilities, *etc*., have been commented upon in C&AG's Audit Reports, which along with Action Taken Notes (ATNs) and assurances given by the Ministry to Public Accounts Committee (PAC) are summarized in **Annexure-V** to this report**.**

The operation and maintenance of the fleet covering the period from 2004-05 to 2008-09 was initially reviewed in audit during October 2009 to April 2010.

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[56] M/s 'V-4', Russia
[57] 'C', a twin engine aircraft, is a fourth generation multi role aircraft.
[58] M/s Hindustan Aeronautics Limited

After addressing the Ministry's security concerns**,** the subject paragraph was issued (May 2012) to the Ministry and reply was received in December 2012. Air HQ/ Ministry furnished certain clarifications and updated status (March / November 2014 and February 2015). The Ministry's replies (November 2014/April 2015) have been suitably incorporated in the paragraph.

2.3.2 Audit Findings

2.3.2.1 Shortfall in performance of aircraft procured from OEM

The evaluation of the aircraft supplied by OEM with different[59] software version was carried out by the Aircraft Systems Testing Establishment (ASTE)[60] during April 2003 and March 2007. Audit observed (February 2011) from the report of ASTE that certain systems and modes of operation such as air to air/air to ground operation of the radars, Electronic Counter Counter Measures (ECCM) functionalities, group action and air to ground bombing modes had not met the contractual specifications, which substantially reduced the effective utilization of the aircraft in its intended role.

In response to audit observation (February 2011) Air HQ stated (March 2011) that the radar and weapon modes had been addressed by the OEM in the 11-I update of the aircraft, trials for which were planned (February 2011) by IAF for evaluating efficacy and completeness of software for envisaged role.

The Ministry in regard to shortfall in performance of OEM aircraft, stated (December 2012) that the software version 11-I had been fully evaluated by IAF and the consolidated report was submitted to the OEM in May 2012. On receipt of final version of software/hardware/firmware configuration from

[59] 3-I, 7-I and 10-I software versions were used in the aircraft from time to time supplied by OEM. Final SOP standard for 'C' was 11-I software version.

[60] ASTE, Bengaluru is a unit of IAF that evaluates aircraft and systems for induction into user organisations. Most new aircraft types and major airborne systems must have ASTE stamp of approval to be considered fit for service in India.

OEM, Standard Operating Procedure (SOP) would be implemented in 'C' fleet.

The Ministry informed (March 2014) that 11-I version had been successfully tested and implemented on 45 aircraft and the entire fleet would be upgraded to 11-I version standard by June 2014 and after its implementation, there would be no performance shortfall.

However, 70 aircraft (out of 204 aircraft) still remain to be modified to 11-I standards and modification was expected to be completed by July 2015 as per the Ministry's reply (April 2015).

Regarding details of performance shortfalls eliminated after implementation of 11-I software and impact of non-availability of 70 aircraft in 11-I standards on the role envisaged for 'C' fleet, Ministry's response was awaited (September 2015).

2.3.2.2 Non availability of Critical Airborne Systems

The airborne systems such as radar warning systems, automatic flight control systems are critical equipment for success of a mission in modern warfare. Status of integration of these airborne systems having operational ramifications on the 'C' aircraft fleet are discussed below:

(a) Deficient Radar Warning Receiver

The Radar Warning Receiver (RWR) system as a part of Electronic warfare (EW) system is used in military aircraft to alert aircrew of the presence of hostile emitters. RWR in its basic form (named Tarang-30) with frequency coverage of 2-18 GHz was developed by DARE and integrated initially on the 'C' aircraft supplied by OEM. During evaluation of the aircraft fitted with Tarang-30, IAF found that masking[61] of RWR antennae existed in a very large

[61] In R-118 system antennae are mounted at specific locations on aircraft for optimal coverage. However, due to geometry of aircraft / manoeuvres the antennae may not detect signals and have 'nil' pick up or 'masking' in certain directions.

area in the front and the rear hemispheres of aircraft thereby affecting its envisaged role. Subsequently DARE enhanced the frequency coverage of RWR (Tarang-30) to 1-18 GHz, known as RWR 'R-118'.

Audit observed that after the flight trials conducted in July-August 2007 and February- March 2008, DARE found that masking could not be improved and the problem would need to be fixed through hardware modifications.

Audit observed from the records of Air HQ that in the meantime, the Ministry concluded (March 2006) two contracts with M/s Bharat Electronics Limited (BEL) for supply of 200 sets of RWR**.** However, before supply of RWR R-118, BEL approached (October 2007) Centre for Military Airworthiness & Certification (CEMILAC) for clearance of RWR R-118 in order to avoid liquidated damages (LD) for supply beyond the prescribed delivery schedule. It was seen in Audit that even though CEMILAC opined to Air HQ that clearance of RWR R-118 before the development and flight testing was not in order, it issued (October 2007) the clearance certificate.

Thus, 200 sets of RWR were cleared by CEMILAC without hardware modifications for integration on the aircraft.

In response to audit observation regarding system performance shortfalls, DARE stated (March 2011) that these deficiencies were due to design limitations and could not be eliminated without major re-design, including upgrading to digital receiver technology.

In response to draft paragraph (May 2012), the Ministry stated (December 2012) that design limitations had been addressed and the RWR R-118 was currently the SOP[62] for 'C' aircraft. Ministry further stated (March 2014) that all the 'C' aircraft had always been equipped with RWR.

Regarding DARE's response (March 2011) relating to major re-designing of RWR R-118 including upgrading to digital receiver technology**,** Ministry

[62] Standard of Preparation

intimated (April 2015) that DARE had informed Air HQ that most of the observation would remain unresolved even with digital receiver system, accordingly Air HQ had directed (July 2014) DARE to foreclose the project.

The reply of Ministry confirms that 'C' aircraft fleet operates with 200 sets of RWR 'R-118' which were produced by BEL and cleared by CEMILAC for integration on the aircraft before development and flight testing to overcome the design deficiency. Further, though DARE carried out software fixes to overcome the problem, the RWR 'R-118' remained afflicted with inherent design limitations. Even the improvement project was closed (July 2014) in view of DARE's opinion that problems would remain unresolved. It was also seen from procurement contracts (March 2006) with BEL that 'I' level and 'D' level maintenance[63] were not catered for.

Therefore, due to design deficiencies of the RWR 'R-118' system, which continue to persist, has compromised the survivability of 'C' aircraft.

(b) Frequent Snags of FBW system

Audit Noticed (February 2011) from the reliability study of Fly by Wire[64] (FBW) system carried out (December 2009) by Air Force Station, 'S-12' that 'C' aircraft is a super maneuverable aircraft with an inherently unstable platform. Therefore it requires a FBW flight control system for stable flight. Audit observed (February 2011) from the reliability study report (December 2009) that 31 'C' aircraft (15 OEM manufactured and 16 HAL manufactured) were grounded since induction in 2007 to November 2009 (160 days in respect of HAL manufactured aircraft and 75 days OEM manufactured) due to 111 FBW snags (33 snags on OEM manufactured aircraft and 78 snags on HAL manufactured aircraft). The report (December 2009) attributed the down time of aircraft to quality of OEM supplied aircraft being better than those supplied by HAL; lower levels of expertise of IAF technicians as compared to the OEM

[63] Intermediate maintenance (I-Level) normally under taken at operating squadrons. Depot maintenance (D-Level) are being carried out at Base Repair Depots of IAF or at HAL.

[64] Fly-by-wire (FBW) is a system that replaces the conventional manual flight controls of an aircraft with an electronic interface and allows automatic signals sent by the aircraft computers to perform functions without the pilot's input, as in systems that automatically help stabilize the aircraft.

technicians; non-availability of adequate publications and test equipment; and limited knowledge on FBW system by maintenance personnel.

In response to audit observation (February 2011) regarding FBW snags in 'C' aircraft, Air HQ stated (February 2011) that failure of FBW system was being taken up on case to case basis with the OEM.

The Ministry in their reply to draft report, stated (December 2012) that the type of failures[65] referred in the reliability study report (December 2009) implied catastrophic failure. Ministry subsequently stated (April 2015) that FBW snags on 'C' aircraft had come down and five FBW components under the purview of 'high failure rate' aggregates have been studied by OEM based on failure data sent to them and changes have been introduced for reliability improvement.

The Ministry's reply (April 2015) did not confirm whether FBW snags were fully removed or not.

Thus, FBW system, which was supposed to have very high reliability index, was performing below expectations of IAF thereby affecting the required stability and controllability, flight safety and automatic flight control of 'C' aircraft.

2.3.3 Operational Readiness

2.3.3.1 Utilization rate, serviceability and Aircraft-on-Ground (AOG)[66] of aircraft

Audit examined efficiency of operation and utilization of the 'C' aircraft fleet and found that it was low due to high rate of AOG, low serviceability and less achievement in flying hours.

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[65] Power supply and computing unit, power supply, Digital Signal corrector, Redundant Position Sensor, *etc.*

[66] AOG refers to those aircraft which are not airworthy.

Flying task for each type of aircraft is fixed by the Ministry and prescribed in the policy pages of the squadrons. As per these norms the serviceability[67] of aircraft should be maintained at 75 *per cent.*

The year-wise serviceability, AOG (2006-2010) and flying task achievement (2004-05 to 2008-09) are indicated in the Table below:

Table 2.8 : Serviceability and Achievement of Flying Task of 'C' aircraft

Low serviceability of aircraft (in percentage)				Achievement of Flying task (in hours)			
Year	**Serviceability**	**AOG**		**Year**	**Task allotted by MoD**	**Task achieved**	**% of shortfall *w.r.t* MoD's approved task**
2006	55.50	13.94		2004-05	2400:00	1373:55	42.77
2007	57.45	15.32		2005-06	3840:00	2644:57	31.13
2008	58.95	11.71		2006-07	5520:00	3149:30	42.95
2009	59.73	10.90		2007-08	8640:00	5032:30	41.76
2010	59.16	12.28		2008-09	12960:00	7381:70	43.05

Source- Air HQs (Dir of Eng A1) letter no Air HQ/S21577/9/EA1(T)/BM dated 21.3.2011

As against the prescribed norm of 75 *per cent*, average serviceability of the fighter fleet ranged between 55.50 and 59.73 *per cent* and AOG of the fleet ranged from 10.90 to 15.32 *per cent* respectively during the years 2006 and 2010 at six operating units.

There were significant shortfalls in flying efforts by squadrons with reference to the tasks prescribed in Policy Page[68] of the squadron. The shortfall in flying efforts ranged between 31.13 *per cent* and 43.05 *per cent* during 2004-05 to 2008-09. One squadron[69] stated (December 2009) that non availability of serviceable aircraft was the main reason for shortfall in achieving the flying task.

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[67] Serviceability denotes aircraft are airworthy.

[68] Policy page issued by Government of India, Ministry of Defence defines the role and task to be performed by a unit and manpower sanctioned for its functioning.

[69] 'Sq-3' Squadron

Air HQ stated (March 2011) that reason for low serviceability was mainly non-availability of repair facilities at HAL divisions leading to long repair cycle, as Cat 'D' aggregates were being sent to OEM for repair. Due to low serviceability, the required number of aircraft was not in a ready to fly condition, adversely affecting their availability to the squadrons for use for the assigned task of Air Defense.

In response to audit observation (May 2012), the Ministry stated (December 2012) that situation would improve after setting up of repair/overhaul facilities at HAL by February 2013. However, the repair/overhaul facilities were incomplete as of December 2013 as commented upon in Paragraph 9.1.5.6 of the Report of C&AG of India, Union Government (Defence Services) Army, Ordnance Factories and Defence Public Sector Undertakings (Report No. 35 of 2014).

In response to audit query (November 2013) regarding the utilization of 'C' aircraft, the Ministry accepted (March 2014) that operational utilization of 'C' aircraft fleet was low on account of low serviceability rate and high percentage of AOG due to inadequate support from OEM / HAL.

To audit query (February 2015) regarding the present position of setting up of repair and overhaul facilities at HAL for 'C' fleet, the Ministry stated (April 2015) that repair and overhaul facility (ROH) of aircraft and all aggregates[70] had been set up at HAL, except for four aggregates. It was also stated that there had been delay in setting up of ROH facilities at HAL divisions due to delay in supply of jigs/fixtures, tools, *etc*., by OEM resulting in delay in commissioning of ROH facilities and mastering[71] by HAL.

Ministry's reply (April 2015) was silent as to impact of delay and measures taken to improve the utilization / serviceability /AOG of the 'C' fleet pending setting up of ROH facilities.

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[70] Spares which could be repaired / overhauled for its further use.
[71] Understanding the skills of ROH facilities

2.3.3.2 Manpower

IAF did not project any manpower requirement, at the time of obtaining approval of the Cabinet Committee on Security (CCS) for the procurement of the 'C' aircraft in 1996, on the ground of lack of adequate/field experience, as aircraft was first of its kind to be inducted in IAF. Induction of the 'C' aircraft commenced in June 1997.

Air HQ admitted (February 2010) that shortage of manpower led to sub-optimal performance of the 'C' aircraft squadrons.

In December 2010 (after 13 years), Air Force Standing Establishment Committee (AFSEC) recommended establishment of 686 personnel (58 Officers, 550 Airmen, 61NCs (E)[72] and 17 Civilians) as a fleet standard per 'C' aircraft squadron. Thus, total manpower requirement for 11 squadrons was worked out to 7546.

Audit observed (February/March 2011) from the records of Air HQ that after considering the manpower available with the 'C' aircraft squadrons, Air HQ projected a requirement of 3317 personnel (351 Officers, 2739 PBORs, 152 NCs (E) and 75 civilians) for all 11 squadrons.

Regarding the present position of sanction for the required manpower for 'C' aircraft squadrons, Ministry stated (April 2015) that proposal in the form of a CCS Note was being processed.

Thus, in spite of induction of 'C' aircraft since 1997, no manpower has been sanctioned for 'C' aircraft squadrons and the deficiency of manpower continues to persist. Further, non-availability of required manpower with IAF led to sub-optimal performance of the 'C' aircraft squadrons as admitted (February 2010) by Air HQ.

2.3.3.3 Delay in setting up of Service Support Centre

The contract (November 1996) with OEM for 'C' aircraft envisaged setting up of Service Support Centre (SSC) at place close to operation of aircraft. The

[72] Non Combatants (Enrolled)

purpose of setting up of SSC was to carry out limited repair of 'C' aircraft avionics and aero engines in order to reduce dependence on overhaul agency *i.e.* OEM/ HAL.

Audit commented in Paragraph No. 2.8 of the Report of C&AG of India **(**Report No.8 of 2000) regarding delay in setting up of SSC at Air Force Station (AFS) 'S-11'. Ministry in their Action Taken Note 'ATN' (2003-2004) stated that setting up of SSC was planned in three phases[73] and efforts were being made to ensure that repair and overhaul facilities would be ready in a phased manner within the stipulated timeframe *i.e.* by June 2006 to sustain the operations of fleet.

Delay in setting up of SSC at AFS 'S-11' was again commented upon in the Paragraph No.1.4.12 of the Report of C&AG of India (Report No.4 of 2006). The Ministry in its Action Taken Note (May 2011) accepted the facts without further commitment.

With the induction of HAL manufactured 140 'C' aircraft, IAF felt (October 2006) the need for establishing two more SSCs at AFS 'S-12' and 'S-13'. The test facilities for SSC at the first base for operation of 'C' aircraft[74] at AFS 'S-11' were set-up between the years 2006 and 2010 in phased manner[75].

Regarding status of procurement of equipment for three SSCs, Air HQ stated (March 2010) that procurement of equipment for AFS 'S-11' (12 equipment/ systems for Phase-III) and 23 equipment/ systems each for AFS 'S-12' and 'S-13', initiated in August 2007 had been delayed as OEM did not respond in time. Air HQ further informed (March 2011) that 95 *per cent* building work of SSC, 'S-12' was completed and building work for SSC 'S-13' had not yet commenced. In regard to the procurement of requisite equipment for

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73 Phase I by December 2004, Phase II by December 2005, and Phase III by June 2006.

74 50 aircraft were inducted between 1997 and 2004.

75 At SSC 'S-11', 5 equipment/systems were procured and commissioned under Phase I during 2006 and 6 equipment/systems were procured and commissioned under Phase II during 2010. Phase III has not commenced so far.

installation at SSCs at 'S-12' and 'S-13', it was stated contract with M/s 'V-4'[76] was being processed for procurement of 18 equipment.

Regarding delay in setting up of SSCs and consequent impact on operational capability of IAF, Ministry stated (March 2014) that SSC at 'S-11' was fully established and accepted the fact that delay in setting up of SSCs at two other AFS, constrained IAF in support facilities.

Giving present status of SSCs at 'S-12' and 'S-13', the Ministry stated (April 2015) that the validity of the quote, for procurement of 19 systems[77] for repair facility for SSC at 'S-12' and 'S-13', had expired and vendor did not extend the commercial offer validity. Fresh Commercial Offer was being sought after the approval of Defence Procurement Board (DPB). Ministry also stated (April 2015) that work services for SSC at 'S-12' was completed in June 2011 and tender action for work services in respect of SSC 'S-13' was in process.

The Ministry's reply (March 2014) regarding full establishment of the SSC at 'S-11' may be viewed against the fact that Phase III of SSC which was to be completed by June 2006, had not commenced (April 2015) thereby hampering the SSC in undertaking repair of aggregates of 'C' aircraft.

Thus, in spite of the Ministry's assurance (December 2003)[78] to the PAC with respect to early setting up of SSC at 'S-11', there has been inordinate delay in establishment of SSC (Phase III) at AFS 'S-11'. Further, setting up of SSCs at AFS 'S-12' and AFS 'S-13' has also been delayed as contracts for procurement of the requisite equipment / systems for these SSCs from the OEM were yet to be finalized (April 2015). Further, while the work services executed for SSC at 'S-12', have remained idle since June 2011 for want of requisite equipment / systems, work services for SSC at 'S-13' were yet (April 2015) to commence pending conclusion of contract for the purpose.

In view of above, the envisaged aim of improving operational efficiency of the fleet through fast turnaround of failed aggregates by SSCs working close to operational squadrons of 'C' aircraft, is yet to be realized despite a lapse of over 19 years since induction of the aircraft in IAF.

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[76] M/s 'V-4'
[77] One system from Israel and 18 systems from Russia.
[78] 59th Report of the Public Accounts Committee (2003-04).

2.4 Upgradation and maintenance of 'DD' aircraft

The up-gradation programme undertaken by IAF was neither completely successful nor comprehensive. IAF selected unproven 'BB' radar for use in Air Defence and ground attack role. Performance of radar had not been satisfactory due to various inadequacies in its air to ground range mode and beyond visual range capability. Due to unsuitability /deficiency of critical airborne electronic warfare (EW) systems the aircraft fleet remains vulnerable to EW threats. There was low serviceability and high percentage of Aircraft on Ground (AOG) due to non availability of spares which resulted in shortfall in flying efforts. There was overall shortage of operational and technical manpower at operating units which affected operation and maintenance of aircraft. The 'D' level facility created at HAL was limited to diagnostic and repair and therefore, dependence on OEM continued for major repair/overhaul of upgraded system involving long duration of time for repairs which affected the fleet serviceability.

2.4.1 Introduction

The 'D' is an agile fighter aircraft, best suited for the short range air defence role and for limited ground attack. The aircraft was inducted into IAF squadron service in 1978. The aircraft was also licence-manufactured at Hindustan Aeronautics Ltd. (HAL), Nasik Division which had manufactured 220 'D' aircraft up to 1987. IAF had 210 'D' aircraft in its inventory (1995).

To make the 'D' aircraft capable of effectively operating in the air defence role for the foreseeable future, Government approved (January 1996), the upgradation of 125 'D' aircraft at a total cost ₹2,003 crore. The main systems[79] identified (1995) by IAF for upgradation were envisaged to make the aircraft a viable combat aircraft.

[79] These systems were Multi-mode Pulse Doppler (KOPYO) radar, Inertial Navigation System (INS) / Global Positioning System (GPS), Radar Warning Receiver (RWR), Counter Measure Dispensing System(CMDS), Self Protection Jammer (SPJ), Advance air-to-air and air-to-ground weapons , Display system including a Head-up-Display (HUD) and Multi Function Display (MFD), Helmet Mounted Sighting Device (HMSD), Video Recording System (VRS), Single Piece Front Wind-shield and an HMSD compatible canopy and Incorporation of hand-on throttle and stick (HOTAS) concept

The upgradation was to be achieved by integrating advanced avionics and weapon which were either to be imported or developed indigenously. There were no plans of upgrading engine and airframe of 'D' aircraft. While the Design and Development (D&D) Phase of two aircraft was to be completed by original equipment manufacturer (OEM) at USSR by August 1998, the series modification of remaining aircraft was to be completed indigenously by HAL, Nasik Division by September 2001 and the upgraded 'D' was christened as 'DD'.

Delays in upgradation of 'D' and its impact were commented upon in Paragraph 6 of C&AG Report No 8 of 2001. In reply to a Public Account Committee (PAC)'s question, Ministry had stated (May 2004) that upgradation of 'D' aircraft was estimated to be completed by 2005-06.

Audit was informed by IAF (May 2009) that a total of 125[80] 'D' aircraft were upgraded by OEM and M/s HAL and inducted into IAF between 1998-1999 and 2007-08. Air HQ also intimated (February 2011) to Audit that calendar life of aircraft had been extended up to 40 years[81]. Upgraded 'D' aircraft were being operated from six IAF squadrons[82] and one Tactical and Combat Development and Training Establishment (TACDE).

Audit reviewed the upgradation programme of 'DD' fleet during 2009-10 and after addressing the Ministry's security concerns the draft Report was issued in May 2012, the reply of which were received in December 2012.

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[80] 2 'D' aircraft D&D phase and 123 'D' aircraft series upgradation

[81] Directorate of Engg A2 'DD', Air HQ vide letter no. Air HQ/81756/5/9/EA2 (T) Dated 12 February 2011 intimated to DMP that the present TCL of 'DD' aircraft is 40 years.

[82] 'Sq-1' Sqn, 'Sq-4' Sqn, 'Sq-6' Sqn, 'Sq-8' Sqn, 'Sq-5' Sqn, 'Sq-2' Sqn,

The matter was reviewed subsequently and status of issues raised in audit was requested from the Ministry in September 2014 and again in May / August 2015, the replies to which were awaited (September 2015).

Inadequacies in the upgradation of the fleet are discussed in the succeeding paragraphs.

2.4.2 Audit Findings

2.4.2.1 Role effectiveness and capability

(a) Inadequate combat capability due to sub-optimal performance of 'BB' radar system

To improve Beyond Visual Range (BVR) capability of 'D' aircraft, IAF selected (1995) Multi Mode Pulse Doppler Radar named 'BB'[83] which was to be fitted into aircraft, at a cost of USD 840,000 (₹2.89 crore)[84] per unit. The radar was to be used in the Air Defence and ground attack role for guiding of air-to-air missiles and air-to-ground weapons. Audit noticed (November 2009) that since its induction, the performance of the radar had not been satisfactory due to various inadequacies in the Air-to-Ground Range (AGR) mode.

One of the reasons for the poor performance was selection of unproven radar for induction by IAF, for which the software was still under development/modification (July 2009). IAF stated (November 2010) that OEM specialists were sent (November 2010) to the Air Force Station, 'S-17' to load a new software to resolve the inaccuracies in AGR mode. However, there was no improvement in the AGR mode further. Audit also noticed from the report submitted by 'W-9' Wing Air Force to SWAC (December 2010) that missile integration checks were successfully completed only in December 2010.

The Ministry stated (November 2012) that AGR mode did remain inconsistent and inaccurate but the BVR capability of an aircraft pertains to its capability to

[83] Russians developed this radar specifically for 'D' upgrade and named it 'BB'.
[84] 1 USD = ₹34.39

fire air to air missiles. The error in accuracy of AGR mode thus affected the delivery of air to ground weapons only and did not affect the BVR capability of the platform. Ministry also stated that further trial did not result into any significant inputs which could improve the AGR further.

The Ministry's contention was in conflict with its reply on sub optimal performance of 'BB' radar sub-assemblies and non-integration check of 'EE' Missile till July 2009 which affected BVR capability of the aircraft during this period and expiry of life of 'EE' Missile in December 2010 as discussed in para 2.3.2.4(a).

Ministry's response to Audit query (May 2015) regarding extension of life of 'EE' Missile and effect on BVR capability of 'D' aircraft, was awaited (September 2015).

(b) Increased vulnerability to detection due to non-installation of Self Protection Jammer Pods

The Self Protection Jammer (SPJ)[85] is a critical electronic warfare (EW) equipment of a strike aircraft that contributes to success of a mission. MoD procured (February 1996) 92 SPJ pods (82 for IAF and 10 for Navy) from M/s 'V-1', Israel. Out of 82 pods, 50 pods costing ₹152 crore were for the 'D' aircraft which were to be delivered between December 1997 and July 1999. However, these were actually delivered between August 2000 and December 2004.

It was observed (February 2011) that during series upgradation, all the 125 aircraft were modified for carriage of SPJ Pods. However, only 50 SPJ pods were procured. A case was initiated by Air HQ (July 2005) to procure additional 36 SPJ pods for 'DD' aircraft to cater to 70 *per cent* of the modified fleet and the approval of the Defence Acquisition Council (DAC) was obtained in January 2006. However, the proposal for procurement of additional SPJ pods for 'DD' aircraft was not processed in view of the limited

[85] The SPJ utilize various deception techniques to degrade the enemy radar tracking system to avoid a Lock-On and break it, if one has already been achieved

residual life of the aircraft. Thus, only 43 *per cent* of the 'DD' fleet was operated with SPJs, leaving the remaining aircraft vulnerable to detection by the enemy radars (February 2011) thereby affecting the operational capability of IAF.

Accepting the facts, the Ministry stated (November 2012) that the 'V-1' pods are easily removable/ fitted on any modified aircraft in a very short time and in case of exigencies the operational requirement would be met by re-distribution of available 'V-1' pods.

The reply may be seen in view of serious shortage (57 *per cent* in February 2011) of SPJs pods with the operating units. Further, non-procurement of pods after approval of DAC on the ground of limited residual life of aircraft is not tenable as the Total Technical Life (TTL) of the aircraft had been extended up to 40 years. Also, the very fact of initiation of proposal for additional pods in 2005 means that the Ministry's argument (November 2012) about easy removability and fitment of pods is an afterthought.

Present status of deployment of SPJ pods was requested (May 2015) from the Ministry; reply was awaited (September 2015).

(c) High failure rate of Radar Warning Receiver system

The Radar Warning Receiver (RWR) system as a part of EW system[86] is used in military aircraft to alert aircrew of the presence of hostile emitters. As a part of the upgrade programme, all the 125 'D' aircraft were to be fitted with indigenous 'Tarang' RWR developed by Defence Avionic & Research Establishment (DARE) and procured (September 2005) from M/s Bharat Electronics Limited, Bengaluru.

Audit observed (February 2011) that the operating units of IAF had been reporting (May 2009) high failure rate of 'Tarang' RWR which affected the

[86] Electronic Warfare (EW) system of a strike aircraft is the most critical equipment for the survival and success of the mission in the modern electronic battlefield.

operational capability of squadrons. In response to an audit query regarding performance of 'Tarang' RWR Air HQ stated (February 2011) that the 'Tarang' system was not able to detect future generation radars.

Delay in development of indigenous radar by DARE and its unsatisfactory performance were commented in para 2.2 of the Report of C&AG of India, Union Government, Defence Services (Air Force & Navy) for the year ended March 2011 (Report No. 17 of 2012-13). The Ministry stated (November 2012) that Design and Development of Digital RWR, an advance version of radar so as to resolve the existing performance issues, was under progress in DARE. Ministry, in their ATN also stated (November 2014) that the new radar was still under development at DARE. The Ministry further stated (April 2015) that digital technology based RWR projects has been closed, as discussed in *paragraph 2.3.2.2 (a)* of this report.

Therefore, deficiencies in RWR continue to persist, compromising survivability of the aircraft.

2.4.2.2 Performance of other upgraded system

(a) Unserviceability of Video Recording System

A Video Recording System (VRS) is used for de-briefing and off-line analysis of the sortie flown. 125 VRS were procured from M/s 'V-7', France under a contract (March 1996) at 24.80 million Franc (₹17.26 crore) for which the delivery was completed in November 2003.

Audit observed (April 2010) that performance of VRS had not been satisfactory since its induction due to frequent failure of its components. Unreliability and obsolescence resulted (July 2008) in difficulties in maintenance support from the OEM. The parts of the VRS continued to be

sent to OEM for repair under LTRA[87], involving high repair cost. During 2004-05 to 2009-10, a total of 44 Line Replaceable Units (LRUs) of the VRS were sent for repair to OEM, involving an expenditure of 175,797.00 Euro (₹1.04 crore)[88] on their repair. Air HQ had expressed its concern (August 2008) that the main reason for failure of VRS was unserviceability of its video tape recorder and planned (December 2008) to replace the existing VRS[89] with Solid State Digital Video Recording system (SSDVRS) and its ground replay system.

In reply to the audit observation (May 2012) regarding inordinate delay in replacing the existing VRS with SSDVRS, Air HQ stated (November 2012) that Acceptance of Necessity (AoN) had been granted (December 2010) for the replacement of existing VRS with SSDVRS on Limited Tender Enquiry (LTE) basis. Further, many vendors claimed to possess the capability to develop and provide SSDVRS. Hence, the instant case was referred to MoD for changing the mode of tendering from LTE to Open Tender Enquiry (OTE) and the matter was still pending.

The present status of replacement of VRS with SSDVRS was sought for from MoD (September 2014); their reply was awaited (September 2015).

(b) Design deficiency in 'LL' system

'DD' aircraft is incorporated with Flight Data Recorder in the form of 'LL'-B system. The 'LL' system comprises two component (i) 'LL' B – an air component meant for flight data acquisition and processing unit (ii) 'LL' N – a ground component system used for transfer, processing and analysis of flight data and testing of 'LL'-B system. 'LL' system was procured from Russia

87 Long Term Repair Agreement
88 1 Euro = ₹ 59.55 (average rate for the period from April 2004 to 2010)
89 Existing VRS is a tape driven video recording system which was to be replaced with solid state digital video recording system (SSDVRS).

between January 1999 and November 2006 at USD 6,419,613.39 (₹29.20 crore)[90] and inducted as part of the upgrade programme.

Audit observed (December 2009) that since induction, there had been a high failure rate of certain parts[91] of 'LL' system due to design deficiency which was attributable to housing of these components near the engine and thus exposing them to high temperature. To overcome the problem, fleet modification was carried out by the OEM in 2006 free of cost. However, even after fleet modification the components continued to fail.

Audit further observed (December 2009) that from 2007 onwards, a total of 178 Line Replaceable Units (LRUs) failed, of which 82 LRUs were repaired through the OEM under Long Term Repair Agreement (LTRA) during 2007 to 2009 involving an expenditure of USD 1,628,521.30 (₹7.24 crore)[92] and 14 LRUs were repaired through local vendor. As of December 2009, a total of 48 Aircraft on Ground (AOG) demands raised by the operating units between December 2008 and November 2009 were pending for materialization. The repair facilities for 'LL'-B system aggregates at HAL became functional from 21 August 2011 due to delays in ToT by the OEM.

The Ministry stated (November 2012) that due to the vintage airframe design of 'D' aircraft it was not possible to fit an off the shelf system. Therefore, Flight Data Recorder had to be designed especially for this aircraft and no design deficiency was envisaged during D&D phase.

In brief, IAF accepted a system with design deficiency for induction which led to frequent failure of its components involving an avoidable expenditure of USD 1,628,521.30 (₹7.24 crore) on repair of components by OEM.

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90 1 USD = ₹45.5 (average rate for January 1999 to November 2006)
91 BSOI-1 and ZBN
92 1 USD = ₹44.46 (average rate for the period 2007 to 2009)

2.4.2.3 Operational readiness

(a) Utilisation rate, serviceability and Aircraft-on-Ground (AOG)[93] levels of aircraft

Flying task for each type of aircraft is fixed by the Ministry and prescribed in the Policy pages of the squadrons. As per these norms the serviceability[94] of aircraft should be maintained at 75 *per cent.* The year-wise position with regard to serviceability, AOG and flying task achievement of aircraft from 2004-05 to 2008-09 were reviewed in audit during 2009-10 and is given in the Table below:

Table 2.9: Serviceability, AOG and flying task achievement for 'D' aircraft Sqns

Year	Percentage		Flying task (in hours)			Percentage of shortfall w.r.t Government approved flying task
	Service-ability (in %)	State of AOG (in %)	Flying Task allotted by Government[95]	Revised Flying Task allotted by Air HQ	Flying Task achieved	
2004-05	51.52	23.02	12698	5144	5626	55.70
2005-06	41.32	37.34	12884	5000	6270	51.34
2006-07	42.19	25.16	13257	5267	8448	36.28
2007-08	47.16	29.41	13444	5292	9533	29.09
2008-09	44.83	33.27	13631	5065	8961	34.26

Thus, against the prescribed norms of 75 *per cent* the average serviceability rate of aircraft ranged between 41.32 *per cent* and 51.52 *per cent* during 2004-05 to 2008-09 due to high rate of AOG. Actual flying tasks performed also fell

93 Aircraft on Ground (AOG) refers to those aircraft which are not air worthy.
94 Serviceability means aircrafts are airworthy
95 The variation in task was due to reasons that actual strength of aircraft at the squadrons during the particular year was taken into account for calculation of allotted task.

significantly short of the flying task prescribed by the Ministry and ranged from 29.09 to 55.70 *per cent*. The Air HQ had also reduced the task on its own which was being achieved.

The Air HQ had stated (June 2010) that serviceability of aircraft was low due to low Mean Time Between Failure (MTBF)[96] of certain upgraded systems like 'BB' radar, VRS[97], INGPS[98] and 'LL' B[99]. Although reliability issues had been addressed to a great extent, serviceability continued to suffer due to poor repair support of 'BB' radar aggregates by the OEM.

The Ministry while accepting fact stated (November 2012) that the task was reduced based on expected serviceability. Actual serviceability was low because of non-availability of spares and failure of items before their expected life. Ministry also added that contract for additional spares to cater for long repair cycle was concluded in June 2010 and deliveries were expected to be completed by September 2012. Ministry further intimated (March 2014) that there was low serviceability of aircraft and high percentage of AOG due to non availability of spares and failure of items before their expected life resulted in shortfall in flying efforts.

The current status was enquired (September 2014) from the Ministry; reply was awaited (September 2015).

Thus, the efficiency of operation and utilization of the 'DD' aircraft fleet was low due to high rate of AOG, low serviceability and less achievement in flying hours.

2.4.2.4 Beyond Visual Range (BVR) 'EE' Missile

'DD' aircraft was modified for fitment of BVR 'EE'-AE missile (*i.e.* an air-to-air missile) at the time of upgrade. IAF entered into a contract in March

[96] MTBF - Mean Time Between Failures means failure of equipments before their normal expected life.
[97] Video Recording System
[98] Inertial Global Positioning System
[99] Flight data acquisition and processing unit

1996 with M/s 'V-4' for procurement of BVR 'EE'-AE missiles which were delivered in 2002 with a shelf life of eight years. Audit observed (February 2010) that IAF had considered that integration checks for BVR 'EE' missile were not required as the upgraded aircraft was worthy of launching the missile. Audit further observed (February 2011) that fitment of 'EE'- AE missile on the 'DD' aircraft commenced from January 2009 only and as the missile could not be launched properly from the aircraft, Air HQ and HAL decided (July 2009) to undertake missile integration checks on all the Bison aircraft. The checks were successfully carried out (December 2010).

In response to draft report (May 2012), Ministry stated (November 2012) that the BVR 'EE'-AE missiles were used with 'DD' aircraft on various occasions prior to integration problem observed in 2009 due to unserviceability of 'BB' radar sub-assemblies and in the interim, the missiles were available for utilization on the 'C' aircraft.

Ministry further stated (March 2014) that integration of the BVR 'EE' missile had been completed during D&D phase in the year 1999 itself and the missile was successfully fired from Bison aircraft in 2006. Ministry, however, admitted that in a few cases the field units had reported integration issues owing to unserviceability of some components of 'BB' radar which resulted in non-identification of the missile by the aircraft.

Ministry's reply of November 2012 that BVR 'EE'-AE missile had been used with 'DD' aircraft on various occasions prior to integration problem observed in 2009 and their further statement of March 2014 that after integration of the missile, the 'EE'-AE missile was successfully fired from Bison aircraft in 2006 are not consistent in view of the following:

- As per weapon operating procedure, BVR 'EE' missile integration checks were necessary to ensure serviceability of communication channels between the aircraft and the missile. However, missile integration checks were not undertaken by IAF till 2009.

- Air HQ in its reply of February 2011 stated that at the time of procurement of 'EE'-AE missile during the series upgrade it was not realized to procure any mobile SK rig or any other related testers to conduct integration checks, as the OEM suggested to conduct the

integration check suspending live missile (BVR 'EE' AE missile) on the aircraft.

- As per IAF's own admission (February 2011) fitment of BVR 'EE' missile on 'DD' aircraft commenced only in January 2009 and the missile could not be launched properly from 'DD' aircraft. In view of this, IAF decided in July 2009 to go for integration check in all 'DD' aircraft.

Thus, by the time the missile integration checks were successfully completed on 'DD' aircraft in December 2010 the shelf life of BVR 'EE' missile had expired in 2010.

Ministry's response to Audit query (May 2015) regarding extension of life of 'EE' Missile, was awaited (September 2015).

2.4.2.5 Availability of manpower

During audit of fleet upgradation of 'DD' in 2009-10, position of sanctioned and available manpower was reviewed. Deficiency in operational manpower at the operating squadrons both at the level of officers and airmen during the period 2004-05 to 2008-09 was as under:

Table 2.10 : Manpower position at operating squadrons of 'DD' aircraft

Year	Operational manpower(Officers)			Technical manpower(Airmen)		
	Sanctioned	Posted	Deficiency in percentage	Sanctioned	Posted	Deficiency in percentage
2004-05	80	61	23.75	1018	635	37.62
2005-06	80	75	06.25	1021	694	32.03
2006-07	80	64	20.00	1021	699	31.54
2007-08	80	67	16.25	1021	666	34.77
2008-09	80	63	21.25	1021	707	30.75

Thus, shortage of pilots was between 6.25 *per cent* and 23.75 *per cent* and that at airmen level were between 30.75 *per cent* and 37.62 *per cent* at the squadrons.

In reply to audit observation (December2009), unit authorities stated (March 2010) that shortage of manpower had led to extended working hours so as to meet the required deadlines of the tasking and the situation had led to cumulative fatigue of both aircrew and technical manpower.

Accepting the facts, Ministry stated (November 2012) that in the recent past there had been instances where IAF had to induct new system/equipment without induction of manpower for the same due to ban imposed by the Government in 1984. Ministry further added that internal adjustments effected to operationalise these new systems/equipment had led to lowering of actual manning levels of existing units.

The current status regarding manpower was enquired (June 2014, September 2014 and January 2015) from Air HQ. Reply was awaited (September 2015).

2.4.2.6 Training- Delayed procurement and installation of APTT

The Avionic Part Task Trainer (APTT) of upgraded 'DD' aircraft is a training aid to provide training to pilots on the avionics systems of the aircraft. Although delivery of upgraded aircraft commenced in 2001-02, the Ministry concluded (March 2005) a contract with HAL Bengaluru for procurement of five APTTs at a cost of ₹22.50 crore. As per the terms of the contract, delivery, installation and commissioning of five APTTs were to be completed between June 2006 and March 2007 but these were actually commissioned between October 2008 and January 2009 due to delay in completion of Factory Acceptance Test (FAT) of the APTT by HAL.

In the interim period, training of pilots for familiarization before flying the actual aircraft was conducted on System Integration (SI) Rig procured (May 2002), as a part of 'D' aircraft upgrade programme, from OEM at a cost of ₹38.07 crore and installed/commissioned (May 2002) at the Software Development Institute (SDI), Bengaluru. Audit observed (December 2009) that SI Rig had become unserviceable in June 2005. To compensate the training on SI Rig, the training syllabus was amended (August 2005) by Air HQ and additional sorties had to be conducted on the fighter aircraft between August 2005 and January 2009 till installation of APTT at operating bases involving additional expenditure by way of flying cost besides risk of flight safety of pilot/aircraft.

The Air HQ while confirming the fact stated (January 2010) that training on SI Rig had continued till it became unserviceable and the syllabus was amended to compensate for training. Air HQ further stated (January 2010) that the availability of APTT could not coincide with the delivery of upgraded aircraft due to inherent delays in procurement action.

Audit further observed (November 2012) that spares worth ₹35.64 lakh had been procured by IAF between November 2005 and May 2006 on the basis of analysis of faults for making the Rig serviceable. However, the Rig was not made functional due to inadequate expertise, non-availability of trained manpower and qualitative discrepancies in certain spares supplied by the OEM. The Rig was made partially serviceable (May 2007) in respect of navigation function and 'KK' Bomb[100] firing using available expertise, however, ATP (Acceptance Test Procedure) of the Rig was held up as the Rig continued to be in unserviceable condition since June 2005.

Ministry stated (November 2012) that contract had been signed with M/s 'V-2' for the repair of SI Rig and repairs were expected to be completed by November 2012.

[100] 'KK' is a laser guided bomb

Present status of the repair of the SI Rig was sought from the Ministry (September 2014). Expenditure incurred on cat 'D' LRUs was further enquired (February 2015) from MoD; reply was awaited (September 2015).

2.4.2.7 Availability of repair and maintenance infrastructure

An aircraft comprises complex systems and its utilization and serviceability is critically dependent on the timely availability of supporting repair and maintenance infrastructure and services. All maintenance activities relating to I and II line servicing of 'DD' aircraft are carried out at operating bases. Third and fourth line servicing, *viz.* repair and overhaul of aircraft, is carried out at HAL. Shortcomings noticed in maintenance activities are discussed below:

(a) Non-Functioning of SK test bench and associated operation repair panels

The SK Rig is used for the 'I' level[101] servicing of 'BB' monoblock and for identification of unserviceability, if any, of its component blocks, *viz.* antenna, transmitter, receiver, exciter, *etc.* The Operation Repair Panels (ORPs) are used to test these blocks for their independent performance before fitment on the monoblock. IAF procured SK Rigs and associated ORPs from M/s ROE, Moscow against a contract of July 1999 at a unit cost of ₹9.48 crore, which were received at three Air Force units[102] between June 2003 and April 2004 and installed at these units between August 2003 and September 2008. These three SK Rigs were rendered unserviceable between 2006 and September 2008 for want of spares, General Purpose Instruments (GPIs) and unserviceability of associated ORPs. Due to unserviceability of SK Rigs and ORPs at these units, Cat 'D' LRUs of 'BB' radar were being sent to HAL/OEM for repair.

The Ministry stated (November 2012) that in absence of the indigenous solution, repair / annual maintenance contract (AMC) for the 'BB' radar test equipment was being pursued with the OEM and further added that proposal

[101] 'I' level – Intermediate Level Servicing carried out at the Operating Base.
[102] 'W-3' Wing, 'W-9' Wing and 'W-1' Wing

was sought (May 2012) from OEM in order to work out repair of unserviceable test equipment of all operating bases.

Present status of these test rigs was called for from the MoD (September 2014). Expenditure incurred on cat 'D' LRUs was further enquired (February 2015) from MoD; reply was awaited (September 2015).

(b) Delay in Setting of 'D' level facilities at HAL

As per the contract of March 1996, there was a provision for Transfer of Technology (ToT) for manufacture and repair/overhaul of 'DD' aircraft and its aggregates by HAL. However, ToT could not materialize in spite of efforts of IAF, MoD and HAL. Hence, Air HQ directed (May 2003) HAL not to pursue the ToT for manufacture of the aggregates and suggested to establish diagnostic and repair/overhaul facilities for 'BB' radar and system and aggregates of aircraft on fast track basis by January 2008.

Audit observed (April 2010) that though the repair facilities for 'BB' radar had been established (August 2008), these facilities needed (March 2009) further instrumentation for diagnosis and testing at an additional estimated cost of ₹4.50 crore by HAL. Further, the full complement of training on repair of 'BB' radar LRUs could not be imparted by the OEM specialist due to non-availability of sufficient population of Cat 'D' repairable since most of the repairable had been sent to OEM for repair. Hence, additional training was required to be imparted to HAL personnel by deputation of OEM specialist to India at an estimated cost of ₹1.80 crore. Audit also observed (April 2010) that repair and overhaul facilities for 'BB' radar set up at HAL strictly fell under the category of second line repair which was also being established as 'I' level facilities in all the operating units and full-fledged 'D' level facilities had not been set up at HAL.

Air HQ stated (April 2010) that setting up of 'D' level facilities had not been considered economically viable as the present facilities were being used only for 'DD' aircraft, and the same would not be useful after withdrawal of 'DD' aircraft from service.

Air HQ reply is not acceptable in view of the fact that the calendar life of 'DD' aircraft had been extended (March 2010) up to 40 years. Due to non-availability of complete repair/overhaul facilities, 297 'BB' LRUs and 564 non-'BB' LRUs were offloaded to OEM for repair/overhaul during the period from April 2007 to November 2009, against Long Term Repair Agreement (LTRA) concluded (April 2007) by HAL with OEM involving a total repair cost of USD 976,593.52 (₹4.33 crore)[103].

Ministry stated (November 2012) that efforts made to set up repair facilities for 'BB' radar aggregates had not been successful and instead of setting up full overhaul facilities, only diagnostic and repair facilities were proposed at HAL. Ministry further stated (November 2012 and March 2014) that in the absence of repair facilities, aggregates had to be sent to OEM for repairs resulting in continued dependency on OEM for major repair/overhaul.

Ministry's response to an audit query (May 2015) regarding completion of additional instrumentation for diagnosis and testing and details / cost of 'BB' LRUs offloaded to OEM for ROH between December 2009 and March 2015, was awaited (September 2015).

(c) Prolonged unserviceability of Moon Automatic Test Equipment (ATE)

'W-3' Wing AF, was holding two 'V-1' Self Protection Jammer (SPJ) Automatic Test Equipment (ATE) for providing 'I' level servicing facility to 'V-1' internal and 'V-1' Pod. Out of two, one ATE (Moon version)[104] costing ₹6.20 crore, which had been installed (March 2003) and commissioned (April 2003) at 'W-3' Wing became unserviceable (June 2005). As the rectification of ATE could not be undertaken at the unit level, cannibalization of some of the components was carried out by No. 'Y' BRD on another ATE (Jupiter Version) held by the Wing. Since ATE (Jupiter Version) was capable of 'I' level servicing of SPJ pods, the matter was taken (September 2009) up

[103] 1 USD = ₹ 44.42 (average rate for the period from April 2007 to November 2009)

[104] ATE Moon version is used to carry out Acceptance Test Procedure of SPJ POD in 'DD' Aircraft.

by 'W-3' Wing, AF with HQ WAC to allot the ATE to 'Y' BRD for proper utilization and maintenance. However, the ATE was not allotted (December 2009) with the result the ATE costing ₹6.20 crore continued to remain in unserviceable condition at 'W-3' Wing AF.

'W-3' Wing, AF in response to the audit query (December 2009) on prolonged unserviceability of the ATE stated (January 2010) that standard test equipment and custom made drawers of Moon version ATE had been allotted (September-October 2008) by Air HQ to 'Y' BRD, and 'W-14' Wing AF to repair ATEs at their base. Hence, the instant ATE could not be allotted out as a whole.

The Ministry stated (November 2012) that allotment out of the unserviceable ATE (with deficient sub system) from 'W-3' Wing, AF to 'Y' BRD would not solve any purpose. However, case for refurbishment and extended maintenance warranty for all the ATEs procured from M/s 'V-1' was still under process (October 2012).

The present status of refurbishment of ATE was asked from MoD (September 2014). Their reply was awaited (September 2015).

Fact remains that ATE costing ₹6.20 crore continued to be in unserviceable conditions (October 2012) and could not be put to use for intended purpose as a result IAF could not derive any benefit out of the investment of ₹6.20 crore since June 2005.

2.4.3 Conclusion

Audit of upgradation of 'DD'aircraft was initially taken up in 2009-10 and data pertaining to 2004-05 to 2008-09 was analysed, however it was not finalised due to certain security concerns raised by the Ministry. The summary of audit findings as a result of revised report is as under.

The upgradation programme undertaken was neither completely successful nor comprehensive due to various inadequacies. IAF selected unproven 'BB' radar

for use in Air Defence and ground attack role. Performance of radar had not been satisfactory due to various inadequacies in its air to ground range mode and Beyond Visual Range capability. Due to unsuitability /deficiency of critical airborne EW system the aircraft fleet was vulnerable to electronic warfare threats. There was low serviceability and high percentage of Aircraft on Ground (AOG) due to non availability of spares which resulted in shortfall in flying efforts. There was overall shortage of operational and technical manpower at operating units which affected operation and maintenance of aircraft. The 'D' level facility created at HAL was limited to diagnostic and repair and therefore, dependence on OEM continued for major repair/overhaul of upgraded system involving long duration of time for repairs which affected the fleet serviceability.

2.5 Inappropriate procurement of tent based medical shelter

Tent Based Medical Shelter (TBMS) which were planned to be light weight and meant for immediate and temporary deployment for medical relief in disaster area could not be utilized, as critical medical equipment were deleted and housing package including staff accommodation, flooring, hospital furniture, *etc*., were added to initial scope, which made it heavier. Resultantly user RAMT found it difficult to transport and deploy. Thus, even after spending ₹10 crore on procurement of TBMS for providing assistance during disasters, the nation was deprived of its intended benefits due to its heavy weight.

Three Rapid Action Medical Teams[105] (RAMTs) were set up (July 1999) in IAF to provide organized medical aid at a disaster area for a limited period of time (*i.e.*72 hours). Thereafter, civil administration would take over the role.

In order to overcome difficulties such as lack of administrative support, communication system, sleeping bags, rations, drinking water, detachment of 3-4 men operating away from base camp and spending nights in open as tents

[105] No.1,2 and 3 RAMTs are co-located with three AF hospitals at Bengaluru, Jorhat and Hindon.

supplied by Ordnance Factory were heavy and cumbersome , *etc*., encountered by relief medical teams during deployment (May 2008) in Myanmar after the cyclonic storm *'Nargis'*, Director General Armed Forces Medical Services (DGAFMS) suggested (July 2008) to three services that RAMTs were required to be equipped with Tent Based Medical Shelters (TBMS) with high quality, waterproof, foldable, easy to pitch and light weight tents as being used by international relief teams. Accordingly, Director General Medical Services (DGMS, Air) proposed (February 2009) to Air HQ to procure two sets of 25 bedded deployable TBMS from M/s Alaska Structure on Propriety Article Certificate (PAC) basis. The estimated cost of each TBMS was ₹4.5 crore including shelters, flooring, generators, HVAC[106] units, beds, electric wiring, staff accommodation and freight.

The procurement was proposed by DGMS) (Air) to be made under Schedule XII (J1A)[107] through Capital head (919/36) using revenue procedure. Acceptance of Necessity (AON) was accorded (February 2009) by Vice Chief of Air Staff (VCAS) and Air HQ decided (February 2009) to procure TBMS on PAC basis from M/s Alaska Structure. Air HQ issued (March 2009) Request for Proposal (RFP) to M/s Alaska Structure on PAC basis and the firm submitted its offer (April 2009) by quoting ₹33.46 crore for two sets of TBMS. However, Cost Negotiation Committee (CNC) decided (April 2009) to procure only one complete set of TBMS at a cost of USD 19,99,999.00 (₹10 crore[108]) after making some changes in the requirement[109]. It was also decided to procure the second set after the evaluation of the first set.

Integrated Financial Advisor (IFA) while concurring with the proposal under Schedule XII (J1A)[110] recorded (May 2009) that main reason for increase in price from ₹4.5 crore to ₹9.99 crore per shelter was primarily due to addition of several items in basic shelter such as staff accommodation with toilet

106 HVAC – Heating, ventilation and air-conditioning.
107 Schedule XII (J1 A) of the Delegation of Financial Powers (DPFs) is related to Procurement of Maintenance Store and also describes the financial powers of competent authorities accorded by GoI.
108 1USD = ₹50.00 (May 2009).
109 Additions of staff accommodation with toilet facility and dining area, oxygen dispensing system with portable oxygen plant and forklift and deletions of pre/post/CSS PKG, Radiology PKG, supply/Adm PKG and spares kit and routine maintenance PKG.
110 Meant for Procurement of Maintenance Stores.

facility and dining area, oxygen dispensing system with portable oxygen plant, forklift, *etc*. VCAS approved the proposal in May 2009. Thereafter, Air HQ placed (May 2009) a supply order on M/s Alaska Structures, USA for supply of one TBMS at a cost of USD 19,99,999.00 (₹10 crore) with a delivery period of 3 months from the receipt of supply order. The firm supplied the TBMS in September 2009.

In April 2010, Air HQ again proposed to procure second set of TBMS under Schedule XII (J 1A). However, Principal Integrated Financial Advisor (PIFA), commented that no financial powers had been laid down in schedule XXII[111] and XII (J 1 A) for the procurement of TBMS.

Further, following deployment (September 2009 to February 2011) of the TBMS for exercise purpose at Agra, Bengaluru and Hindon. 3 RAMT submitted (August 2011) a performance report to DGMS (Air) indicating that AN-32 aircraft and MI-17 helicopter were unsuitable for transporting TBMS which requires three sorties of 'A' or seven sorties of C 130-J aircraft. Further, transportation of TBMS by rail requires one full rake or at least nine wagons besides trucks and manpower for the containers, whereas road transportation involves 10 flat top trailers (30 feet). It was also stated that setting up of TBMS takes 4 to 5 hours with adequate trained manpower.

Audit observed that use of financial powers of the VCAS under maintenance stores {Schedule XII (J1A)} for procurement of TBMS *i.e*. a Medical/Dental store, was irregular and thus it needed sanction of the Ministry of Defence (MoD). Further, inclusion of additional requirements made the TBMS heavier *vis-à-vis* the basic shelter (light weight) recommended by the DGAFMS.

In reply to observation, DGMS (Air) stated that TBMS was not a medical equipment but temporarily deployable accommodation. Therefore delegated financial powers of VCAS under XII (J1 A) were proposed to be utilized, which was also concurred by PIFA. Accepting procurement of heavy TBMS,

[111] Schedule XXII stipulates the financial power of competent authorities in respect of Medical/Dental Stores.

Air HQ stated that the isolated procurement of light weight tent would not have improved the capability for delivering quality medical care and TBMS was likely to be deployed at remote/isolated locations for many days; for which the appropriate staff housing package was planned and procured along with TBMS.

Audit does not agree with the argument of the DGMS (Air) as Schedule XII is meant for procurement of Maintenance Stores, which was also confirmed by IFA during second procurement of TBMS. Further, while accommodation/housing elements of TBMS were upgraded, the most critical medical equipment pre/post/CSS PKG, Radiology PKG, Pharmacy PKG, portable patient oxygen concentrators, *etc.*, which had been included in the original proposal of IAF, were deleted. Further, the difficulties in transporting TBMS had also been explained in the performance report regarding TBMS submitted (August 2011) by 3 RAMT to DGMS (Air).

Audit further noticed (May 2014) that due to non-availability of aircraft/non requirement by the civil authorities, No. 3 RAMT with TBMS was not deployed during the three disasters namely Operation Rahat at Uttarakhand, Typhoon Haiyan at Philippines and Super Cyclone Phalin in Odisha occurred between August 2009 and January 2014.

Air HQ stated (October-November 2014) that No. 3 RAMT with TBMS was used during Commonwealth Games-2010 (CWG) in New Delhi, Aero India show and Uttarakhand post floods. Air HQ also stated that RAMT was deployed at Port Blair for exercise (2-10 February 2014), for Flood Reliefs in Purnea, Bihar (4-8 August 2014) and Jammu & Kashmir (J&K) (7-29 September 2014) respectively.

Audit differs on the purpose as none of these deployments were for disaster relief at isolated spots. Deployment of TBMS at Port Blair was for exercise purpose. In J&K, TBMS was not deployed in flood areas but at AF Station, Awantipur which already had medical facility and in Purnea, Bihar, TBMS was used as a normal health camp for school children, teachers, *etc.* During CWG-2010, TBMS was actually kept in readiness at AF Station Hindon which

was 27 kilometers away from the main venue of CWG. Thus, TBMS could not be used as envisaged by IAF for providing quick medical aid at a disaster area. In response to the draft paragraph, MoD stated (July 2015) that light weight TBMS had been procured with equipment which had improved the capability for delivering quality medical care.

Ministry's contention relating to procurement of light weight TBMS with equipment is not acceptable as critical medical equipment were deleted from the scope of TBMS being procured, whereas housing package containing staff accommodation with toilets, flooring, HVAC units, hospital furniture, generators, *etc.*, were added subsequently. Addition of housing package which made TBMS heavier was also contrary to the recommendation of the DGAFMS for the basic shelter (light weight TBMS). The user *i.e.* 3 RAMT found heavier TBMS difficult to transport and its deployment was possible only with trained manpower. The alterations in scope of TBMS were not in line with purpose of RAMT, which was meant for immediate relief in disaster area for a maximum period of 72 hrs.

Therefore, TBMS procured by IAF at a cost of ₹10 crore with a view to provide immediate organized medical aid at disaster area, could not be utilized in natural calamities. Deletion of critical medical equipment defeated the primary objective of providing immediate quality medical care in disaster areas. Further utilization of TBMS also seems remote due to attendant constraints in its deployment as reported by user RAMT. The financial powers were also exceeded in the procurement.

2.6 Excess procurement of Speech Secrecy equipment

Excess procurement of 127 speech secrecy equipment by IAF, resulted in avoidable expenditure of ₹4 crore.

Speech secrecy equipment is used as an add-on device to telephone, FAX and data communication equipment so that voice, fax and data network remain secured. Air Force Stations are connected through static voice and data

communication lines which are secured by speech secrecy equipment. Besides this, Indian Air Force (IAF) also uses a dedicated Air Force Network (AFNET) which is capable of secure voice/data/video communication on real time basis within IAF. AFNET has already been implemented in 161 locations, covering almost all static locations of IAF. IAF also has secured Satellite Based Wide Area Network (SATCOM) as standby link of AFNET to cater for operational communication.

IAF was authorized (May 1992) to use 168 speech secrecy equipment on static civil telephone lines by Raksha Mantri. Accordingly, IAF procured 168 Subscribers End Secrecy Device (SECTEL) equipment from M/s Bharat Electronics Limited (M/s BEL), between 1996 and 2002. As SECTEL was getting obsolete, Air HQ concluded (March 2014) a contract for procurement of 168 MSD-SEED[112] equipment from M/s BEL, at a total cost of ₹5.29 crore for replacement of SECTEL equipment, on one-to-one basis.

While auditing records of Air HQ, it was noticed (September 2014) that IAF had also procured (January 2008, August 2008 and May 2011) 127 MSD-SEED of the identical technical specifications under three different supply orders placed on M/s BEL. Further, while working out the replacement of 168 SECTEL equipment in 2014, the 127 MSD-SEED equipment procured earlier (between January 2008 and May 2011) were not taken into account by IAF.

As a result, against authorized 168 speech secrecy equipment, IAF had, procured 295 (168 + 127) equipment. The speech secrecy equipment were not scaled since it's authorization in 1992, although as per IAP-1503[113], IAF was required to review its requirement and fix the scale accordingly for all types of equipment.

In reply Air HQ stated (February 2015) that the formal scaling action of MSD-SEED would be initiated shortly. The Ministry in response to the draft

[112] Media Secrecy Device Subscriber End Encryption Device
[113] Indian Air Publication-1503 – Manual for fixation of scales

paragraph issued (January 2015) stated (April 2015) that 27 MSD-SEED equipment were procured (January to August 2008) to provide secured communication on FAX deployed between Air HQ and command HQ, while 100 MSD SEED equipment were procured for AFNET due to increased operational requirement of IAF in addition to civil lines. It further stated that AFNET and SATCOM have media encryption device which secure voice, fax and data traffic at exit point of IAF campus whereas SECTEL secures communication up to subscriber device. The Ministry further stated that AFNET provides secrecy beyond IAF campus and does not cater for communication security within campus.

Ministry's reply may be viewed in light of the fact that AFNET connectivity is based on dedicated and secured optical fiber networking. AFNET has already been graded by SAG[114] for Bulk Encryption Units (BEUs) with complete encryption of voice and data. Further it has been implemented (September 2010) in IAF 161 locations covering almost all static locations. AFNET is based on next generation technology under which telecommunication devices are security graded. Also, AFNET is totally controlled and accessed by IAF personnel only. Moreover, IAF also has Satellite Based Wide Area Network (SATCOM) as a standby link.

Hence, keeping in view that the AFNET and SATCOM contain enough security measures to cater for IAF operational requirement, Air HQ decision for deployment of MSD-SEED as standby to AFNET was injudicious. Further, IAF should have reviewed its actual requirements in the light of extant authorization (168) and procured only balance 41 (168 -127) speech secrecy equipment in March 2014.

Thus, the procurement of 127 MSD-SEED speech secrecy equipment by IAF in excess of their authorization for 168 equipment resulted in avoidable expenditure of ₹4 crore. Also, despite lapse of 22 years since its initial

[114] Scientific Advisory Group gives clearance for security grading for encryption devices.

authorization in May 1992, IAF has not reviewed and scaled their actual requirement.

2.7 Procurement of Intelligence System

Incorrect identification/delayed evaluation of the identified aircraft platform by IAF resulted in delay in installation of state-of-the-art intelligence system. Further, the system acquired after twelve years of 'in principle approval' and after incurring expenditure of ₹88.70 crore remained afflicted with software issues, raising concerns on its performance as envisaged. Annual Maintenance Contract (AMC) for the system was yet (May 2015) to be concluded post expiry of warranty (December 2014).

'JJ' system is used for gathering intelligence about capability and state of mobilization/ preparedness of adversary forces. Air Headquarters (Air HQ), projected (January 2001) to the Ministry the requirement for installation of three 'JJ' system for augmenting intelligence capability, two for 'F' aircraft and one as reserve. The proposal was 'in principle' approved (July 2002) by Raksha Mantri.

The Operational Requirements (ORs) for 'JJ' system and specification of 'F' aircraft were defined by Air HQ in the Request for Proposal (RFP) issued (October 2003) to 11 vendors, of which M/s BEL, India and M/s 'V-1', Israel responded. After following due process, a contract was concluded by the Ministry in February 2007 with M/s 'V-1', at a total cost of USD 19097135 (₹88.70 crore). As per the contract, delivery and installation of all three 'JJ' system were to be completed by February 2009.

Audit noticed (September 2014) that M/s 'V-1' conducted preliminary survey (December 2003) of 'F' aircraft and based on the information relating to electric power, cooling capacity and payload capability of the 'F' aircraft indicated in the RFP (October 2003), accepted (December 2003) installation of 'JJ' system on 'F' aircraft. The Technical Evaluation Committee (TEC) also carried out evaluation (December 2004) of the system and held that the 'JJ' system proposed by M/s 'V-1' complied with all the ORs. The TEC further

recommended that the compliance to ORs indicated by M/s 'V-1' was only on paper and therefore there was need to assess the claims on site. Thereafter, IAF carried out 'on site' [*i.e.* Field Evaluation Trial (FET)] evaluation of the 'JJ' system in Israel on the offered aircraft *i.e.* 'H', and accepted the system for 'F' aircraft. This was despite the fact that crucial elements of any aircraft, like electrical power, cooling capacity and all up weight carrying capacity differ from aircraft to aircraft. On the basis of acceptance by TEC as well as on Field Evaluation Trial, the Ministry (February 2007) concluded a contract for procurement of 'JJ' system for 'F' aircraft.

The contract required IAF to provide detailed information relating to performance of aircraft namely 'F'. While providing (May 2007) detailed information of aircraft, IAF found that electrical power, cooling capacity and all up weight carrying capacity of the 'F' aircraft were not suitable for installation of 'JJ' system, due to its ageing. Air HQ opined (July 2007) to the Ministry that the advanced capabilities of the 'JJ' system would not be fully exploited on 'F' aircraft due to its limitations.

Air HQ proposed (September 2007) to the Ministry the change of platform from 'F' aircraft to 'G' aircraft so as to exploit the advanced capabilities of the proposed AISIS. Resultantly, an amendment to contract was signed by IAF with M/s 'V-1' in January 2009 without any financial implication, for installation of 'JJ' system on 'G' aircraft instead of 'F' aircraft with revised installation schedule as January 2012.

Audit observed (September 2014) that incorrect identification of 'F' aircraft as suitable aircraft platform and subsequent change of the same to 'G' aircraft resulted in delay in installation of 'JJ' system (April 2012) which was originally planned to be installed in February 2009. Further, performance of the 'JJ' systems was not found (July 2014) satisfactory on both the 'G' aircraft by IAF since its installation due to large number of faults relating to hardware as well as software. Three Time Serve Units[115] (TSU) became critically unserviceable since April 2014 which had reduced the availability of operational aircraft to one.

[115] Time Server Unit – It is crucial component required for booting of 'JJ' system.

Air HQ stated (December 2014) that during the preliminary survey (December 2003) at TEC stage the 'JJ' system was found suitable for mounting on 'F' aircraft. However, during the post-contract survey electrical power, cooling capacity and all up weight carrying capability of 'F' aircraft were not found suitable due to ageing and continuous operational exploitation of the aircraft.

Air HQ reply is not acceptable in view of the fact that the Operational Requirements (ORs) for the 'JJ' system were framed by IAF and evaluation of the system was also carried out by them. Moreover, the specifications for installation of 'JJ' system on 'F' aircraft were decided by IAF prior to placement of RFP in October 2003 and the 'F' platform was found suitable after technical as well as field evaluation of the system which was also carried out (September 2005) by IAF team before entering into the contract with M/s 'V-1'.

In response to draft paragraph issued (March 2015), Air HQ stated (May 2015) that preliminary survey of the 'F' platform was jointly carried out by IAF, HAL and M/s 'V-1' based on the inputs on the 'F' aircraft provided by HAL and specifications given in aircraft manuals. Further, Field Evaluation Trial (FET) was carried out on the assumption that OEM *i.e.* M/s 'V-1' who had participated in the aircraft survey prior to submission of their techno-commercial proposal had confirmed that their system could be installed on the aircraft. Air HQ also stated that IAF's findings relating to the performance of the aircraft (July 2007) were based on actual performance of the aircraft which were found significantly reduced from the specifications given in the aircraft manuals and information provided by HAL. Accepting the audit observation regarding unsatisfactory performance of 'JJ' system installed on 'G' aircraft, Air HQ stated (May 2015) that the situation had improved during the last six months and faults of Time Serve Units (TSUs) imposed only temporary limitation as new TSUs had been supplied by M/s 'V-1' which were also being tested.

Ministry reiterated (September 2015) the Air HQ reply and further stated that an interim solution has been provided by M/s 'V-1' and TSU has been bypassed. It also stated that testing of new version TSU was incomplete and it would take approximately three months to provide a viable solution. Ministry

also stated that the case for Annual Maintenance Contract (AMC) was at final stage of contract signing and specialists from M/s 'V-1' were available even after the expiry of warranty which had ensured that system was in fully operational status.

Ministry's reply was in nature of providing a temporary solution to the problem. The fact remains that Air HQ acceptance of field evaluation (September 2005) of the 'JJ' system on a different aircraft platform (*i.e.* 'H' aircraft) and post contract assessment (July 2007) of actual performance of the identified 'F' aircraft, necessitated contract amendment (February 2009) and caused a delay of two to three years in installation of state-of-the-art intelligence system on the changed aircraft platform ('G' aircraft). Moreover, Ministry's reply (September 2015) that 'JJ' system has been facing frequent software and hardware faults since installation raises question mark on the envisaged utilization of the system procured at an expenditure of ₹88.70 crore.

2.8 Arbitrary planning in the resurfacing of extended portion of runways

Resurfacing of newly extended portion of runways within three years of previous resurfacing without identifying any defect /deterioration was arbitrary which indicated lack of due diligence in taking up the work and therefore resulted in injudicious expenditure of ₹1.48 crore. It was also done without getting the approval from Competent Financial Authority *i.e.* MoD.

Air Force Station (AFS), Bidar has two Runways[116] numbered 02/20 and 08/26[117]constructed in 1942. As per layout the two runways cross each other. Both the runways are used throughout the year due to the peculiar wind pattern of Bidar airfield. To cater to the needs of Advanced Jet Trainer (AJT) during induction (November 2007), both these runways were extended[118] in November 2007 and March 2008 respectively at a cost of ₹32.10 crore.

[116] Runways are numbered between 01 and 36. The number indicates the runway's heading. Since runways are normally used into two directions, it will have a second number.
[117] 08/26 is main runway and 2/20 is second runway.
[118] 02/20 by 2687.90 m and 08/26 by 663.24 m

Audit noticed (July 2014) that the last resurfacing of runways 02/20 and 08/26 was done in 1999-2000 and 2010-11 respectively. Further, based on the report (July 2007) of Soil Engineering and Material Testing and recommendations of a Board of Officers (BOO) (August 2008), Ministry of Defence (MoD) had sanctioned (June 2010) resurfacing of runway 02/20 at an estimated cost of ₹41.68 crore with Probable Date of Completion (PDC) of 104 weeks (June 2012). However, scope of work did not include resurfacing of the extended portion of any of the runways. Tender for the work was accepted (September 2011) and Chief Engineer (AF) Bengaluru concluded (September 2011) a contract agreement (CA) for a sum of ₹35.75 crore. As per CA, the work was required to be commenced in November 2011 and to be completed by December 2013.

Audit also noticed (July 2014) that after commencement (November 2011) of the runway 02/20 resurfacing work, AFS, 'S-25' proposed (January 2012) to resurface the extended portions of both runways 08/26 and 02/20 at cost of ₹1.55 crore as a deviation[119] to the contract by justifying that the extended portions of the runways, if left unattended now, had to be resurfaced at a different point of time which would involve relocation of aircraft thereby affecting the flying operation and causing infructuous expenditure. Chief Engineer accorded (March 2012) in principle approval for the deviation work. The resurfacing of the extended portion of both the runways was completed (April 2012) by Military Engineer Service (MES) by incurring expenditure of ₹1.48 crore against the estimated cost of ₹1.55 crore.

Audit observed (July 2014) that resurfacing of the extended portion of the runways was inappropriate in view of the following:

(a) Requirement of additional scope of work for the extended portion of both runways was neither deliberated by the Board of Officers[120] (August 2008) convened for assessing the work of resurfacing Runway 02/20 at the time of recommendation (March 2009), nor approved (June 2010) by the CFA

[119] During the performance of works under a contract, deviations may be taken for material improvement as per Para 435 of RMES.

[120] Constituting of representatives from MES and Air Force.

i.e. MoD while sanctioning the resurfacing work of runway 2/20. Thus, the initial planning for resurfacing of the runway 2/20 was made on ad hoc basis and not comprehensive.

(b) Resurfacing of the extended portion of the other runway *i.e.* 08/26 was also justified by AFS, Bidar and approved even though the runway of 8/26 had not been taken up for resurfacing.

(c) As per Air Field Pavement Management System (AFPMS) issued by E-in-Cs Branch, Army HQ, the existing design analysis caters for a structural pavement life of 20 years. Both the runways had been extended during 2007-08 and runway 08/26 was resurfaced in 2010-11; and no defects/deterioration was noticed in the extended portions of runway till January 2012[121] when the proposal was made for their resurfacing.

(d) No opinion of Soil Engineering and Material Testing Wing (SEMT) on performance & soundness of the extended portion was obtained before executing the work as required under Annexure 'C' to para 20 Chapter V of IAP – 2501**.**

(e) While forwarding (February 2012) the proposal to CWE & CE, Garrison Engineer (GE) indicated that his office was going ahead with the work assuming the AIP (Acceptance in Principle) for the additional work would be granted by the Competent Engineer Authority. MES proceeded (January 2012) with resurfacing of the extended portion of runways (addition to the sanctioned work) without even preparing supplementary estimates and obtaining approval from Competent Financial Authority (CFA) as required under Para 140 of MES Regulations which stipulates that if changes or additions become necessary through revision of scales or establishments or for other administrative reasons, a supplementary estimate will be prepared and administrative approval to the entire work (including both original and supplementary estimates) will be accorded by the CFA. While according administrative approval in such cases, the CFA

[121] AFS, Bidar proposed resurfacing of the extended portions of runway in January 2012.

will certify that the supplementary estimate has been necessitated by purely administrative reasons.

In response to audit observation (July 2014), Assistant Garrison Engineer (AF), Bidar had, while confirming (August 2014) that no defects had been noticed on the extended portion of runways at the time of proposal (January 2012), clarified that opinion of SEMT was not found necessary as work of the same specifications had earlier been done at the main stretch of runway. It was further stated that the resurfacing of the extended portion of the runways was due to operational requirement of IAF as proposed (January 2012) by Air Force authorities to HQTC/MES and the work, being a deviation, was approved (March 2012) by the Chief Engineer, Air Force (CE, AF) Bengaluru. With regard to resurfacing of the extended portions of runways within three years, Headquarters Training Command, IAF, stated (February 2015) that deviation in the scope of work had been necessitated so that the flying operations might not be affected for prolonged duration at a later stage and also due to high intensity flying operations and functional distress. The Command further stated that prior sanction of CFA would require in the event of quantity being exceeded by 25 *per cent* in single item and overall amount by 10 *per cent.* As such prior sanction of CFA in the present case was not required.

The reply is not tenable in view of the following:

(i) The justification by the Air Force regarding simultaneous resurfacing of the extended portions of runways 08/26 and 02/20 is fallacious since both the runways cross each other as they are in 'X' formation. Therefore resurfacing of second runway, whenever it takes place would impact operations of first runway also. In such a situation proposal to resurface extension of second runway much ahead of schedule on the logic of it impacting operations subsequently is not logical and this indicates the planning was ad hoc.

(ii) The resurfacing of newly extended portion of runways within three years of its completion in 2010-11 without any defect/deterioration being noticed was improper and also against the structural pavement life of twenty years.

(iii) Para 435 of Regulations for the Military Engineer Service (RMES) clearly defines 'deviations' and states that material improvement is authorised only for 'works under a contract'. As CE AF, Bengaluru concluded the contract (September 2011) for 'resurfacing of the runway 02/20,' taking up 'resurfacing of the extended portions of runways 08/26 (a different runway) and 02/20' under the scope of present work of the contract was not a deviation but execution of additional / new work without approval of the original sanctioning authority *i.e.* MoD as required under Para 140 of MES Regulations (Referred at sub-para (e) above).

Thus, resurfacing of newly extended portion of runways within three years of previous resurfacing without noticing any defect / deterioration was arbitrary which indicated lack of due diligence in taking up the work and therefore resulted in injudicious expenditure of ₹1.48 crore. It was also done without getting the approval from Competent Financial Authority *i.e.* MoD.

2.9 Incorrect procurement of compressor working fluid

Failure on the part of Air HQ in not ordering staggered supply of compressor working fluid worth ₹2.52 crore led to expiry of its shelf life.

Indian Air Force Manual of Provisioning stipulates that in the case of items of perishable nature and those having limited shelf-life, deliveries indicated on indents should be so staggered as to ensure that the quantities supplied are likely to be utilised before the expiry of their life and usefulness.

The Compressor Working Fluid (CWF) is used in the booster compressor of Russian make ground based oxygen vehicles, which is mostly used by Russian origin fighter/transport aircraft.

Directorate of Stores, Air Headquarter (Air HQ) placed an indent in July 2008 for procurement of 390 liters (equivalent to 720 Kg.) of fluid for meeting the requirement of 57 months in respect of ground based oxygen vehicles used for 'C' aircraft. Based on the indent, Directorate of Procurement (Foreign Procurement Wing) Air HQ issued tenders (August 2008) to three foreign

firms[122] of which M/s 'V-4', Russia quoted (October 2008) USD 577029 (₹2.52 crore[123]) and was found to be the lowest (L1). At the time of submitting quote, the firm mentioned that guaranteed storage life of the fluid was one year from the date of manufacture.

Air HQ concluded a contract (April 2009) with the firm for supply of 390 liters fluid at a cost of USD 577029 (₹2.52 crore). Despite knowing the fact that shelf life of the fluid was only one year from the date of manufacture, Air HQ overlooked the stipulated provisions and did not impose the condition in the contract to supply the fluid in a staggered manner as per IAF requirements. The entire quantity of fluid (390 liters) supplied by the firm in November 2009, was reported to be manufactured during July 2009. Thus the supplied fluid had remaining shelf life of only eight months (up to July 2010).

The samples of CWF was sent (April 2010) to a laboratory M/s AVI OIL India, Faridabad for testing and subsequently (March 2011) to another laboratory namely Controllerate of Quality Assurance (Petroleum Products), Kanpur by 'Y' Equipment Depot (ED) AF which is their stockholding depot, for determination of shelf life. As both these laboratories did not have testing facilities to carryout full specification tests, their test results (received in February 2011 and May 2011 respectively) remained inconclusive.

In reply to draft para issued (June 2013) to the Ministry, Air HQ stated (September 2013) that 379 liters fluid lying in stock as Category 'C'[124] had been upgraded (July 2013) to Category 'B' and issued (July 2013) to units to sustain existing oxygen generating vehicles procured from Russia.

It was also seen (September 2013) from the reply of Air HQ that the sample of CWF was again tested (June 2013) by M/s Avi Oil India (P) Ltd. Though the firm confirmed the product specification standard to the Unit ('Y' Equipment Depot[125], AF) but the test report of the firm did not indicate revised storage life of the CWF. However, Air HQ granted (July 2013) provisional life of 12 months (*i.e.*, up to July 2014). Audit further enquired (November 2014) as to how IAF entrusted the task of testing CWF to M/s Avi Oil India (P) in absence

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122 M/s 'V-4', Russia, M/s 'V-8', UK and M/s 'V-9', Russia

123 1USD = ₹43.75

124 The condition of fuel is categorised as 'Category 'A' New and unused, Category 'B' Usable for immediate re-issue, and Category 'C' Usable subject to functional test.

125 'Y' Equipment Depot is Stock Holding Depot for Fuel, Oil and Lubricant items of Indian Air Force.

of full test facility at their laboratory. In response to the audit query, Air HQ stated (January 2015) that M/s Avi Oil, though not the supplier of the CWF, tested the sample on personal liaison basis and the product was cleared for usage with a provisional life of one year based on verdict rendered by the firm.

Audit approached (March 2015) the DGAQA[126] to ascertain the competency of the M/s Avi Oil India (P) Ltd in extending the life of CWF. In reply, DGAQA stated (April 2015) that M/s Avi Oil (P) Ltd is not authorized to extend the shelf life of imported CWF or any other store meant for military application. It was also stated that the mandate for defining the shelf life of CWF and its life extension rests with OEM only. DGAQA further stated that extension of shelf life can be done from the date of expiry of defined shelf life and not from the date of retest.

Out of 390 liters, only 11 liters of CWF could be utilized till July 2013, *i.e.* within four years of its manufacture and 379 liters (equivalent to 700 Kg) fluid valuing ₹2.45 crore was lying in stock.

Audit also analysed the consumption pattern from Integrated Material Management Online System (IMMOLS) and observed (May 2015) that after the audit observations IAF had over utilised the CWF in 2014 as given in the Table below:

Table 2.11 : Year-wise consumption of CWF

Sl. No.	Year	Total CWF consumed (in liters)
1.	2009	Nil
2.	2010	19*
3.	2011	14*
4.	2012	Nil
5.	2013	34*
6.	**2014**	**291**

*Possibility of consumption from earlier stock

Audit examined (June 2015) records / documents to ascertain the actual utilization of CWF at three Air Force Station (AFS) (out of eight AFS) to whom CWF was issued by Air HQ and results are as under:

[126] Directorate General of Aeronautical Quality Assurance

1. 'W-15' Wing, AF: - Total quantity of 109.105 liters (30 liters in April 2013 and 79.105 liters in July 2013) of CWF was received from 'Y' ED, AF. The entire quantity of 109.105 liters was used (June 2014 to February 2015) by AFS on indigenized Air Compressor Trolley (ACT) in lieu of 'Compressor Oil Servo 68'.

Audit observed that entire quantity of 109.105 liters was utilized by AFS after a lapse of one year of its receipt which indicates that CWF was not urgently required by the unit and its consumption was made after audit observations. Further 'Compressor Oil Servo 68' in lieu of which CWF was being used was available indigenously at far cheaper price (₹152.46 per liter as against ₹64,615 per liter for CWF).

2. 'W-16' Wing, AF: - The entire quantity of 190 liters of CWF had been issued during the period November 2009 to June 2015 by 'Y' ED AF to 'W-16' Wing AFS.
Audit however noticed (June 2015) that 52 out of 190 liters of CWF was issued[127] by 'W-16' Wing to its lodger units[128] which did not have the Russian make ASVs.

3. 'W-17' Wing AF: - AFS informed (June 2015) that even though no demand for CWF was placed by them, 25 liters of CWF was issued (July 2013) by 'Y' ED AF. Out of which 2.5 liters dispatched (April 2015) to M/s AVI Oil Faridabad for sample test and remaining 22.5 liters issued (June 2015) to TACDE[129], AF. AFS further stated (June 2015) that unit was exploring the possibility to utilize CWF as no vehicle held at their end on which CWF could be utilized.

Thus, IAF failed to exercise due diligence in working out the staggered requirement of 390 liters of CWF, with shelf life of one year. Consequently, only 11 liters was used by July 2013, *i.e.* four years of manufacture. The balance 379 liters of CWF valuing ₹2.45 crore remained in stock since November 2009 and its issue/overutilization to the extent of 291 liters (*i.e.* 76.78 *per cent*) in year 2014 were afterthought and for purposes other than that for which it was imported.

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127 'W' Transportable Radar Unit, Power Plant, flight Store,7 Tactics and Air Combat Development Establishment (7 Tetra RSBN), 24025 /Akash/Missile Squadrons *etc.*

128 Lodger Units are independents units for operational task, however these lodger units depend on respective Wings for Administrative support.

129 Tactics and Air Combat Development Establishment.

2.10 Inordinate delay in commissioning of Low Level Transportable Radar

The critical requirement of Air Defence Surveillance envisaged (1998) to be met by IAF through 37 Low Level Transportable Radars (LLTR) remains unmet for past 17 years due to inordinate delay in supply of 19 LLTRs despite incurring expenditure of ₹454.48 crore. None of the first LLTR has been commissioned so far (June 2015), thereby compromising the Air Defence surveillance capability to detect hostile low level ingress.

While reviewing requirement of surveillance radars in 1982, it was assessed by IAF that majority of future air strikes will be at low level to retain an element of surprise. Low Level Transportable Radars (LLTR) provides cover against aerial threats operating at low levels and also provide 'early warning' to controlling Air Defence Detection Centre (ADDC).

Raksha Mantri had accorded 'in principle' approval in January 1998 for procurement of 37 LLTRs in two phases *i.e.* 19 LLTR to be procured in 9th Plan (1997-2002) and the remaining 18 LLTRs in 10th Plan (2002-2007). The Defence Acquisition Council (DAC) in October 2005 accorded Acceptance of Necessity (AON) for procurement of 37 LLTRs with 19 under 'Buy and Make[130]' category with Transfer of Technology (ToT) and another 18 under 'Make' category. The Department of Defence Production (DDP) nominated M/s Bharat Electronics Limited, (M/s BEL) as the Production Agency to absorb the ToT.

Ministry of Defence (Ministry) concluded two contracts in July 2009 for procurement of 19 LLTRs at a total cost of ₹1272 crore. The 'Buy' part of 'Buy and Make' contract was concluded with M/s Thales, France (Original Equipment Manufacturer, (OEM)) for procurement of six Fully Furnished (FF) LLTRs along with communication and associated equipment; and breakdown kits[131] for 13 radars along with Transfer of Technology (ToT) at a

[130] Purchase from a foreign vendor followed by licensed production/indigenous manufacture in India.

[131] 2 SKD (Semi Knocked Down), 2 CKD (Completely Knocked Down) and 9 IM (Indigenous Manufacture)

total cost of ₹572.20 crore with delivery schedule of February 2012 to March 2013. Advance payment of ₹85.82 crore was also released to OEM in November 2009.

The 'Make' part of 'Buy and Make' contract was concluded with M/s Bharat Electronics Limited, Ghaziabad (M/s BEL) at a total cost of ₹699.54 crore for manufacture and supply of the 13 LLTRs from breakdown kits supplied by the OEM with delivery schedule between March 2013 and March 2015. An advance of ₹160.97 crore was also paid to M/s BEL in November 2009.

Paragraph No. 2.2 of the C&AG's Audit Report No. 20 of 2011-12 (Air Force and Navy), mentioned about inordinate delay in procurement of 19 LLTRs. In their Action Taken Note (ATN), the Ministry had stated (January 2012) that the contract concluded with M/s Thales was progressing on schedule and the Site Acceptance Test (SAT)[132] of the first LLTR was to be conducted in May 2012 and the last of total 19 LLTR, was expected to be received by March 2015.

Scrutiny of records relating to post contract management of LLTR, as a follow up audit exercise of the issue, revealed the following:

1. Delay in supply of fully furnished radar

As per Article 14 of the 'Buy' contract (July 2009) with OEM, though SAT was to be conducted in India in May 2012, the same had not been carried out till April 2015 due to the following reasons as seen in audit:

(i) As per Article 8 of the 'Buy' contract (July 2009) with OEM, the Factory Acceptance Test (FAT)[133] of first Fully Furnished LLTR, which was scheduled to be conducted in December 2011, was conducted from 24 June 2013 to 19 July 2013.

[132] Performance test conducted at buyer's site to verify that the system installed on a site meets the performance specifications.

[133] Performance test conducted at seller's site to verify compliance of equipment subassemblies in accordance with the specifications.

(ii) Due to failure in the antenna drive system[134] and non-compliance of contractual and critical operational observations, the FAT was finally cleared in May 2014 by IAF with nine critical operational observations[135] affecting detection and tracking capability of the radar which were to be complied by M/s 'V-3' during SAT of first LLTR.

(iii) ₹293.51 crore had been released to OEM till December 2014.

The Ministry accepted the delay pointed out in audit and stated (April 2015) that the revised delivery schedule (February 2016) and extension of the validity of Letter of Credit up to January 2017 had been approved with imposition of Liquidated Damages (as per Article 13) for the delayed delivery and the inked signed copy of amended contract was awaited from M/s V-3.

In reply to audit queries (May/June 2015) Air HQ stated (June 2015) that SAT was completed in June 2015 and eight out of nine critical observations linked with SAT had been resolved.

The fact remains that due to delay in completion of FAT, the SAT could actually be completed in June 2015 as against contracted schedule of May 2012. The delay in turn resulted in non-commissioning of first LLTR even after a delay of over 37 months (May 2012 to June 2015).

2. Delay in manufacture of 13 radars by M/s BEL from breakdown kits

As stated earlier, M/s BEL was given the contract (July 2009) as per Defence Procurement Procedure (DPP-2006) for 'Make' part of 'Buy and Make' category for manufacture and supply of 13 LLTR from breakdown kits received from M/s V-3. An advance of ₹160.97 crore was released (November 2009) to M/s BEL as per contract.

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[134] The antenna drive system was a critical sub system of the LLTR and its failure would have bearing on the reliability and operational capability of LLTR.

[135] Observations relating to radar performance *w.r.t.* graceful degradation, Identification Friend or Foe (IFF), detection capability, resolution and accuracy, tracking capability, analysis document for environmental test, *etc.*

M/s V-3. could not deliver breakdown kits consisting of Technical Data Package (TDP), Semi Knocked Down (SKD), Completely Knocked Down (CKD) and Indigenous Manufacture (IM) kits as per contracted delivery schedule (April 2012 to November 2012) so far (April 2015) on account of delay in FAT for first fully furnished LLTR. This consequently delayed the production programme of M/s BEL which was scheduled to commence from July 2013.

While accepting the delay in production by M/s BEL, the Ministry stated (April 2015) that as per the contract, IAF was to provide these breakdown kits after receipt from M/s V-3 to M/s BEL along with the Technical Data Package; but the same had been delayed by more than two years due to delay in completion of FAT of first LLTR. Ministry added (April 2015) that the CKD and SKD kits could not be delivered by M/s V-3 to IAF so far due to expiry of Letter of Credit (LC) on 15 December 2014 and the contract amendment for extension in the validity of LC till 15 January 2017 had been approved by the Competent Financial Authority (CFA). Ministry also stated that the CKD/SKD were now scheduled to be delivered by M/s Thales by April 2015 and August 2015 respectively as per the revised delivery schedule and the delivery of radars manufactured under 'Make' category by M/s BEL from these kits was expected to commence from March 2016.

Regarding delay in induction of LLTRs impacting Air Defence capabilities of IAF, Ministry stated (April 2015) that considering the large volume of Indian airspace, complete low level coverage would require radars in large numbers. In view of this, 34 Rohini radars[136] which perform role of LLTR, were being deployed and the legacy[137] LLTRs were being maintained and sustained for low level coverage. The down gradation[138] of the legacy LLTRs were being done in phased manner to meet the air coverage requirement.

The Ministry's reply regarding legacy LLTRs is not justified as these were either obsolete or had very low detection range.

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136 It is a Low Level Radar developed by DARE, Bengaluru and produced by M/s BEL for using the LLTR role to detect low level aerial threats.

137 The term has been used by the Ministry for old radars *i.e.* ST-68, Indira-I and Indra-II radars.

138 The term has been used by the Ministry for Phasing out.

Thus, the critical requirement of Air Defence Surveillance envisaged (1998) to be met by IAF through 37 LLTRs, of which 19 LLTRs were to be inducted during 9th plan (1997-2002) and remaining 18 LLTRs were to be inducted during 10th plan (2002-2007), remains unfruitful for the past 17 years. This is due to inordinate delay in supply of 19 LLTRs despite incurring an expenditure of ₹454.48 crore. Even the first LLTR has not been commissioned so far (June 2015) and manufacturing by BEL had not commenced. Further, the contract for remaining 18 LLTRs, which were planned to be inducted during 2002-2007**,** was yet to be concluded even though the 'in principle' approval was obtained in January 1998. Thus, the Air Defence surveillance capability to detect hostile low level ingress remains compromised.

2.11 Savings at the instance of Audit

Air HQ/ Ministry reduced the requirements at the instance of Audit which resulted in corresponding reduction of one set of ordered equipment/spares for the crashed 'E' aircraft leading to savings of ₹11.45 crore.

The Ministry of Defence (Ministry) concluded (June 2009) a contract with M/s 'V-6'(OEM)[139] for extension of life of the entire fleet of 105 'E' transport aircraft of Indian Air Force (IAF) at a cost of 397.70 MUSD (₹1964.64 crore). Under the contract, TTLE[140], re-equipment and overhauling of 40 aircraft was to be carried out in Ukraine and similar process for balance 65 aircraft in India for which the contract included procurement of 65 sets of equipment/ spares at a cost of ₹11.45 crore per set.

We observed (August 2012) that out of 65 aircraft, which were to undergo overhaul and re-equipment in India, one aircraft had crashed on 9 June 2009 at Machuka, Arunachal Pradesh before the contract was concluded. However the number of aircraft to be overhauled / re-equipped in India for which equipment / spares were to be procured was not reduced to 64 at the time of conclusion (15 June 2009) of the contract by the Ministry.

[139] Original Equipment Manufacturer
[140] Total technical life extension

On the matter being pointed out in audit Air HQ agreed (November 2012) for cancellation of order for one set of TTLE spares. In April 2014, Air HQ informed that 'In Principle Approval' for cancellation of one set of TTLE spares had been obtained (March 2014) and the matter was being taken up further with the Ministry for cancellation of one set of equipment/ spares, costing ₹11.45 crore.

Ministry stated (April 2015) in response to the draft paragraph issued in February 2015, that the firm had confirmed (March 2015) that the spares for the 65th aircraft would not be supplied and the corresponding amount would not be claimed. Ministry also intimated (April 2015) that the firm was being approached to forward the draft Supplementary Agreement at the earliest.

Thus, Air HQ/ Ministry reduced the requirements at the instance of Audit which resulted in corresponding reduction of one set of ordered equipment / spares for the crashed 'E' aircraft leading to savings of ₹11.45 crore.

CHAPTER-III DEFENCE RESEARCH AND DEVELOPMENT ORGANISATION (AIR FORCE)

3.1 Execution of Mission Mode Projects and delivery of systems by DRDO

Audit examination of 14 Mission Mode projects carried out by DRDO Laboratories revealed that all the projects failed to achieve their timelines and their probable date of completion (PDC) were extended many times. In five projects there were cost overruns as well. Further, although Operational Requirements / Qualitative Requirements / Broad Technical Requirements of IAF existed in all projects, the requirements of IAF were met to their satisfaction only in one completed project *viz.*, project 'Rohini'. In the same project the technology was also transferred leading to its productionisation by BEL and final induction into IAF. The systems developed in other closed projects were yet to be accepted by IAF.
The delays can be attributed to inadequate monitoring by different committees as well as to change of requirements by IAF (three projects). Lack of harmonisation (where multiple agencies were involved) was also noticed in two projects. The projects were therefore not carried out in spirit of Mission Mode which adversely affected Air Defence plans of IAF.

3.1.1 Introduction

Defence Research Development Organization (DRDO) was established (1958) with a view to achieve technological self-reliance in weapon systems and platforms in accordance with the expressed needs of the armed forces *i.e.* three services.

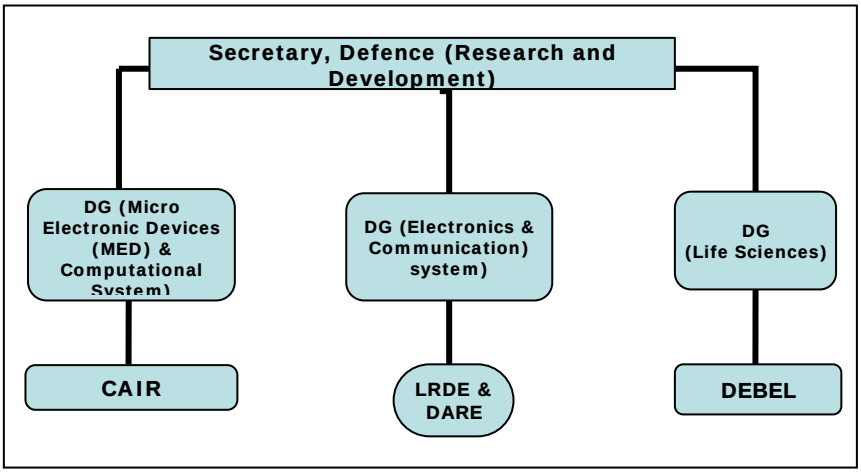
Mission Mode (MM) projects are taken up by DRDO as high priority projects as they are based on specific requirements of Services. MM Projects are those where the technology is already available and which can normally be completed in short duration of less than five years.

Out of 52 DRDO laboratories, nine[1] laboratories normally provide services to Indian Air Force (IAF). Considering importance of these projects to IAF, audit of these projects was taken up. Based on Audit criteria, MM projects undertaken by four[2] (out of nine) laboratories have been selected for the present review.

3.1.2 Organisational set up

DRDO functions under administrative control of Secretary, Department of Defence, Research and Development within the Ministry of Defence (the Ministry). DRDO is divided into seven clusters[3] each headed by a Director General (DG) to whom the Directors of laboratories under the respective clusters report to. The reporting structure of four selected laboratories is as given below:

Figure 3.1: Reporting structure of selected DRDO laboratories



[1] Electronics and Radar Development Establishment (LRDE), Bengaluru, Defence Avionics Research Establishment (DARE), Bengaluru, Aeronautical Development Establishment (ADE), Bengaluru, Gas Turbine Research Establishment (GTRE) Bengaluru, Centre for Airborne Systems (CABS), Bengaluru, Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, Microwave Tube Research and Development Centre (MTRDC), Bengaluru, Defence Electro-medical and Bioengineering laboratory (DEBEL) Bengaluru, Defence Food Research Laboratory (DFRL), Mysore.

[2] LRDE, DARE, CAIR & DEBEL, all located at Bengaluru

[3] Electronics & Communication Systems, Aeronautical Systems, Micro Electro Devices (MED) & Computational Systems, Life Sciences, Naval systems & Materials, Armament & Combat Engineering Systems and Missile & Strategic Systems.

3.1.3 Scope of Audit and Audit Sampling

For purpose of the present audit, all MM projects having sanctioned cost more than ₹ one crore and either completed or under execution beyond the original probable date of completion (PDC) as on 31st March 2014, were selected. Accordingly, out of 27 MM projects **(Annexure-VI)** executed by the nine laboratories during the period covered in audit *i.e.* 2007-08 to 2013-14 to meet the requirement of IAF, 17 projects[4](seven closed and ten on-going) met the audit criterion. This audit therefore examined 14 projects (six closed and eight on-going) valuing ₹1017.31crore as detailed in **Annexure-VII (A)**.

3.1.4 Audit Objectives

Audit was conducted with a view to evaluate whether projects were executed efficiently, effectively and in a time bound manner as Mission Mode projects.

The audit objectives were to evaluate:

i. Compliance to policies or guidelines for the execution of the MM projects.

ii. Operational Requirements (ORs)/Qualitative Requirements (QRs) were met as per IAF satisfaction and whether projects were delivered / executed within defined timelines.

iii. Project planning and monitoring.

iv. Transfer of technology for production and induction in IAF.

3.1.5 Audit Methodology

An Entry Conference was held on 4th August 2014 at Defence Avionics Research Establishment (DARE), Bengaluru with the DRDO HQ and

[4] Two projects *viz.*, Development of Kaveri engine for LCA by GTRE, and Development of Electronic Warfare (EW) Suite for MiG 27 aircraft by DARE had already been commented vide Para 5.1 of C&AG' Report No. 16 for the year 2010-11 and Para 2.1 of C&AG Report No. 4 for the year 2014 respectively. The project for Airborne Early Warning & Control (AEW&C) system of CABS is planned for a performance audit separately due to its materiality.

representatives of concerned laboratories wherein audit objectives and scope were discussed. Audit of the selected 14 projects was conducted at the concerned laboratories, DRDO HQ and concerned Directorates of Air Headquarters (Air HQ) from August 2014 to October 2014. During audit, audit memos and queries were issued for obtaining requisite information, for eliciting replies, gathering evidence, obtaining clarifications and giving audit observations. Exit conference was held on 19th December 2014 at DARE with the representatives of DRDO HQ and the concerned laboratories, wherein results of audit were discussed. The draft report was issued (April 2015 and August 2015) to the Ministry. The replies (June 2015) of DRDO have suitably been incorporated in this report. Reply of the Ministry was awaited (September 2015).

3.1.6 Sources of Audit Criteria

Audit criteria were derived from:

- Procedures for Project Formulation and Management (PPFM) in DRDO published in January 2006 and May 2014
- Defence Procurement Procedure (DPP) of 2008 and 2011
- IAF requirements- Operational Requirements (ORs), Qualitative Requirements (QRs)
- Project proposals, sanctions, execution, system trials, user evaluation, project closure reports (Technical and Administrative)
- Annual Reports of concerned Laboratories

3.1.7 Acknowledgement

Audit acknowledges the co-operation extended by the Ministry, DRDO HQ, concerned Laboratories and Air HQ for smooth conduct of audit and timely response to observations. DARE deserves a special mention for arranging Entry and Exit Conferences.

3.1.8 Audit Findings

Audit findings are broadly organised as under:

a) Macro perspective relating to policies, requirements of IAF and achievement, project planning and time and cost over runs (*Paragraphs 3.1.8.1 to 3.1.8.4*).

b) Closed projects *i.e.*, projects which were closed by March 2014 (*Paragraphs 3.1.8.5 to 3.1.8.9*).

c) Ongoing projects as of March 2014 (*Paragraphs 3.1.8.10 to 3.1.8.15*).

d) Conclusion and Recommendations (*Paragraphs 3.1.9 and 3.1.10*).

3.1.8.1 Standardised process for MM Projects

DRDO had formulated Procedures for Project Formulation and Management (PPFM) in January 2006 which included procedure and guidelines for execution of projects. PPFM was further modified in May 2014. PPFM included procedure for feasibility study, formulation of project proposal, sanction, execution of projects, monitoring and review, PDC extension, projects closure, *etc.* It was seen that the Laboratories had broadly followed these guidelines in execution of the projects as per PPFM, except for following.

As per PPFM, 'a key stage in concluding a project is to confirm that the project has met expectations of the user'. The PPFM further prescribes that after completion of project related tasks, the project has to be evaluated and measuring customer satisfaction is part of this process.

However it was seen that Electronics and Radar Development Establishment (LRDE), Bengaluru had carried out user trials and acceptance of projects 'Rohini' (*Paragraph 3.1.8.5)* and 'Aslesha' radars *(Paragraph 3.1.8.6)* as separate projects.

Further LRDE's project 'Aslesha' (*Paragraph 3.1.8.6*) and DEBEL's 'Common Helmet and Mask' and 'Nuclear, Biological and Chemical-Individual Protective Equipment (*Paragraphs 3.1.8.8 and 3.1.8.7*) were closed without meeting user specification. PDC of CAIR's project 'Meghdoot' had expired in December 2013 and IAF had not accepted the security solution developed by the laboratory so far (July 2015) (*Paragraph 3.1.8.9*).

3.1.8.2 Requirements of the IAF *vis-à-vis* achievement

All 14 MM projects had defined Operational Requirements. Out of six closed projects, only 'Rohini' radar developed by LRDE was productionised and inducted into IAF (*Paragraph 3.1.8.5)* and remaining four[5] projects were yet (July 2015) to be accepted by IAF. Shortfalls *vis-à-vis* user requirements as noticed in audit in these projects are discussed in *Paragraphs from 3.1.8.6 to 3.1.8.9.*

It was also noticed that in three projects ('Ashlesha', Common Helmet-Mask and D 29) IAF either did not indicate its complete requirement [*e.g.* power supply systems, sensor head, commander's display unit (*paragraph 3.1.8.6),* requirement of Helmet Mounted Sighting Display (HMSD) for certain types of aircraft (*Paragraph 3.1.8.8*)] *ab-initio* in the ORs or changed its requirements for the systems relating to weight, testing, *etc.*, *(Paragraph 3.1.8.6, 3.1.8.14)* subsequently, leading to further delays in these projects.

3.1.8.3 Deficiencies in project planning and monitoring

The sanctions issued by the Ministry contained mechanisms for monitoring of projects by certain committees along with frequency of their meetings. Shortfalls in monitoring by these committees (*Paragraphs from 3.1.8.9 to 3.1.8.11*) were noticed impacting the project execution.

There were deficiencies in project planning in respect of three projects *viz.* development of Common Helmet-mask for all types of aircraft and helicopters of IAF by DEBEL, Bengaluru (*Paragraph 3.1.8.8),* development of Medium

[5] The development of the Rohini radar and its user trials/acceptance was carried out separately under two projects.

Power Radar (MPR) by LRDE *(Paragraph 3.1.8.10*), and development of Electronic Warfare Suite (D-29 system) for MiG-29 aircraft by DARE *(Paragraph 3.1.8.14).*

3.1.8.4 Time and Cost overruns

Audit examination of selected 14 MM projects revealed that there were time overrun of 25 to 210 *per cent (Paragraphs 3.1.8.5 to 3.1.8.15)* in all the projects. Further out of 14 projects, there was cost overrun in five projects ranging from of 0.57 to 158.94 *per cent,* four projects were completed in less than initially sanctioned cost resulting into savings ranging from 7.44 to 25.07 *per cent.* In the remaining five projects (all on-going) there was no cost overrun as of 31st March 2015. The details are in **Annexure-VII (B)**.

Further as against the normal requirement of completing the Mission Mode projects in less than five years, only two projects (NBC IPE and Common Helmet-Mask) were completed in less than five years, however these were yet to be accepted by IAF (June 2015).

DRDO stated (June 2015) that in three projects, time overrun was due to technical reasons and in the remaining 11 projects, it was due to erroneous estimate of PDC by the laboratories as time required for user trials was not taken into consideration while projecting PDC, non-availability of platform for fitment for user trial and change in specification by the user. DRDO also stated that the cost escalation was due to additional modifications and change in specifications which cannot be attributed only to DRDO as other agencies were also involved.

Significant time overruns in all selected Mission Mode projects is a cause of concern.

3.1.8.5 S-band Surveillance Radar system 'Rohini'

3D (Dimensional) Surveillance radar system is a S-band[6] medium range radar capable of scanning and tracking airborne targets up to 150 km for 2 square meter (sq m).

[6] S-Band denotes frequency range 2 to 4 GHz.

Based on IAF's Operational Requirements (ORs) (August 2003) for the radar to perform as a base radar[7] and LRDE proposal therefor, MoD sanctioned (November 2003) a Mission Mode project 'Rohini' to LRDE at a cost of ₹34.05 crore with a PDC of 36 months (*i.e.* by November 2006). However, the project sanction did not include the post development activities such as user trials and its acceptance by IAF.

LRDE developed (August 2007) the radar within the extended PDC (August 2007) with an expenditure of ₹28.02 crore and closed (August 2007) the project. Subsequently, LRDE submitted (September 2007) a new proposal for evaluation and user trials of 'Rohini' radar along with 'Revathi' radar, also developed by LRDE for Indian Navy. MoD sanctioned (December 2007) the project under MM category at a cost of ₹8.00 crore, with a PDC of 15 months (March 2009). IAF carried out the trials of 'Rohini' radar between February 2008 and March 2008 and recommended its induction into Service. The project was completed (December 2010) with an expenditure of ₹7.27 crore.

Audit noticed (October 2014) that during the course of development and trials of 'Rohini' radar itself, Air HQ had placed two supply orders (March 2006 and July 2009 respectively) on M/s BEL, the production agency, for manufacture and supply of 37 'Rohini' radars.

In response to Audit observation (December 2014) on non-inclusion of user trials of 'Rohini' radar in the initial sanction and status of supplies under the BEL order, LRDE stated (January 2015) that as the radar required extensive trials to prove the capabilities in various environmental conditions, a separate project was initiated. Non-availability of the users, site and aircraft, *etc.*, was also cited as reasons for splitting up the project activities. As of December 2014, 36 'Rohini' radars had been delivered.

The fact remains that splitting up of the activities of a MM project was in violation of provisions laid down in the PPFM. Hence, two sanctions issued separately by the Ministry for development and user trials were not in order.

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[7] Medium range 3 dimensional surveillance radar, to work in stand-alone mode mounted on TATRA vehicles.

3.1.8.6 Low Level Light Weight Radar 'Aslesha'

Low Level Light Weight Radars (LLLWR) are mobile radars having a range of 50 Km that can be transported by animal carts/ trucks/ helicopters for deployment in difficult terrains.

Based on IAF's requirement (August 2004) for 36 LLLWRs and Defence Acquisition Council (DAC)'s 'in-principle' approval (September 2004) for procurement of 15 LLLWRs through 'Buy' option and balance 21 through indigenous development by DRDO, MoD sanctioned (December 2004) development of LLLWR ('Aslesha') to LRDE under Mission Mode at a cost of ₹21.94 crore with a PDC of 30 months (June 2007). However, in deviation from PPFM, the project sanction did not include the need for conducting trials and user acceptance.

As per the sanction, LRDE developed one laboratory prototype and one fully engineered prototype[8] of LLLWR within the revised PDC of June 2008. To facilitate user trials and post development activities of 'Aslesha' radar, LRDE submitted a new proposal (September 2008) at a cost of ₹1.98 crore. However, DRDO HQ sanctioned (November 2008) the project at a cost of ₹50 lakh with a PDC of 15 months.

After user trials (December 2009-February 2010), IAF trial team recommended (February 2010) improvements in power supply system, sensor head and Commander's Display Unit, *etc.*, of LLLWR. LRDE agreed to carryout changes in production model and closed (September 2011) the project as successful with an expenditure of ₹20.77 crore. Subsequently, MoD concluded (March 2012) a production contract with BEL for supply of 21 Aslesha radars at a cost of ₹205.13 crore with delivery commencing from June 2013 onwards.

However, implementation of IAF suggested improvements on LLLWR by BEL under the production contract (March 2012) resulted in increase in weight of 'Aslesha' radar from the specified 190 Kg to 205 Kg. Though, the

[8] Laboratory prototype is retained by concerned laboratory for future modification / up gradation. Fully engineered prototype is meant of production purpose.

increase in weight of LLLWR was acceptable to IAF, the delivery of the radars was withheld pending amendment to the contractual specifications[9] with regard to increased weight.

Audit observed (December 2014) that as per PPFM, a key stage in concluding a MM project was to confirm that the project has, in fact, met the specifications of the user. However, in the instant case, before closing the project as successful, LRDE did not ensure to carryout suggested changes as recommended by IAF in the prototype model instead of the production model (after conclusion of the contract). This made the acceptance of LLLWR with increased weight by IAF a fait accompli.

In response, LRDE stated (January 2015) that modifications/improvisations were incorporated in production model as suggested by the user. The DRDO HQ, in its reply (June 2015) to the draft report (April 2015) agreed that modifications/improvisations suggested by the users should have been addressed in the prototype model before conclusion of the production contract and as a remedial measure, DRDO HQ had contemplated to form a Change Control Board (CCB) to oversee any modifications post development of projects.

Thus, the requirement to amend the contract by MoD has delayed the delivery of LLLWR by 23 months (June 2015) thereby affecting the Air Defence capability of IAF.

3.1.8.7 NBC Individual Protective Equipment (IPE) for crew of Transport Aircraft and Helicopter

Nuclear Biological Chemical (NBC) Individual Protective Equipment (IPE) protects crew of transport aircraft and helicopter fleet from NBC hazards. Based on Joint Services Qualitative Requirements (JSQR) (July 2007), DRDO HQ sanctioned (August 2008) a Mission Mode project to DEBEL for development of NBC IPE including its sub-systems[10] at a cost of ₹1.35 crore with a PDC of 30 months (February 2011). However, the sanction did not

[9] DGAQA will clear production of LLLWRs only as per contract specifications.

[10] Sub-systems, *viz.* Protective Respiratory mask, Canister for filtering air, blower system and battery for blower and flexible hose from blower system to respirator.

specify the requirement of user trials. DEBEL developed (February 2012) IPE (Respiratory protective mask) with an expenditure of ₹1 crore.

Audit observed that in contravention to PPFM guidelines for MM projects, DEBEL closed (July 2013) the project without completing the field trials on the plea that it was a long drawn affair involving considerable amount of time.

DEBEL stated (October 2014) that respiratory protective mask developed by them could only be tested along with other IPEs[11] which were expected to be developed by other DRDO labs[12] by June 2015. DEBEL justified its decision (July 2013) to close the project pending user trials on the ground that its aim was only to design and develop the respiratory protective system.

In reply to Draft Report (April 2015), the DRDO HQ stated (June 2015) that the requirement of other NBC IPE was beyond the scope of the subject project which led to non-completion of user trial and time over run.

DRDO HQ reply is not acceptable as NBC-IPEs, though executed by different DRDO laboratories under a project, cannot lose sight of the project objective, which was the successful development of NBC-IPE in the instant case. Moreover, DRDO HQ did not indicate in their MM sanction (August 2008) the need to conduct user's trials along with other NBC-IPEs being developed by other laboratories. Further, on account of the delay in development of NBC-IPE by other DRDO laboratories, as confirmed (June 2015) by DEBEL, a proposal for import of 40,000 sets of NBC IPE items by Tri-Services was under progress (May 2015).

The fact thus remains that DEBEL closed the MM project without user trials and acceptance of the developed NBC-IPEs by IAF. Further, DRDO did not ensure effective synchronisation *vis-à-vis* the development of remaining NBC-IPE undertaken by other laboratories. Thus, the delay in indigenisation of the NBC-IPE had forced the defence forces to resort to import to meet their requirements.

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[11] NBC Glove, NBC Over boot and NBC suit.

[12] DRDE, DMSRDE, INMAS, VRDE, R&D (E) Est, DFRL, SSPL and LASTEC.

3.1.8.8 Design and Development of Common Aircrew Helmet-Mask

Indian Air Force (IAF) operates different types of aircraft with unique helmets and oxygen masks for aircrew. A common helmet mask not only alleviates the problems of procurement and logistics but also make the inventory holding manageable.

Hence, based on Air HQ QRs (February 2009), DEBEL proposed (May 2009) to develop a common aircrew helmet-mask for Russian[13] and European series[14] aircraft at a cost of ₹48.5 lakh. DRDO HQ sanctioned (July 2009**)** the MM project to DEBEL at a cost of ₹47.5 lakh with a PDC of three years (July 2012). However, the sanction did not include the requirement of user trials.

The prototypes of helmet-mask assemblies developed (November 2011) by DEBEL were subjected for 600 knots of wind blast test at National Aeronautical Laboratory (NAL) Bengaluru. However, at the instance of IAF, further testing at 600 Knots in open jet wind blasts (OJWB) at M/s CEAT, France was carried out by DEBEL to meet Military specification. During OJWB minor failures occurred on helmet-mask and to resolve these failures, the design of the helmet-mask was changed by DEBEL from acrylic visor to poly carbonate visor and also to manufacture of additional prototypes. This led to change in scope of project and specifications of the MM project resulting in enhancement of project cost twice[15] aggregating to ₹1.34 crore[16] and extension of PDC up to July 2013. DEBEL developed the modified prototype helmet-mask and closed (July 2013) the project at a total expenditure of ₹1.23 crore.

Audit observed (October 2014) that the prototype developed was not fit for use in three aircraft *viz*., Su-30 MKI, MiG-29 and MiG- Bis as the helmet of these aircraft needed Helmet Mounted Sighting Display (HMSD) [17]. Neither did IAF specify in their initial ORs (February 2009) about the requirement of

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13 MiG-21, MiG-Bison, MiG-23, MiG-27, MiG-29, Su-30 MKI aircraft and Cheetah / Chetak Helicopters.
14 HPT-32, Kiran, Hawk, Jaguar and Mirage-2000.
15 February and May 2012.
16 ₹47.5 lakh (original) + ₹44.50 lakh (enhanced) + ₹42 lakh (enhanced).
17 HMSD projects information on visor of the aircrew helmet.

HMSD on these helmets for three aircraft nor DEBEL brought out this fact in their project proposal. As a result, IAF had issued (November 2013) separate QRs for these three aircraft. This was against the provisions of a Mission Mode project in which before sanction of a project, the laboratories are required to carry out a detailed feasibility study wherein *inter-alia* the goals of the project are defined after taking inputs from all stakeholders. Audit also observed (October 2014) that in contravention to the spirit of MM project, DEBEL closed the project without user trials and acceptance of the helmet-mask by IAF and that the project saw a time and cost overrun of 33 *per cent* and 158.84 *per cent* respectively.

In response to audit observation, DEBEL stated (October 2014) that user's insistence (November 2011) for testing the prototypes at France resulted in escalation in cost and time of the MM project which could not be anticipated. DEBEL further added that design of common helmet-mask developed by them was not catered for HMSD mounting and hence was not suitable for Su-30 MKI, MiG 29 and MiG Bis aircraft and RCMA (Aircraft) had provisionally cleared (October 2014) helmets only for MiG-21 variants. DEBEL, further stated (January 2015) that since conducting flight trials was pending with Aircraft Systems and Testing Establishment (ASTE), IAF, the project was closed without seeking further PDC extension.

In reply to Draft Report (April 2015), the DRDO HQ stated (June 2015) that design restrictions were observed by users at a later stage of the development which forced users to consider a new design of helmet for three aircraft.

Reply may be viewed in light of DEBEL admission that design of common helmet-mask developed by them was not catered for mounting of HMSD which was contrary to their project proposal which included the above three aircraft. Further, Air HQ changed the requirement for testing only after development of the prototype, which resulted in consequent design changes/cost over-run /delays and issue of fresh ORs for three aircraft. Thus, the objective of the Mission Mode project was yet to be achieved (August

2015) as neither DEBEL properly appraised the work involved nor IAF projected their initial requirements correctly.

3.1.8.9 Secure video, voice and fax communication between Air borne platform and Ground station 'Meghdoot'

Encryption is the process of encoding messages or information in such a way that only authorized parties can read it, and is thus, effective way to achieve data security.

IAF had planned[18] to procure three Boeing Business Jet (BBJ) VVIP aircraft from USA which had inbuilt Video Tele Conferencing (VTC) system which was unencrypted and therefore unsecure. Hence, in pursuance of IAF requirement (October 2006) for an indigenous security solution for information flowing between the VVIP travelling on aircraft and ground locations and CAIR proposal (August 2007), Ministry sanctioned (December 2007) the project 'Meghdoot' to CAIR under MM at cost of ₹9.76 crore with a PDC of 24 months (December 2009). The sanction provided for project monitoring once in six months by a Steering Committee and once in three months by the Project Monitoring and Review Committee (PMRC).

CAIR completed (March 2009) design and development of the security solution on COTS[19] equipment and placed (March 2009) a supply order on M/s BEL, Ghaziabad for hardware platforms for VTC security solution at a cost of ₹6.61 crore with a PDC by December 2009.

However, after assessing the vulnerability of COTS, the Scientific Analysis Group (SAG)[20] of DRDO changed (December 2009) norms for Cipher Policy Committee (CPC)[21] evaluation of security solution. Hence, CAIR redesigned

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18 Ordered in October 2005 from M/s Boeing, USA and aircraft received between August 2008 and January 2009.

19 Commercially off the shelf

20 SAG evaluates communication equipment to be introduced in Services

21 CPC is the evaluation arm of SAG and will evaluate and grade the encryption security solution.

the security solution by providing an add-on card with an additional cost of ₹1.33 crore.

In order to install CAIR redesigned security solution on the BBJ aircraft, Air HQ concluded (January 2010) a contract with the OEM (M/s Boeing) for modification of all three aircraft with a staggered delivery (December 2011 and January 2013). Meanwhile, CEMILAC[22] cleared (December 2012) the redesigned security solution for fitment on the aircraft followed by security grading by the CPC in May 2013.

After installation of the security solution on the modified BBJ aircraft, IAF carried (May 2013) out the user trials wherein rise in temperature of on-board security solution up to 56 degree centigrade as against CEMILAC stipulated limit of 35 degree centigrade was observed. In order to resolve the issue, the project PDC was extended upto December 2013.

Audit observed (October 2014) though the overheating of the security solution persisted (October 2014), CAIR neither got the PDC extended (from December 2013) nor submitted a formal closure report, which was against the norms of a Mission Mode project. Audit also observed that as against required 27 Project Monitoring and Review Committee (PMRC) meetings, only eight were held (October 2014) thereby indicating inadequate project monitoring.

In response CAIR stated (December 2014) that deficiency was not in design of security solution but in inadequacy of cooling arrangement by aircraft OEM, hence PDC extension was not obtained. The laboratory accepted that PMRCs could not be carried out at the specified intervals.

CAIR subsequently informed (June 2015) to audit that problem of inadequate cooling was resolved by OEM, security solution required for deployment and spares along with the necessary key management equipment was handed over to IAF although the secured communication system developed by CAIR was yet (June 2015) to be accepted by IAF. Moreover, the security solution

[22] Centre for Military Airworthiness and Certification.

developed by CAIR was yet (June 2015) to be cleared by CEMILAC for regular service use.

Thus, requirement of the on-board secured communication system was yet to materialise (August 2015) since its projection (October 2006) thereby forcing the three VVIP aircraft inducted in IAF between August 2008 and January 2009 to fly[23] without the essential prerequisite.

3.1.8.10 Medium Power Radar 'Arudhra'

Medium Power Radar (MPR) is capable of automatic detection and tracking air intrusions at an altitude of about 100 meters up to a range of 30 km.

IAF projected (November 2002) a requirement of 23 MPRs with active phased array[24] radar technology for replacement [between X (2002-07) and XII (2012-17) Five Year Plan] of existing radars (PSM-33 radars, P-40 and TRS-2215 radars), which had completed their service life of 20 years.

Based on Air HQ ORs (November 2004) and due to non-availability of technology, MoD approved (April 2006) import of 15 MPRs by IAF and indigenous development of eight MPRs by LRDE with a delivery schedule of 60 months (April 2011). LRDE submitted (November 2006) a proposal to Air HQ for development of MPR using imported antenna[25] at a cost of ₹97.84 crore to meet IAF time frame of 36 months. However, Air HQ insisted (June 2007) LRDE to develop a fully indigenous MPR including its antenna using latest technology.

Accordingly, LRDE submitted (September 2007) revised proposal to develop active phased array technology based MPR with Digital Beam Forming (DBF)[26] feature, the Ministry sanctioned (November 2008) the project MPR 'Arudhra' under MM at a cost of ₹134.14 crore with a time frame of 54

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23 During 2014-15, all the three BBJ aircraft had under taken 239 sorties involving 442.03 Flying hours.

24 In active phased array each antenna has transmit / receive (T/R) modules to boost up output power of the transmitted signals required for maximum detection range.

25 Through direct import of MAP antenna from M/s Thales, France.

26 Digital Beam Forming is employed to synthesize multiple signals received in the form of a beam.

months (May 2013). The sanction provided for monitoring of the project by an Empowered Steering Committee (ESC) on need basis and by a Technical Coordination Authority (TCA)[27] on quarterly basis.

LRDE finalized (May 2009) radar architecture and Preliminary Design Review (PDR) for the development of radar through 13 developmental partners catering for 16 sub-systems of the radar **(Annexure-VIII)**.

Audit observed (September 2014) that:

a) Though, Developmental partners were identified during Empowered Steering Committee meetings held in January and June 2009, the supply orders were actually placed (between March 2010 and February 2013) by LRDE after delays ranging from nine months to 44 months (since June 2009) due to time taken in designing system hardware, technical evaluation, *etc.*

b) Only five out of 16 sub-systems ordered were received, tested and accepted within original PDC (May 2013) of the project and remaining 11 sub-systems were received with delays due to time taken in design finalization by LRDE, conducting Electro Magnetic Interference (EMI) / Electro Magnetic Compatibility (EMC) evaluation tests and Factory Acceptance Tests (FAT), *etc.*

c) As per minutes of sixth Empowered Steering Committee (April 2013), antenna cabin was sub-contracted (April 2010) to M/s Larsen & Toubro (L&T) Mumbai and same was received (April 2014) by LRDE after a delay of more than two years due to diversion of man power by L&T to another project 'Ashwini' of LRDE.

d) Against 16 TCA (as of June 2014) meetings as per sanction, only six were held despite instructions (August 2011) of DRDO HQ on strict adherence to project review meetings.

[27] Both the Committees *i.e.* ESC and TCA consist of representatives of DRDO, IAF, Production Agency namely BEL and between the two, ESC comprises of senior officials.

The PDC of LRDE project was extended latest in October 2014 (up to December 2014) to complete pending work such as main radar integration, testing and user trials.

In response to audit observation, LRDE stated (October 2014/ January 2015) that DBF and many of sub-systems were being developed for the first time, hence major unexpected problems were noticed which delayed the project schedule. In regard to monitoring meetings, it was stated that as progress of project was less in the initial stages, the frequency of TCA meetings was also less.

The fact remains that given the IAF requirement (November 2002), ORs (November 2004), Ministry's qualified (i.e catering for import of 15 MPRs to meet out the urgent requirement) approval (April 2006) for time bound indigenous development, the follow up and implementation of the indigenous project has not been in the spirit of a Mission Mode project and the MPR prototype was yet to be tested / trial evaluated by IAF (August 2015) by when ₹130.06 crore had been incurred on the project. The delays have affected the Air Defence (AD) plan.

3.1.8.11 Low Level Transporable Radar 'Ashwini'

Low Level Transportable Radars (LLTR) are intended to provide surveillance against low level intrusion of airspace up to a height of 30 meters in a range of 150 kms.

Air HQ projected (1997) a requirement of LLTR based on active aperture array technology and obtained (January 1998) 'in-principle' approval of MoD for acquisition of 37 LLTR. Air HQ efforts to import LLTR on four occasions (between March 1998 and February 2002) did not fructify due to DRDO HQ objection on extent of transfer of technology (ToT) from foreign vendor.

To meet immediate requirements of IAF, Defence Acquisition Council (DAC) accorded (October 2005) acceptance of necessity to import 19 LLTR under 'Buy & Make'[28] category with ToT and balance 18 LLTR under 'Make'[29]

[28] 'Buy and Make' means buying a portion of demand, obtaining ToT and production in India for remaining demand.

[29] 'Make'-developed by DRDO laboratories through indigenous efforts and manufactured by an Indian production agency.

category by LRDE.

In backdrop of Air HQ ORs (February 2006), DRDO HQ emphasized (September 2008) to MoD not to seek ToT from foreign vendors as technologies for LLTR were already available indigenously or under development and also confirmed that LLTR developed would be a Transmit/Receive (T/R)[30] module based active aperture phased array radar.

Based on LRDE's proposal (January 2009), the Ministry sanctioned (June 2009) the project ('Ashwini') at a cost of ₹73.95 crore with a PDC of 42 months (December 2012). The project was to be monitored by a two tier committee *viz.*, Empowered Steering Committee (ESC) on need basis and the Project Monitoring & Review Committee (PMRC) after every four months. As per LRDE, parallel indigenous development of LLTR was taken up to reduce dependency on imported LLTRs for future requirements.

The Ministry also concluded (July 2009) a contract with M/s Thales, France for procurement of 19 LLTR (six fully furnished, two semi-knocked down, two completely knocked down and nine indigenous manufacture based on ToT) at a cost of ₹1272 crore along with ToT at a cost of ₹575.20 crore with delivery schedule from October 2011 to March 2014.

LRDE engaged 13 partners **(Annexure-IX)** for development of LLTR. Out of 13 supply orders placed for various sub-systems, supplies were delayed in respect of four sub-systems (*i.e.* Mobile platform, antenna, Operational shelter & power supply systems) due to delays by LRDE in finalisation of critical design parameters / import of critical sub-systems and also in despatching IFF[31] antenna to the firm for integration with 'Ashwini' antenna array and delays by development partners contributing to overall delay in the project as described in **Annexure IX**.

[30] It transmits and receives signals.

[31] Identification of Friend or Foe (IFF) is a secondary radar. Antenna was realised by M/s AMPL Hyderabad and Input Device from M/s Thales, France.

Audit observed (September 2014) that despite LRDE claim about availability of requisite technology, the development of LLTR could not be completed within original PDC (December 2012). Further, against required 11 PMRC meetings as per sanction, six meetings were held (up to August 2014).

In response to audit observations, LRDE stated (October 2014 / January 2015) that development of LLTR with DBF feature was taken up for the first time indigenously. Further, delay in development had been due to unexpected problems at different stages of project and erroneous estimation of completion date. Also shortfall in project monitoring was due to less incremental progress achieved at the beginning of the project.

Audit noticed (May 2015) from the Brief for Executive Board (EB) meeting on Project 'Ashwini' of May 2015 that the assembly engineering and integration of the main antenna cabin had not progressed and complete calibration / evaluation of the main antenna array / user trials was yet to be completed. Though most of the sub-systems were realised by LRDE, these sub-systems were yet to be tested in an integrated environment. An amount of ₹63.72 crore had been incurred (March 2015) on the project 'Ashwini' and its PDC extended (October 2014) up to April 2015. No further extension for the project had been accorded so far (May 2015).

In response to draft report (April 2015), the DRDO HQ stated (June 2015) that realising an integrated active array with T/R module and DBF was attempted by LRDE for the first time, which took considerable time to understand, simulate and analyse the concepts, algorithms and finalise the architecture.

The fact remains that in spite of confidence of DRDO to produce LLTRs indigenously, the first field worthy indigenous LLTR was yet (August 2015) to fructify as DBF and many sub-systems were developed by LRDE for the first time although the project was sanctioned as Mission Mode. Also, prolonged consideration of DRDO reservations on ToT through import delayed the placement of import order (July 2009) *vis-à-vis* the IAF projected requirement (1997). Consequently, only two (out of 19) imported LLTRs had been received (March 2015) from M/s Thales, France by IAF. Thus the delay

in development of indigenous LLTR has adversely affected[32] the IAF plans for Air Defence (AD).

3.1.8.12 Primary Radar for AEW&C system

An airborne early warning and control (AEW&C) system[33] is an airborne radar system designed to detect aircraft, ships and vehicles at long ranges and perform command and control of the battlespace. When used at altitude, the radar on the aircraft allows the operators to detect and track targets much farther away than a similar ground based radar.

Development of AEW&C system was sanctioned (October 2004) to CABS under MM category. Primary Radar (PR) is one of the major sub systems of AEW&C which was entrusted (December 2004) by CABS to LRDE, at a cost of ₹550 crore, with a time frame up to April 2011 (*i.e.*, in line with overall PDC of AEW&C System).

Primary Radar consists of three major sub-systems *viz.* Active Aperture Array Unit (AAAU), Central Unit (CU) and Radar Processing Unit (RPU). Since, LRDE planned to use the AAAU developed under L-STAR[34] (a TD project) which was found not suitable because of its excess weight for elevation scan as required for the AEW&C System. Hence, Expert Committee recommended (October 2007) the usage of slotted array antenna developed by CABS for AEW&C system. Hence, the project cost sanctioned to LRDE was revised by CABS (June 2009) to ₹97 crore (for CU and RPU).

Three primary radars [jointly developed (December 2013) by CABS and LRDE] were integrated in System Testing and Integration Rig (STIR) at CABS and performance validated for fighter and commercial aircraft (February 2014). The mounting of Primary radar on Embraer aircraft[35] was also completed.

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[32] As against Govt authorised 75 LLTRs, IAF held (July 2005) 38 technologically obsolescent LLTR.

[33] Sanctioned cost of AEW&C was ₹1800 crore with a PDC of April 2011. The cost of the project was revised twice up to ₹2275 crore. PDC was also revised twice up to December 2015.

[34] L-STAR project was carried out to demonstrate active phased array technology.

[35] Embraer aircraft is platform for AEW&C system.

Further, PDC for all the tasks of PR including Final Operational Clearance (FOC) which were expected to be completed by April 2011 had been extended from time to time with latest extension up to December 2015. LRDE had incurred an expenditure of ₹66.90 crore (March 2015) towards development of CU and RPU.

Audit observed (March 2015) that PDC extensions for sub-project of PR were not sought by LRDE, but were given by CABS to synchronise with overall development of AEW&C system and the flight trials of PR was under progress.

LRDE stated (March 2015) that flight trials of the primary radar were going on and the phase-I of Initial Operational Clearance (IOC) of the PR was expected to commence in May 2015. However, LRDE subsequently stated (July 2015) that there was no plan to conduct IOC and FOC for PR and Acceptance Test Procedure (ATP) was planned to commence and complete in November 2015.

Thus, acceptance of primary radar jointly developed by LRDE and CABS has been delayed as ATP of PR is expected to be completed in November 2015.

3.1.8.13 Dual Colour Missile Approach Warning System (DC MAWS)

Missile Approach Warning System (MAWS) is essential for all airborne platforms to warn pilot of missile attacks. Defence Acquisition Council (DAC) accorded (September 2004) clearance for installation of MAWS[36] in 100 aircraft. Hence, DARE, Bengaluru proposed (January 2005) to Air HQ a project to design and development of Dual Colour (DC) MAWS, jointly with Israel Ministry of Defence (MoD) and M/s Elisra, Israel. Air HQ accepted (July 2006) the proposal, agreed (March 2008) to install DC Infra-Red (IR)

[36] MAWS- Dual Colour IR MAWS, the IR wave length band is divided into two bands, one for noise and one for missile plume. Ratio of signals in both the bands is taken, thereby achieving less false alarm rate over single colour IR MAWS. Further, UV based MAWS is used for slow moving platforms such as transport aircraft and helicopter, whereas IR DC MAWS is suitable for fighter aircraft.

MAWS on Su-30 MKI aircraft and projected an initial requirement of 50 DC MAWS system.

Ministry of Defence (MoD) accorded (November 2008) sanction for development and integration of Dual Colour IR MAWS on Su-30 MKI aircraft by DARE at a total cost of ₹193 crore (including FE of ₹172 crore), with a PDC of 55 months (June 2013) under MM category.

DARE signed (December 2008) a tripartite contract with Israel MoD and M/s Elisra, Israel at a cost of 37 MUSD (₹148 crore) for joint development[37] of DC MAW system[38] with a PDC of 48 months (December 2012). The scope of contract *inter-alia* included delivery of six Infra-Red (IR) sensors. M/s Hindustan Aeronautics Limited (HAL)[39] was selected by IAF / DARE as agency for modification of Su-30 MKI aircraft for integration of IR sensors on the aircraft.

DARE found the model version of IR sensors submitted by M/s Elisra to be heavier and bigger in dimension (24 cm in height and 4 kg in weight) and hence, informed (May 2009) M/s Elisra that the system might not be accepted for fitment on aircraft as it would cause serious restriction on flight envelope[40]. Air HQ also expressed (March 2010) the same view. However, vendor expressed (June 2010) its inability to make any significant weight reduction.

Installation of six IR sensors on Su-30 MKI aircraft was not cleared (December 2012) by an Expert Committee(EC)[41] at locations specified by DARE as it would involve cutting internal structure of aircraft, thermal

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37 Ms Elisra will develop IR sensors and DARE would develop hardware for sensors.

38 DC MAWS consists of three LRUs *viz.*, IR sensor, Central Processor Unit and an Air Borne recording system.

39 The licensed manufacturing and repair agency of Su-30MKI aircraft.

40 Flight Envelope of an aircraft refers to the capabilities in terms of airspeed and load factor. Broadly it is range of combinations of speed, altitude, angle of attack, *etc.*, within which an aircraft is aerodynamically stable.

41 The Expert Committee on Aerodynamics consists of members from CEMILAC, ADE, ADA and RCMA (Nasik).

masking[42] and aircraft plume (trail), *etc*. Subsequently, the EC cleared (January 2013) aircraft with only four sensors upto 15 *degrees* (as against the Su-30 MKI aircraft capability of 90 *degrees)* angle of attack (AoA)[43].

DARE approached (February 2013) the Original Equipment Manufacturer (OEM)[44] of Su-30 MKI aircraft for expert review and clearance of the proposal for aircraft modification to integrate DC MAWS sensors on aircraft. The OEM clarified (May 2013) that on integration of DC MAWS sensors, performance of aircraft would worsen significantly.

The project cost enhanced (December 2011) by the Ministry to ₹228.80 crore due to exchange rate variation (ERV), was again enhanced (July 2013) to ₹273.80 crore (*i.e.*by ₹50 crore). The Ministry also extended (July 2013) PDC of the project by 24 months (up to June 2015).

Audit observed (October 2014) that though increase in weight of IR sensors was a cause of concern to Air HQ as well as DARE, IR sensors were accepted with its present weight and with this, possibility of adverse effect on flight envelop of Su-30 MKI aircraft remained.

In response to audit observation regarding delay in development of DC MAWS and its operational impact, DARE agreed (January 2015) that MAWS capability of Su-30 MKI aircraft would be limited in its absence. It further added that DC MAWS requirement on Su-30 MKI aircraft was not envisaged by IAF and hence executed it as a TD project instead of MM project and the project was wrongly categorized as MM.

Subsequently, DARE relocated installation of IR sensors on the aircraft to the satisfaction of Air HQ and expert committee, who concurred (February 2015) the installation of all the six sensors. M/s Elisra, Israel delivered (March/April 2015) all the six IR sensors only after the completion of factory acceptance test (FAT). The flight evaluation of DC MAWS was also carried out (March - April 2015) on a test bed (Cheyenne - a transport aircraft) available with M/s Elisra. An amount of ₹194.16 crore had been incurred on the project (March 2015).

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[42] The heat emitted by aircraft plume and release of missiles will mask the IR sensors which in turn increases the thermal capacity of the sensors beyond saturated point thereby affecting its performance.

[43] The angle of attack is the angle between the wind and the nose of the aircraft during its flight.

[44] M/s Rosoboronexport, Russia.

Air HQ stated (April 2015) that flight trials of DC MAWS on Su-30MKI aircraft were expected to commence in December 2015.

Audit also observed (June 2015) that in order to meet the latest PDC (June 2015) of the project, DARE, after development and testing of the system on test bed of transport aircraft available with M/s Elisra and not Su-30 MKI aircraft, closed the project claiming it successful. In order to prove the developed DC MAWS system on Su-30 MKI aircraft, DARE had proposed (June 2015) to take up a separate project.

DARE further stated (June 2015) that the delay in development was due to time taken (from February 2012 to February 2015) by Air HQ to assess the impact on aerodynamics of the Su-30 MKI aircraft on fitment of sensors.

In response to Draft Report (April 2015), the DRDO HQ reiterated (June 2015) the views of DARE that DC MAWS project was taken up as a TD project and suggested to exclude the project from draft report.

The replies may be seen in light of the fact that Air HQ had clearly projected (March 2008) the requirement of DC MAWS for Su-30 MKI aircraft and accordingly, the project was sanctioned under MM category**.** Also neither DRDO HQ nor DARE took any initiative during development to obtain an amendment to sanction from MM to TD project. Further, flight evaluation of developed DC MAWS was carried out on test bed of Cheyenne transport aircraft and as such, the success or otherwise of DC MAWS with oversized sensors, would be known only after flight evaluation on modified Su-30MKI aircraft, for which a separate sanction was awaited. Till then, Su-30 MKI aircraft fleet would have to operate without missile approach warning capability.

3.1.8.14 Electronic Warfare Suite (D-29 system) for modified MiG-29 aircraft

Electronic warfare (EW) consisting of electronic attack (EA), electronic protection (EP) and electronic warfare support has become an important component of modern warfare.

Based on Air HQ ORs (October 2006) for an EW suite[45] for fitment on MiG 29 upgrade[46] aircraft, DARE, Bengaluru proposed (October 2007) joint development of a state-of-art EW suite (D-29 system[47]) with M/s Elisra, Israel.

MoD sanctioned (March 2010) the project to DARE under Mission Mode for design and development of D-29 system at a cost of ₹168.85 crore (FE ₹157.55 crore) with a PDC of 33 months (December 2012). Accordingly, DARE signed (April 2010) a tripartite agreement with the Ministry of Defence, Israel and M/s Elisra at a cost of 26 MUSD (₹115.57 crore @ 1USD= ₹44.45) with a PDC of 28 months (August 2012).

Meanwhile, based on Ministry's sanction (March 2009), DARE concluded (March 2009) a contract with OEM (M/s RAC MiG) of MiG-29 aircraft for structural modification of six MiG-29 aircraft (which were already positioned with the OEM for up-gradation) for fitment of the proposed D-29 system at a total cost of 14.25 MUSD (₹74.10 crore) with a PDC of 20 months (November 2010).

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45 IAF projected requirement for EW suite as MiG-29 aircraft fitted with Tarang 1 B RWR did not have self protection jammer.

46 Air HQ concluded (March 2008) a contract with OEM (M/s RAC MiG) for up-gradation and life extension of 63 MiG-29 aircraft. The contract was to be carried out in two stages *i.e.*, (a) Design and Development (D&D) in two years (2008-2010) on six aircraft in Russia and (b) Series upgrade of remaining 57 aircraft in India (2010-2014).

47 D-29 system consist of Unified Receiver Exciter Processor (UREP) which encompass Radar Warning Receiver (RWR), Electronic Support measure (ESM) and Electronic Counter measure (ECM) along with Special Protection Jammer 'SPJ'(Transceiver) of M/s Elettronica, Italy.

Scrutiny (October 2014) of the documents revealed that:

a) During structural modification, OEM encountered issues related to positioning and installation of Line Replaceable Units (LRU)[48] of D-29 system for which DARE suggested (June 2011) certain additional modification on the six MiG-29 aircraft. However, three aircraft after upgradation were delivered (December 2012) to IAF by the OEM without additional modification to facilitate training of pilots on the upgraded aircraft.

b) The D-29 system was developed by DARE in March 2013 but it could not be evaluated on the three aircraft received in India without the additional modification, which was necessary to carry out testing of the system.

c) The remaining three aircraft, after upgradation and structural modification (including additional modification) for fitment of D-29 system were received in India only in December 2013 due to delay in upgradation by the OEM.

d) The evaluation of D-29 system was further held up (October 2014) as IAF used the upgraded aircraft for testing various systems that were fitted by the OEM for upgrading the aircraft.

Thus, there was lack of synchronisation of upgradation with structural modification (including additional modification) of MiG-29 aircraft and development of D-29 system for the aircraft.

In response to an audit query (October 2014) regarding absence of EW suite (D-29) on operational capability of MiG- 29 aircraft, Air HQ stated (October 2014) that absence of EW system in upgraded MiG-29 aircraft was an operational limitation.

In response to audit observation (December 2014) regarding non-synchronisation of the activities and consequent delay in proving the

[48] The LRUs are RWR, ECM , SPJ

D-29 system on MiG-29 aircraft, DARE stated (January 2015) that delay in completion of up-gradation of aircraft was beyond the control of laboratory and testing of the developed D-29 system was delayed for want of aircraft. For operational limitation, DARE stated that 'Tarang' 1B RWR[49] would be used in absence of D-29 system.

Reply may be seen in light of the fact that 'Tarang' 1B RWR was without a Special Protection Jammer (SPJ), because of which, IAF projected the requirement for D-29 system. Therefore, 'Tarang' IB RWR cannot be treated as a substitute for an effective EW system.

Audit noticed (April 2015) that DARE had spent ₹199.82crore[50] (March 2015) on development of D-29 system and structural modification of MiG-29 aircraft.

In response to draft report (April 2015), the DRDO HQ while reiterating the views expressed by DARE, stated (June 2015) that additional modifications were initiated at the behest of IAF for easy operation/ maintenance. DRDO HQ agreed with Audit that synchronization of activities is to be ensured in cases where more than one agency was involved.

Thus, evaluation of the D-29 system on MiG-29 aircraft developed by DARE under Mission Mode has been pending since March 2013. Further, though Air HQ admitted (October 2014) that the absence of an EW suite was an operational limitation in MiG-29 aircraft, delay by IAF/DARE in evaluating the D-29 system only reduces its utilization as the upgraded MiG-29 aircraft has a Total Technical Life of 20 years only.

3.1.8.15 ESM and SPS for AEW&C system

Electronic Support Measure[51] (ESM) and Special Protection Suite (SPS)[52] are two major sub-systems of AEW&C system being developed by CABS as

[49] DARE developed Tarang RWR in late 90s and its improved version Tarang 1B RWR (without a SPJ) was developed by DARE in 2002 and ToT to BEL (in November 2004).Tarang 1B will be fitted during the series upgrade of MiG-29 aircraft in India and will be replaced by D-29 system after its development and manufactured by BEL.

[50] ₹138 crore towards development + ₹62 crore towards structural modification.

[51] ESM includes Radar Warning Receiver (RWR).

[52] SPS includes Communication Measure System (CSM) , Ultra Violet (UV) Missile Approach Warning System (MAWS) and Counter Measure Dispenser System (CMDS)

mentioned in *paragraph 3.1.8.12*. The Electronic Support Measure (ESM) is intended to aid in identification / classification, based on the various emissions from the targets, whereas, SPS is a self-defence suite comprising of Radar Warning Receiver (RWR) [53], Missile Approach Warning System (MAWS)[54] and Counter Measure Dispensing system[55] (CMDS).

DARE proposed (February 2005) to build one laboratory prototype followed by one engineering prototype and two flight worthy systems of Integrated RWR-ESM-SPS System (IRESS) with indigenous content of 30 *per cent* and 70 *per cent* during development and production phases respectively. CABS sanctioned (May 2005) two separate sub-projects for development of three sets each of ESM and SPS at a cost of ₹75.00 crore and ₹18.00 crore respectively with a time frame up to April 2011 (in line with overall PDC of AEW&C system).

DARE placed 15 (ten foreign and five Indian vendors) supply orders between March 2006 and June 2012 with different vendors. Delays in receipt / acceptance of some of these stores which affected overall project are given in **Annexure-X**. Main delay was in receipt of an important part of ESM/RWR system *viz.*, Multiple Channel Radio Frequency Signal Processor (MRDSP) from M/s Elta, Israel which was delivered with ToT, after a delay of 34 months (August 2011) from the original PDC (October 2008) [56] due to delay in conduct of Preliminary Design review (PDR) as well as Critical Design Review (CDR) by DARE.

Audit observed that:

a) Even after lapse of nine years, the flight trials of ESM and ground trials of SPS were in progress.

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[53] Radar Warning Receiver-it receives signals emitted from enemy radars and warns the pilot.

[54] MAWS is a Passive System operating in UV region. It is designed to detect potential missile threats in initial launch phases to provide maximum warning time.

[55] When the aircraft sensors detect a threat, the CMDS automatically launches radiofrequency and infrared countermeasures at the optimum time to defeat incoming missiles.

[56] PDC was extended twice-October 2010 and August 2011

b) As per CEMILAC (certifying agency), minimum essential standard[57] to assess the flight safety of the equipment during developmental phase and final deliverable of SPS were level-C[58] and level-B respectively, whereas, DARE had developed SPS, only up to Level-D (August 2014), citing paucity of time thus compromising flight safety.

c) CABS extended the PDC of the sub-project thrice[59] in line with extensions of the main AEW&C programme, without DARE request.

d) Out of sanctioned amount of ₹76.36 crore towards FE, DARE had incurred (March 2015) an amount of ₹72.61 crore (*i.e.*, 77 *per cent)* towards FE), which indicated high import content in the development However, except in MRDSP, no ToT was obtained as stated in the project proposal.

In response to audit observation, DARE stated (July 2015) that ground trials of SPS were completed and flight trials of ESM were expected to be completed in September 2015. Further, ToT was planned only for MRDSP as competence existed with several vendors for all other LRUs. Also, DARE attributed the high import content to inclusion of only bought out items in cost and cost did not include the software developed in-house and manpower of the laboratory.

DARE reply may be viewed in light of the fact that import component in development of ESM and SPS was 77 *per cent* as against the sanctioned 70 *per cent.* Further, ESM and SPS were yet to be proved (June 2015) despite lapse of more than nine years from its sanction.

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[57] DO-178B guidelines.

[58] Five levels of flight safety criticality standard of the airborne item prescribed by CEMILAC (Level-A is catastrophic failure condition, Level-B is hazardous / severe failure, Level –C is major failure, Level-D is minor failure and Level-E is no effect).

[59] April 2014, October 2014 and the latest December 2015

3.1.9 Conclusion

DRDO takes up Mission Mode projects as per user (Services) requirement at short notice and these normally depend on technologies that are already available, proven and readily accessible.

Audit examination of 14 Mission Mode projects carried out by DRDO Laboratories revealed that all the projects failed their timelines and their PDC were extended many times. In five projects there was cost overrun as well.

Further, although Operational Requirements/Qualitative Requirements/Broad Technical Requirements of IAF existed in all projects, the requirements of IAF were met to their satisfaction only in one completed project *viz.,* project 'Rohini'. In the same project the technology was also transferred leading to its productionisation by BEL and final induction into IAF. The systems developed in other closed projects were yet to be accepted by IAF.

The delays could partly be explained by inadequate monitoring by different committees and partly by change of requirements by IAF (three projects). Lack of harmonisation (where multiple agencies were involved) was also noticed in two projects.

The projects were therefore not carried out in spirit of Mission Mode which adversely affected Air Defence plans of IAF.

3.1.10 Recommendations

Recommendations after audit analysis are as under:

I. Mission Mode project should be considered complete and successful only after it meets user requirements.

(Paragraph 3.1.8.5 and 3.1.8.9).

II. Any modification/ improvisation should be at prototype stage. Modifications at production stage should be avoided.

(*Paragraph 3.1.8.6)*

III. In cases of projects involving multiple agencies for development of a product, effective synchronisation between their activities is necessary to avoid slippages.

(Paragraph 3.1.8.7)

IV. User requirements should be well defined before commencement of the Mission Mode project.

(Paragraph 3.1.8.8)

V. In cases of projects involving multiple agencies for development of a product, effective harmonisation between their activities is necessary to avoid slippages.

(Paragraph 3.1.8.14)

CHAPTER IV: HINDUSTAN AERONAUTICS LIMITED

Audited Entity Profile

Defence Public Sector Undertakings (DPSUs) function under the administrative control of Department of Defence Production. There are nine DPSUs which are headed by respective Chairman cum Managing Director. Hindustan Aeronautics Limited (HAL) is a fully owned Government of India undertaking under the administrative control of Department of Defence Production, Ministry of Defence. HAL is currently involved in manufacture of Aircraft (trainers and fighters), Helicopters (utility and weaponised) their accessories and spares, repair and overhaul of the aircraft and helicopters, design and development of new product upgrades and manufacture of some of the important structures used in satellites. Indian Air Force is the major customer of HAL constituting more than 70 *per cent* of its turnover.

4.1 Estate Management in Hindustan Aeronautics Limited, Bengaluru

HAL had not formulated a Land Use Policy for management of its vast land resource spread over different locations. Acquisition of land already encroached upon and failure to clear the encroachments resulted in the land being not available to the Company. The Company also did not have the title for land valued ₹211.69 crore.

4.1.1 Introduction

Hindustan Aeronautics Limited (HAL), a Navratna company under the Ministry of Defence, is engaged in design, development, manufacture, upgrade, repair and overhaul of aircraft, helicopters, aero-engines, avionics

and navigation system equipment and marine & industrial gas turbine engines for both military and civil applications.

HAL had acquired 11275.34 acres of land from Government and private parties till 31 March 2014 (**Annexure XI**).

4.1.2 Audit Findings

Audit observed the following:

4.1.2.1 Maintenance of Land Records

(i) Land in Possession of HAL: A comparison of the land in possession of HAL as per 1985 Compendium with the Award Copies[1] and Record of Rights of Tenancy and Crops Certificate[2] (RTC) revealed discrepancies like land included in the Compendium was in names of private parties as per RTC, non inclusion of Survey numbers in the Compendium and variation in area of land as per Award and Disinvestment details.

Management stated (March 2015) that the details of total acquired land was shown in the Compendium whereas in RTC/Award copies, Kharab[3] land was shown separately along with the total land and hence, there was difference between Compendium and RTC/Award copies.

The reply is not acceptable as Audit observed that there were differences between the areas of land mentioned in the Award copies *vis-à-vis* that

1 Order passed by the competent authority acquiring the land and containing details of true area of the land, compensation to be allowed and apportionment of compensation among the persons believed to be interested in the land.

2 This is an important Revenue record as it contains all possible data relating to lands held by an individual or group of individuals such as area, assessment, water rate, classification of soil, number of trees, nature of possession of the land, whether acquired by registered or unregistered document by succession, partition, mortgage, liabilities, tenancy and details of crops grown, land utilization, area under mixed crops, *etc.*

3 Kharab land is one where cultivation is not possible and the land would be full of rocks and barren. The Kharab land will not be included alongwith cultivable land in sale deed and other records. Kharab land belongs to Government and at any time Govt has the power to take over the Kharab land for public cause.

included in the Compendium even after excluding kharab land. In respect of five villages wherein the area as per Award copies was 36 acres and 3 guntas including 32 guntas of kharab land, the same data as per Compendium was 104 acres and 20 guntas.

Audit further observed that:

- Absence of proper documentation for land held in possession of HAL resulted in dispute with M/s BEML, another DPSU[4]. HAL allowed BEML to use the Railway track on 9 acre and 29 guntas (between BEML and Byappanahalli), 5990 sq ft of land for Cycle Stand at a licence fee, 11500 sq ft of land for parking BEML buses and also allotted (June 2009) additional 1,100 sq ft for displaying Metro coach @ ₹17600 per month with 10 *per cent* escalation every year. BEML paid licence fee for these parts of land up to December 2009 and thereafter not only stopped payment but also claimed ownership of the land (April 2010) stating that these land were part of the indenture executed (1966) for transfer of 71.04 acres of land from HAL to BEML. Due to inability to establish ownership and resolve the issue, HAL could not recover rent of ₹8.71 crore (January 2010 to March 2015). HAL had not gone for any civil suit to decide the ownership and protect its interests.

- As could be seen from **Annexure – XI**, HAL was in possession of 2184.86 acres of land in Bengaluru Complex. However, HAL did not have the award copies in respect of 402 acres and 3836 guntas (220 survey numbers) with market value of ₹1499.53 crore as detailed in **Annexure XII**.

Management while accepting the audit observation replied (March 2015) that it was in possession of award copies in respect of 56 survey numbers and for the others it possessed the RTC copies.

[4] DPSU- Defence Public Sector Undertaking

The reply is not factual as audit analysis of 76 out of 220 survey numbers under possession of HAL revealed that HAL's name did not appear in the RTCs in 36 survey numbers covering 68 acres with market value of ₹211.69 crore (eight villages) **(Annexure XIII).**

- 76 survey numbers referred to above included 20 survey numbers owned by HAL in K G Thippasandra village as per the Compendium. Audit observed that HAL was not in possession of award copies in respect of 14[5] survey numbers and in 11[6] of the 14 survey numbers HAL's name was not appearing in the RTCs. Despite not possessing award copies and also RTC being not in the name of HAL, these survey numbers were included by HAL in the disinvestment data as the same was included in the Compendium.

Management replied (March 2015) that the RTC in respect of lands at KG Thippasandra village is in the name of HAL.

The reply is not factual in view of the position brought out above by Audit.

(ii) Title of Land at Nasik: HAL was in possession of 4620 acres and 13 guntas of land as on 31 March 2015 against which indenture[7] was done (June 1978) by MoD for only 4354 acres and 36 guntas. There was no indenture for balance 265 acres and 17 guntas (March 2015) though the land was in possession of HAL. Absence of proper title to the land would render it difficult for HAL to defend the land in case of any encroachment.

Management while accepting (March 2015) the lack of indenture for 265 acres and 17 guntas of land stated that the issue was being pursued with the

5 Survey numbers 59/1,60, 61, 62, 63, 64, 66, 67, 68/3, 69, 70/2,72/1,72/2 and 73.
6 Survey numbers 59/1, 60, 61, 62, 64, 66, 67, 69, 70/2,72/1 and 72/2
7 granting, conveying, transferring and assuring HAL all right, title and interest in and upon the said land

Government of Maharashtra. Management also stated that land holdings were demarcated and compound wall constructed.

The reply is not acceptable as HAL Nasik division had earlier replied (December 2014) that though the land was initially demarcated and compound wall constructed, the adjacent villagers had repeatedly broken the wall. As the land is prone to encroachment as evident from repeatedly breaking of compound wall, HAL needs to take necessary action for updating land records.

4.1.2.2 Land under Encroachment

It was seen that 63.51 acres of land of HAL was under encroachment (**Annexure-XI)**. Few cases are discussed below:

(i) Acquisition of land despite existence of slums: 11.96 acres of land at Belur, Marathahalli and Vibhuthpura in Bengaluru was encroached. The Compendium of 1985 had brought out that HAL had acquired 10 acres and 19 guntas (out of 11.96 acres) despite existence of slums. HAL identified alternate land to rehabilitate the slum dwellers of Belur **v**illage and also accorded approval (July 2010) for allotment of 3.55 acres of land to Karnataka Slum Clearance Board (KSCB) for shifting of slums subject to allocation of equal area of land to HAL at the chosen place. As MoD approval was not received, KSCB decided (March 2014) not to allot the alternate land chosen by HAL and return the allotment of land made by HAL to it for rehabilitation of the slum. As HAL could not evict the slums, land remained under encroachment (March 2015).

Similarly, HAL's efforts since 1980-81 to evict the encroachments of land measuring 4 acres and 34 guntas in survey number 40 and 41 of Marathahalli village situated around the HAL factory at Bengaluru, did not fructify. HAL approached the Revenue Department in August 2007 to relocate the slums. The slum dwellers obtained stay for interfering with their possession by HAL and the case was pending (March 2015).

Management concurred (March 2015) with the observation.

Thus, acquisition of land with encroachment resulted in non-availability of the land to HAL besides leading to problems associated with litigation/clearance.

(ii) Delay in utilisation of land prone to encroachment: HAL identified (May 1998) 29 acres and 33 guntas of land spread over 18 survey numbers in Bengaluru as highly prone to encroachment out of which 27 acres were situated in and around the factory. Board resolved (June 2000) to sell the land and sought the permission of Govt. of Karnataka (GoK) (July 2000) and MoD (August 2000). GoK permitted (September 2000) sale of land to Central and State Government organisations, no communication was received from MoD. Due to lack of approval/directions from MoD, the Board (September 2007) approved 'in principle' the construction of quarters on the said land. The decision was yet (June 2015) to be implemented by HAL management.

(iii) Encroachment in Koraput division: Out of 3121.15 acres of land held by the division, 50.21 acres were encroached by 82 families who were cultivating the land for over 25 years. Though HAL awarded (October 2003) the work of construction of boundary wall to protect the estates, the work could not be completed due to interference by local villagers, lack of clearance from National Highway Authorities, etc.

Audit noticed (December 2014) from records that HAL took up the matter of eviction of encroachments with the District administration in year 2010 and with the Government of Odisha in 2013 to facilitate relocating the encroachers to different locations. Further, HAL Board was appraised in September 2014 that the Government of Odisha would facilitate eviction provided HAL agrees to bear the expenditure for their relocation and livelihood. The cost of eviction and relocation was estimated at ₹4.94 crore.

Management stated (March 2015) that though legal action was not initiated by the Company, HAL was in constant touch with the District administration for

eviction of the encroachers and the State Government agreed to rehabilitate the encroached population.

Reply is not acceptable as besides not considering the legal action despite encountering problems in construction of boundary wall, HAL inordinately delayed (until 2010) taking up eviction of encroachments.

4.1.2.3 Lease and Sale of Land

Audit observed that 1,082.215 acres of land was leased to various agencies (**Annexure-XI)**. Deficiencies in lease of land are discussed as under:

(i) **Non execution of Lease deed**: Audit observed that HAL did not execute the lease deed in respect of 552.41[8] acres of land. Though the Board directed the management to execute the lease with approved terms and conditions to protect the interest of the Company and to get the lease deeds registered (October 2009), the divisions had not executed the lease agreements and registered the lease deeds.

Management stated (March 2015) that the Desk officer vide letter of June 1995 communicated the Ministry of Law's opinion that the ownership of HAL rests with the President of India and as such no lease agreements were entered into with Defence organisations. However, rent for the same was being collected by HAL. Management also stated that the lease agreement could not be executed as the execution of Conveyance/Gift deed of the said land was not executed in favour of HAL.

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Unit	Total acres leased	Lease deed not executed
Bengaluru Complex	149.081	141.0515
Nashik	890.92	400.25
Hyderabad	2.29	2.16
Koraput	4.944	4.944
Kanpur	34.75	4.00
	1081.985	552.4055

The reply is not acceptable as HAL had title over the land and hence, lease deeds were to be entered into to protect the Company's interests and avoid legal complications in future.

(ii) **Non-renewal of Lease agreements**: Out of eight[9] lease agreements due for renewal as on December 2014 in Nasik and Bengaluru Divisions, lease agreements in six[10] cases covering 13.87 acres of land were not renewed till December 2014.

Management replied (March 2015) that Lease deed in respect of MSETCL was completed and efforts were on for getting the remaining five lease deeds renewed.

Reply has to be viewed considering the fact that lease agreements in four out of five cases were pending for the last five years and land being a valuable asset, HAL should have renewed the lease agreements immediately to avoid legal complications in future.

(iii) **Non-execution of Sale Deed:** HAL sold 218.719 acres of land to various organisations during the period from 1972 to 2006. Though the land was sold in 13 cases referred in **Annexure XIV**, HAL did not get the sale deed executed.

Management stated (March 2015) that the Desk officer vide his letter of June 1995 conveyed the Ministry of Law’s opinion that the ownership of HAL rests with the President of India notionally and thus there was no sale of land which is under the ownership of the President.

Reply of the Management is not acceptable as the land belonged to HAL and thus, execution of sale deed was necessary to protect Company's interests in case of legal disputes.

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[9] NAL, Maharashtra State Police, Department of Post, M/s DTL, MSETCL, SBI, PNB and Mandir Samiti

[10] NAL, Maharashtra State Police, Department of Post, M/s DTL, MSETCL and Mandir Samiti

4.1.2.4 Non-inclusion of Escalation clause

Audit observed that HAL leased land for period ranging from five to 30 years and renewed the same for similar period. However, the lease rent remained fixed throughout the lease period as the lease deeds did not have escalation clause to take care of the inflation.

Audit further observed (December 2014) that in case of lease of land to a Joint Venture Company (HATSOFF) the rent was reduced at the behest (July 2008) of Registered Valuer citing closure of airport at HAL and consequent reduction in value of land in the area. Further, in leases with Indian Oil Corporation (IOC), Water Supply and Sewerage Board and three JVCs[11], HAL reduced/deferred the lease rentals at the request of the lessee without justification.

Management stated (March 2015) that the rent of JVCs was fixed on prevailing market rates as suggested by the Government approved valuer. Some of these JVCs requested for negotiated rents as their business module had encountered financial difficulties which were approved by the Board.

The fact remains that JVCs and IOC are commercial entities and HAL did not protect its interests while fixing the lease rentals for these organisations.

4.1.2.5 Absence of land manual

HAL issued three circulars/guidelines in March 1987 (Lease), April 1996 (Lease/Sale), and December 1998 (Amendment to Circular of March 1987) to deal with matters of sale/lease of land.

Audit observed that even though HAL has been acquiring land since 1942, it had not framed a comprehensive land manual covering long term development plans both for functional and non-functional needs vis-à-vis adequacy of the

[11] HATSOFF; International Aerospace Manufacturing Private Limited; HAL-Edgewood Technologies Private Limited and BAeHAL Software Private Limited.

existing facilities and suitability of vacant land available with it in the context of development of civilian infrastructure surrounding it.

HAL replied (March 2015) that preparation of land manual was not envisaged as the same was not mandated as per statute and comprehensive guidelines were already available.

The reply is not acceptable since guidelines are only need based and thus, are not a substitute for a comprehensive manual considering the vast extent of land available with HAL.

4.1.2.6 Non-digitisation of land records

HAL had preserved the land and estate records *i.e.*, approximately 3000 pages of Award copies and other notifications inside a fire proof cabin. Due to passage of time and wear and tear, these paper documents, maps, etc., were under threat of spoilage as only a few award copies were microfilmed.

Audit observed (December 2014) from the Compendium of 1985 that there were 40 years old records and files in the Estate Department, which were important and re-writing of the land registers was recommended. However, HAL was maintaining the records manually.

Management stated (March 2015) that the documents were preserved in fire proof almirah and digitisation of land records was in tendering stage.

The fact remains that even after 30 years of specific recommendation in the Compendium (1985), HAL had just initiated action for preservation of these important documents.

4.1.3 Conclusion

Comparison of land holdings as per the Compendium of land holdings prepared by HAL in 1985, the award copies with HAL and the data prepared for disinvestment revealed several discrepancies. HAL acquired land which was already encroached and failed to clear the encroachments. The lease agreements had not been executed and registered. Similarly, the sale deeds had not been executed even though the land was sold. Lease rents were fixed at nominal rates even for JVCs and commercial organisations. HAL had not framed a comprehensive land manual covering long term development plans both for functional and non-functional needs. The Company continued to maintain the important records manually.

4.2 Investment in Joint Venture Companies by Hindustan Aeronautics Limited

Five JVCs formed by HAL failed to achieve the intended purpose for which they were formed. Against total investment of ₹225.14 crore in 11 JVCs, a provision for diminution in the value of investment amounting to ₹49.90 crore was made in respect of five JVCs. Subsequent to formation of a JVC, shareholding pattern was changed thereby the other JV partner gained majority control in the JVC indirectly which was against the approval of the MoD. HAL failed to protect its interest in a JVC by not ascertaining the cost of license which led to loss of ₹10.93 crore. Lease rent amounting to ₹5.12 crore was pending recovery from two JVCs.

4.2.1 Introduction

HAL, as part of its operational strategy and risk sharing, had formed 11 Joint Venture Companies (JVCs) in the field of information technology, software development, operation and maintenance of aviation products, manufacturing & trading, avionics & simulators, design and development to facilitate development of new technologies and products and services. Details in respect of the JVCs are given in **Annexure XV**.

4.2.2 Performance of JVCs

Three[12] JVCs were earning profits, one[13] JVC was yet to commence commercial production and the balance seven[14] JVCs had accumulated loss as on 31 March 2014. Against total investment of ₹225.14 crore in 11 JVCs, HAL has already made provision for diminution in the value of investment amounting to ₹49.90 crore made in five[15] JVCs in its annual accounts for the year 2013-14. Details about Paid up capital, HAL share, Accumulated Profit/Loss and Diminution provided are given in **Annexure XVI**.

Audit, besides covering the genesis of the JVCs also covered transactions of HAL with the 11 JVCs during the period 2009-10 to 2013-14 to ascertain whether the requirements were complied while forming the JVCs, objectives of JVCs were achieved, HAL protected its interest while dealing with JVCs and proper mechanism existed to monitor and ensure compliance with shareholders agreement and other regulations.

Audit findings are discussed below:

4.2.2.1 Compliance to requirements for Formation of JVCs

(a) Failure to avail professional services in selection of JV partner and formation of JVCs

DPE guidelines (July 1997)/January 2000) stipulated that the proposals for entering into technology joint ventures must be presented to the Board of Directors in writing and reasonably well in advance with an analysis of relevant factors and quantification of the anticipated results and benefits. It further stipulated that risk factors, if any, must be clearly brought out and that all the proposals, where they pertain to capital expenditure, investment or other matters involving substantial financial or managerial commitments

[12] BAeHAL, Snecma and IRAL
[13] MTAL
[14] SAMTEL, HALBIT, HETL, Infotech, Hatsoff, Tata HAL and IAMPL
[15] HALBIT, HETL, Infotech, Hatsoff and Tata HAL

should be prepared by or with the assistance of professionals and experts and should be appraised by financial institutions or reputed professional organisations with expertise in the areas. The financial appraisal should also preferably be backed by an involvement of the appraising institutions through loans or equity participation. HAL formed nine JVCs subsequent to the said guidelines. Audit observed that HAL had not availed the services of any professional organisation with expertise in the respective areas.

HAL stated (March 2015) that the proposals were duly reviewed by in-house experts in the relevant field and finalized with due Board approval.

The fact remains that non-availing of the services of any external professional experts before entering into the JV agreements as stipulated in the DPE guidelines reflected on the performance of seven JVs which had accumulated losses and provision for diminution was made in five JVCs as discussed above.

(b) Non-compliance with provisions of Companies Act, 1956.

Section 297 of the Companies Act, 1956 stipulates that a company shall not enter into a contract with a private company for sale, purchase or supply of materials in which one of the directors of the company is a director. Further, in the case of company having a paid up capital of not less than ₹1 crore, previous approval of Central Government is also required for such transaction. However, it was observed that approval of HAL Board and Government of India was not obtained prior to entering into the contract in March 2008 for sale/service in respect of two JVCs viz., HETL and Hatsoff though one of the directors of HAL was also the director in the JVCs at that time. Audit observed that

- HAL obtained post facto approval of the Board for the contract entered into with HETL after 18 months in July 2009 and that of Government of India in September 2009.

- In respect of contract with Hatsoff, HAL Board was informed only in March 2012 *i.e.* after 4 years.

HAL stated (March 2015) that as regards Hatsoff, the Business plan inter alia, contained provision to source Cockpit from HAL and also for entering into supply agreement with Helicopter Division, there was no requirement to obtain approval of the Board again under Section 297 of the Companies Act, 1956. However, the Board was appraised (March 2012) of the above transaction.

The reply is not acceptable as paid up capital of HAL was more than ₹1 crore and prior approval of Central Government was required for such transactions as stipulated in the Companies Act. Further, the Business Plan spelt out the strategy, was not final and hence, prior approval of the Board was required to be obtained before entering into contracts as per provisions of Companies Act. The reply was silent regarding HETL.

(c) Overall monitoring of the performance of the JVCs

One of the key features behind success of the joint venture and achievement of the objectives of the partners is monitoring the progress of the alliance on a regular basis. Inadequate monitoring might lead to loss of revenue / return on investment made in joint venture and non-achievement of intended benefits to the partners. DPE guidelines, *inter alia*, stipulated (October 1997) that the Public Sector Enterprise (PSE) will establish transparent and effective systems of internal monitoring including the establishment of an Audit committee of the board.

Audit review of the agenda and minutes of the HAL Board (2007-08 to 2013-14) and the Audit Committee revealed that certain significant issues pertaining to the JVCs were not brought to the notice of the Board / Audit Committee of HAL in their meetings as detailed below:

- The Audit Committee only reviewed the orders placed on single tender basis to the JVCs; it did not oversee/monitor any other activities relating to the JVCs.
- Board after considering the proposed business plan of Infotech HAL Limited (a JVC) suggested (February 2007) that in future, SWOT analysis of the proposed JV partner be conducted and put up along with such proposals. However no such analysis was put up to the Board in respect of six JVCs which were formed subsequent to the Board suggestion.
- Board suggested (April 2007) formation of working group to monitor the progress of JVCs and submission of half yearly report to HAL board by the working group for better monitoring. Audit observed that performance of the JVCs was not put up to the Board regularly.
- Corporate Office of HAL issued (August 2009) guideline for formation of nodal agency for compliance to the provisions of Companies Act in respect of disclosure on related parties, disclosure/approval for cases where director's interest was involved and any other statutory provisions. HAL was yet to set up (March 2015) the nodal agency.

HAL stated (March 2015) that analysis in terms of estimated benefits, business potential, etc., was carried out in respect of the JVCs for selection of partners. HAL had an Audit Committee which reviews the placement of orders on Single Tender basis and all related party transactions were put up to the Audit Committee based on the corporate guidelines. HAL also stated that performance of the JVCs was monitored on a monthly basis and report was put up to Management. It added that representatives of the JV partners monitor and exercise control over the JVCs.

The fact remains that the Audit Committee did not oversee/monitor any other activities relating to the JVCs as stipulated in the DPE guidelines. Reply regarding putting up the report to the Board was not factual as Audit observed that no such reports were placed before the Board regularly.

4.2.3 Status of achievement of intended objectives of the JVCs

Audit reviewed whether the objectives for which the JVCs were formed were achieved and it was observed five JVCs had not achieved the objectives for which they were formed. The individual cases are discussed below:

4.2.3.1 BAeHAL Software Limited

The JVC was formed (February 1993) in association with British Aerospace Public Limited Company, U.K (BAe) (49 *per cent*) and HAL (40 *per cent*). The balance 11 *per cent* is presently (August 2015) held by BAeHAL Employees Welfare Trust.

Non-compliance with EOU status

This JVC was formed as a 100 *per cent* Export Oriented Unit (EOU) for development and marketing of computer software which was not related to the core business of HAL. While submitting the proposal for formation of JVC to MOD, HAL stated (1991) that there would be benefits through foreign exchange earnings as the JVC was 100 *per cent* EOU and the objective of JVC was to operate in the growing international market of high technology software. Audit observed that the export turnover which ranged between 90 *per cent* and 100 *per cent* of the total turnover up to 2003-04 decreased to less than 50 *per cent* of the total turnover from 2004-05. It was further observed that the domestic sales constituted 63 *per cent* of total sales. JVC's sales to HAL constituted 87 *per cent* of domestic sales during the period from 2004-05 to 2013-14. Therefore, HAL despite being a minor shareholder indirectly as brought out in para 4.2.7.1 was extending undue support to JVC. With low export turnover, JVC failed to achieve the objective of operating in growing international market.

HAL stated (February 2015) that as per rules, EOU Company can have permitted level of domestic sales and the JVC’s export satisfies the

requirement/obligation as per legal undertaking given to Software Technology Park of India.

The reply is not acceptable since Foreign Trade Policy 2004-09 and 2009-14 stipulate that the entire production of EOU, Electronics Hardware Technology Parks, Software Technology Parks and Bio-Technology Parks shall be exported subject to the condition that for goods and services, including software units, sale in DTA in any mode, including on line data communication, shall be permissible up to 50 *per cent* of the FOB value of exports and/or 50 *per cent* of foreign exchange earned, where payment of such services is received in foreign exchange (FE). However, this has not been fulfilled by the JVC since domestic sales constituted 63 *per cent* of total sales during the period from 2004-05 to 2013-14. Under the circumstances, the JVC has violated the above rule by making the sale in DTA beyond the permissible limit. Thus, even though HAL set up a JVC for operating in the area which was not related to the core business of HAL, the main objective of the JVC viz. drawing benefits through foreign exchange earnings was not achieved due to low export turnover of the JVC.

4.2.3.2 HAL Edgewood Technologies Pvt. Ltd. (HETL)

The JVC was formed (April 2007) with equity participation of HAL, M/s Edgewood Ventures, LLC (Limited Liability Company), California, USA (Edgewood) and M/s Edgewood Technologies Pvt. Ltd. (EdgeTech), Bengaluru in the ratio of 50:26:24 respectively for development and manufacture of 3D technology based products for airborne use. Audit observations regarding the JVC are as under:

(i) Non-achievement of intended objectives: Though the Board desired that the profile of Edgewood and EdgeTech (formed in November 2005 and April 2006 respectively) indicating their financial and technical capabilities as well as confirmation regarding approval of Government of France for transfer of technology to JVC be furnished, Audit observed that no financial and

technical details were furnished by the partners on the ground that revenues were not shown in its books of Edgewood as it was a limited liability company. Audit further observed from the HAL Board Note according approval for setting up of the JVC that 3D technology was patented by 3D Plus, France (an associate of the Edgewood) and the JVC would enter into an agreement with 3D Plus. As per the Annual Report of the JVC for the year ended 31 March 2014;

- the JVC entered (December 2007) into an agreement with 3D Plus for transfer of technology and paid TOT fee of ₹1.17 crore to 3D Plus and also incurred ₹0.55 crore towards Consultancy Fees on the Project.;

- as the agreement did not contain any time frame for setting up of the manufacturing facilities, the JVC entered (March 2011) into an amendment deed with 3D Plus agreeing to setup the manufacturing facilities not later than 31 December 2012 plus additional six months. However, the JVC did not set up the required manufacturing facilities within the date agreed to in the amendment deed;

- 3D Plus served (May 2013) a notice of termination of the Licence Agreement to the JVC and sought ceasing of use of all the confidential information of 3D plus received by the JVC;

Audit observed (December 2014) from the records that the JVC was in the process of discussion with 3D Plus for re-negotiation of the terms of licence.

Therefore, the main objective of formation of JVC viz. development and manufacture of 3D technology based products for airborne use was not achieved due to non-setting up of facilities by the JVC and consequent termination of the Licence Agreement by the partner.

HAL stated (March 2015) in reply that information on experience of the partnering companies was not available in records. HAL also stated that the

JVC was established to set up design facility for absorption of 3D technology but later shifted its focus on Open System Architecture Mission Computer (OSAMC) and in the present context, the relevance of the technology and market demand had to be assessed.

The reply confirms that the JVC was formed without verifying the technical and financial details of the JV partners and without assessing the relevance of the technology and market demand as stipulated in DPE guidelines.

(ii) Awarding of DARIN III Contract on Single tender basis: Audit observed from HAL's Board Note (September 2006) that Digital Map Generator (DMG) was a mandatory requirement for the present generation aircraft and the same was being imported. Considering the substantial requirement of indigenous DMG for all futuristic upgrade and new aircraft, HAL Board had approved (September 2006) proposal for Technology Development (TD) of Open System Architecture Mission Computer (OSAMC) with embedded DMG to be funded by HAL with financial outlay of ₹9.13 crore and to be completed within 18 months (i.e. by March 2008) from the date of sanction. HAL placed (March 2008) purchase order (PO) on the JVC on single tender basis for development of Hardware for OSAMC with embedded DMG at their quoted price ₹1.71 crore (excluding all taxes and duties). The scope of work included specifications finalisation, preliminary design review, engineering model delivery, hardware test delivery, and safety of flight unit delivery. As per the PO, the scheduled delivery of December 2008 was subsequently extended (February 2009) to December 2009. The JVC, however, had not delivered the product (March 2015).

Meanwhile, MoD entered (December 2009) into a contract with HAL for upgrading the Jaguar aircraft to Display Attack Ranging and Inertial Navigation Avionics (DARIN) - III[16] Standard of Preparation (SOP).

[16] DARIN III would be an operationally improved version of DARIN II with additional features like Multimode ELTA Radar, Glass Cockpit with Dual SMD and EFIS, Open System Architecture Mission Computer, Solid Stage Digital Video Recording Systems and additional functionalities relating to display and data handling.

According to the Contract, Final Operational Clearance (FOC) had to be achieved by June 2013. OSAMC was part of DARIN-III.

Even before the completion of Technology Development of OSAMC, HAL placed (July 2010) one more order on JVC on single tender basis for 11 numbers of Mission Computers for prototype development for DARIN III and full qualification testing and certification (QT&C) at ₹12.63 crore to be delivered by March 2012.

Due to non-availability of OSAMC hardware unit from the JVC, Mission and Combat System Research & Design Centre (MCSRDC) Division of HAL proposed (June 2013) for alternate development of six Mission Computers for DARIN III programme from Defence Avionics Research Establishment (DARE), DRDO at cost of ₹8.60 crore.

Audit observed (December 2014) that only three units were delivered by the JVC in October 2013.Development of prototype units was under progress at DARE (December 2014).

HAL replied (March 2015) that

- JVC partner Edgewood had developed many products through their companies in USA and entrustment of the project to JVC would be beneficial to HAL by way of technology and source codes besides flexible upgradations/changes to technology.
- JVC was chosen for this order as its President had good experience in design and development of avionics domain products and this would help immensely in the product development. It also stated that in view of the confidence generated by supply of OSAMC Engineering unit and the progress of Safety of Flights (SOF) testing, HAL released the second order on JVC after Board's approval.

- OSAMC development involved a highly intensive and complex technology, the technical issues arising during development were being resolved in a phased manner and alternate action was taken as a risk mitigation plan for development of OSAMC.

Reply is not acceptable as the JVC had not supplied (March 2015) the Hardware for OSAMC with embedded DMG. Audit observed that Quality Audit Report[17] had pointed out inadequate expertise to handle the project, lack of infrastructure for in house test facilities, non availability of approved automated test equipment and outsourcing of hardware design, fabrication and assembly, etc.,

The fact remains that due to non-assessing the infrastructure available and the technical limitations of the JVC before awarding the work, the FOC of DARIN-III project has not been achieved (March 2015) though the scheduled date was June 2013.

(iii) Outstanding dues from the JVC: An amount of ₹ 8.26 crore was due from the JVC on account of the following:

a) HAL Board approved (July 2009) allotment of 6780 sq. ft. of land to JVC located at HAL main factory premises at a lease rent of ₹ 2.31 lakh per month. The JVC defaulted in payment of lease rent from September 2008 onwards and by July 2014, the dues recoverable on account of lease rent from the JVC stood (March 2015) at ₹2.21 crore.

b) Audit further observed that an amount of ₹5.97 crore being the unadjusted advance granted to JVC between May 2008 and January 2014 for the OSAMC contract was still pending (March 2015).

[17] Undertaken in May 2012 by a team constituted (March 2012) by HAL and comprising of representatives from Centre for Military Airworthiness and Certification (CEMILAC), HAL, Directorate General of Aeronautical Quality Assurance (DGAQA), Bharat Electronics Limited (BEL) and DARE

c) HAL deputed engineers to HETL on payment basis since engineering resources of HETL was highly depleted. An amount of ₹82.14 lakh relating to salary of engineers deputed by HAL was also pending recovery from the JVC (March 2015).

HAL stated (March 2015) that though supplies were due, JVC could not supply as it was cash strapped and agreed with audit observation on the outstanding dues from the JVC.

The fact remains that HAL did not consider the technical and financial limitations of the JVC before awarding the contract of OSAMC. Due to non-adherence to the delivery schedule of OSAMC project by the JVC, the DARIN-III programme was affected and also HAL's funds were blocked.

4.2.4 HALBIT Avionics Private Limited (Halbit)

4.2.4.1 Supply of EFIS by JVC

The JVC was formed (May 2007) with equity participation of HAL (50 *per cent*), Elbit Systems Limited, Israel (26 *per cent*) and Merlinhawk Associates Private Limited, Bengaluru (24 *per cent*) for marketing, designing and integrating of airborne avionics products and systems. HAL placed (September 2011) order for three units of Engine and Flight Instrumentation System (EFIS) at a cost of ₹8.94 crore on the JVC[18] as part of Development phase to be supplied by October 2012. EFIS was required for DARIN-III programme. Audit observed from the records that the JVC supplied three units by November 2014 which had certain technical snags viz. poor performance of Air Data Attitude & Heading Reference System (ADAHRS) during dynamic conditions. Audit further observed from the Minutes of the Meeting of Jaguar DARIN-III Upgrade Programme held in June 2014 that it was decided that the

[18] On Single Tender Basis

alternative EFIS systems if any should be identified and integrated at the earliest.

HAL stated (March 2015) that ADAHRS was performing during rig testing but during aircraft flight testing results were out of tolerance. The flight trials were in progress for detailed performance evaluation. HAL further stated that though the progress was not good, solutions were emerging and hence the process of working with JVC was not discontinued.

The fact remains that placement of the order on JVC on single tender basis for a time-bound programme like DARIN-III upgrade without any previous experience with the JVC was not justified. Due to delay in supply of the units by the JVC, the FOC of DARIN-III project has not been achieved (March 2015) though the scheduled date was June 2013.

4.2.5 HATSOFF Helicopter Training Limited (Hatsoff)

The JVC was formed (January 2008) with equity participation of HAL (50 *per cent*) and M/s Canadian Aerospace Electronics Inc (CAE) (50 *per cent*) for providing and marketing military and civilian helicopter pilot flight training services. Audit observed the following:

4.2.5.1 Non-obtaining of commitment for usage of the facilities: As per the Business Plan, HAL was required to provide Land, Building with all related support infrastructure, structure and cockpits for three variants of DHRUV[19] (Army – IAF, Navy – Coast Guard and Civil Variants), While according 'in principle' approval (July 2006) to the proposal for the project ‘HATSOFF’ (Helicopter Academy to train by simulation of flying), HAL Board decided to take up with the Services (IAF, Army and Navy) and other operators for firm and long term commitments to use the simulator facility. Audit observed from the HAL Board Note (July 2007) that while the Indian Navy committed to use

[19] Advanced Light Helicopter

the facilities, no commitments were received from Indian Army and Air Force. The business plan of the JVC projected 18.97 *per cent* of the business from Navy and 60.85 *per cent* from Army and Air Force simulators. Though no commitment for usage of the facilities was received from Army and Air Force, HAL invested in the JVC. As the main income as per the JVC's business plan was from Army and Air Force simulators, HAL should have ensured the commitment of Indian Army and Air Force for utilisation of facilities before going ahead with the investment in the JVC. Audit also observed that the naval simulator was shelved (March 2012).

4.2.5.2 Extra expenditure due to non-ascertainment of cost of Licence: JVC entered into an agreement (September 2008) with HAL for supply of two fully populated cockpits of ALH and aircraft data licence at a total cost of USD million 7.27 (₹32.72 crore) which included ₹3.37 crore towards cost of acquiring rights and licence fee for Line Replaceable Units (LRUs) of Utility version and Weapon System Integrated (WSI) version of ALH. HAL had to procure the licences for the LRUs version as well as WSI version. Audit observed that HAL continued with the procurement of licences even though no commitments were received from Army and Air Force and the expenditure towards rights and licences was ₹14.30 crore after negotiation with M/s Israel Aerospace Industries, Israel (the vendor who was to provide the rights and licences for the utility version of ALH). Failure on the part of HAL in ascertaining the rates of licence before entering into an agreement with the JVC led to additional expenditure of ₹10.93 crore (₹14.30 crore – ₹3.37 crore) excluding cost of licence for WSI version which had not been ascertained.

HAL stated (March 2015) that the non-achievement of the projected business cannot be considered as a failure on HAL's part and HAL may extend support to the JVC. HAL further stated that it is not the responsibility of HAL to secure order for the JVC, Installation of Simulator was to be done by JVC and not by HAL. HAL further stated that it expected/considered that most of the suppliers involved would agree to give permission to use their LRUs at nominal cost and 28 out of 36 suppliers agreed to permit use of the LRUs and

consent was obtained from three out of the balance eight suppliers for the LRUs of utility version at a cost of ₹14.30 crore against the estimated funds of ₹3.37 crore. It also stated that for WSI version, the extent of additional expenditure towards resolving rights and licence fee issue was yet to be analysed (March 2015).

Reply confirms that HAL had not done due diligence before entering into an agreement with JVC. Thus, investment in JVC without obtaining firm commitment from the Defence Services and subsequent shelving of Navy simulator resulted in non achievement of the intended benefits by JVC besides additional expenditure of ₹10.93 crore to HAL due to acquisition of rights and licences for LRUs.

4.2.5.3 Undue Financial assistance: DPE guidelines specify that all the proposals, where they pertain to capital expenditure, investment or other matters involving substantial financial or managerial commitments should be prepared by or with the assistance of professional and experts. However, without seeking the assistance of external professionals and experts, HAL released (March 2012 and June 2014) two loans of ₹12.10 crore to the JVC due to its poor financial position. The loan of ₹5.60 crore and interest of ₹58.42 lakh (₹66.64 lakh less TDS) were converted to equity in March 2013 and July 2013 respectively. As the JVC was performing far below projections, HAL extended repeated financial assistance to the JVC.

HAL stated (March 2015) that DPE Guidelines of October 1997 talks about Capital Expenditure and Investments and providing loans of ₹6.50 crore does not fall under this category.

The reply is incorrect since the said DPE guidelines address all matters involving substantial financial or managerial commitments with respect to the JVCs. Extending financial assistance to the JVC was not in HAL's interests.

4.2.5.4 Outstanding dues from JVC: JVC had also not paid lease rent to HAL for the land leased to JVC amounting to ₹2.89 crore for the period from April 2011 to March 2015.

HAL replied (March 2015) that the JVC had not paid the lease rent due to financial crisis.

4.2.6 Indo Russian Aviation Limited (IRAL)

4.2.6.1 Over dependence on HAL

The JVC was formed (September 1994) with equity participation from HAL (48 *per cent*), ICICI (5 *per cent*) and three Russian[20] partners (47 *per cent*) for undertaking supply of aviation equipment, providing services for repair and overhaul and ensuring technical and engineering support for exploitation of the aviation equipment and other related activities in India and abroad except former Republics of USSR**.** Audit observed from the Quality Audit Report[21] (QAR) that the JVC engaged only in trading activities *i.e.* supply of accessories, aggregates and spares, etc., and HAL was the major customer contributing upto 95 *per cent* of the turnover of the JVC during the period 2007-13. Further, QAR also pointed out that the JVC did not have any access to technology for engaging in other objects as defined in the Memorandum of Association and efforts were mainly focused on increasing the JVC business through trading activities.

HAL stated (March 2015) that IRAL was supporting HAL in supply of spares and ROH of LRUs of Russian Origin especially where major suppliers like Rosoboronexport did not support HAL as volumes were low and HAL was deriving the benefit of the JVC in this way.

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[20] Federal State Unitary Enterprise, RAC MiG (31 *per cent*), Ryazan State Instrument Plant (10 *per cent*) and Aviazapchast (6 *per cent*)

[21] Carried out (December 2013) at the instance of HAL by a team comprising of representatives of HAL and DGAQA

Audit further observed that the total turnover of the JVC during the period from 2007-08 to 2013-14 was ₹360.59 crore of which domestic sales was ₹347.44 crore (96 *per cent*) and export sales was ₹13.15 crore (4 *per cent*). Further, out of domestic sales of ₹347.44 crore, sales to HAL was ₹343.88 crore (99 *per cent*). This confirms the fact that the JVC was functioning only as a trading company and also was over dependent on HAL.

4.2.7 Non-protection of HAL's interest

HAL had invested in the JVCs and had appointed nominees on the Board of JVCs to monitor their performance. However, change in the shareholders made HAL a minority shareholder indirectly in one JVC was not in HAL's interest as discussed below:

4.2.7.1 BAeHAL Software Limited

Prior to giving approval for formation of JVC, MoD had observed (February 1991) ab-initio that there was no direct benefit to HAL from the JVC either by way of capacity utilization or transfer of technology as export earnings would accrue only to the JVC. It further stated that it appears that British Aerospace Public Limited Company (BAe) are keen that it shall remain a private company so that it does not come under the purview of the Government/Parliament and major exports earning of the proposed JVC seems to be only from captive orders from British Aerospace and as such the benefits envisaged in formation of the JVC have to be viewed with caution. However, HAL assured (February 1991) that it would exercise adequate control over the policy decisions as a majority share holder (HAL 49 *per cent* and Indian Financial Institution 11 *per cent*) and would be subject to rules similar to HAL. 11 *per cent* share of Indian Financial Institution was held by UTI when the JVC was formed. The shares held by UTI were transferred (March 2002) to BAeHAL Employees Welfare Trust. BAeHAL Employees Welfare Trust had three trustees viz. one chairman (HAL nominee) and two directors (BAe nominees). Due to BAe having more number of trustees, the Trust was *de facto* controlled by BAe only. Consequently BAe was a major shareholder

indirectly in the JVC (by virtue of 40 *per cent* share in the JVC and *de facto* control through the Trust which had 11 *per cent* shareholding in the JVC). Thus, this was in violation to the assurance given to the Government.

HAL did not furnish any reply to the audit observation.

4.2.8 Conclusion

The JVC's were formed without availing the services of any professionals and experts. Five JVCs did not achieve the objectives for which they were formed. HAL failed to protect its interests while dealing with JVC's and also had no effective monitoring mechanism to oversee the operational performance despite being a major shareholder/equal shareholder in the JVCs.

4.3 Acceptance of contract for DARIN-III with fixed delivery schedule led to liquidated damages

Acceptance of a design and development contract with fixed delivery schedule without resorting to change orders provided for in the contract resulted in recovery of liquidated damages of ₹7.19 crore as of March 2014 by the customer.

MoD entered into (December 2009) a contract with M/s Hindustan Aeronautics Limited (HAL) for upgrading the Jaguar aircraft to Display Attack Ranging and Inertial Navigation Avionics System (DARIN) - III[22] Standard of Preparation (SOP) at a package price of ₹3113.02 crore as firm and fixed cost. The scope of the contract included trial modification and certification of three DARIN-I aircraft (a single seat, a maritime and a two seat

[22] DARIN III would be an operationally improved version of DARIN II with additional features like Multimode ELTA Radar, Glass Cockpit with Dual SMD and EFIS, Open System Architecture Mission Computer, Solid Stage Digital Video Recording Systems and additional functionalities relating to display and data handling.

Jaguar aircraft) up to Final Operational Clearance (FOC) standard at a cost of ₹411 crore and series modification of 58 Jaguar aircraft to FOC standard at a cost of ₹2702.02 crore. The contract stipulated levy of liquidated damages (LD) at 0.5 *per cent* of the value of delayed/undelivered stores/services for delay of every week or part thereof subject to a maximum of 5 *per cent*. The contractual timelines were:

Milestone	Details	Cumulative timeline
1	Project sanction (21 December 2009)	
2	Preliminary Design Review (PDR) was to be completed by 20.02.2010	2 months
3	Critical Design Review (CDR) to be completed by 20.09.2010	9 months
4	Commencement of the aircraft integration by 20.04.2011	16 months
5	First flight of prototype aircraft by 20.10.2012	22 months
6	Initial Operational Clearance (IOC) of Single Seat aircraft by 20.12.2012	36 months
7	Final Operational Clearance (FOC) by 20 .06.2013	42 months

Thus, according to the contractual commitment, FOC had to be achieved in 42 months of the project sanction which was June 2013.

The Contract stipulated that preliminary design review and critical design review would be achieved in co-ordination with IAF and thus it was inherent in the contract that there could be changes to the SOP and technical requirements. Clause 6 of the Contract clearly stated that though the specifications and statement of work are mentioned in the annexure to the Contract, HAL was to carry out the technical upgradation/alterations in design, drawings and specifications in consultation with the customer. It was also

provided that any major change in technical specifications and its time and cost implications would be only through prior written agreement of both the parties through a Change order. However, HAL did not resort to change orders though there was major change in technical specifications which impacted the time and cost.

Audit observed that even after 60 months (December 2014), HAL had achieved only the fifth milestone of first flight of one prototype (Maritime) aircraft which should have been achieved in 22 months (*i.e.* by October 2012). Audit also observed that though HAL had 16 months available for procurement of all the parts/components required for commencement of aircraft integration by April 2011, there were delays ranging from eight to 24 months in procurement process of Avionics Integration Rig (AIR) and three systems[23] which were to be fitted on to the aircraft. The delivery schedules prescribed for supply of the three systems by HAL itself were beyond April 2011. As the contract timelines were not adhered, IAF deducted (2012-13) ₹4.11 crore towards liquidated damages for delay in achievement of the fifth milestone and HAL, considering further delays, had provided for ₹3.08 crore towards liquidated damages.

Management stated (February 2014/December 2014) that there were changes in SOP and configuration of design architecture considering the futuristic programmes of IAF which led to delay in freezing of technical requirements and finalisation of new systems in coordination with IAF and procurement. It also stated that the contract amendment would be taken up when the design and configuration would be mature enough to estimate the impact properly.

The reply has to be viewed in the context that HAL had committed to a fixed delivery schedule being aware of the fact that there could be changes in SOP as well as delay in freezing of technical specifications by IAF which would impact the committed delivery schedule. Acceptance of a fixed delivery schedule without freezing of SOP and not working through change orders

[23] Telemetry, smart multi function display and engine flight instruments system.

resulted in liability of ₹7.19 crore towards liquidated damages as on March 2014 and has potential to cause further losses to HAL with the progress of the contract. This decision of HAL was against its financial interests.

New Delhi **(B.P.YADAV)**
Dated: 18 November 2015 **Principal Director of Audit**
Air Force

Countersigned

New Delhi **(SHASHI KANT SHARMA)**
Dated: 23 November 2015 **Comptroller and Auditor General of India**

ANNEXURE

Annexure-I

(As referred in Para 1.6.2)

A. List of Paras/Reports on which ATNs have not been received even for the first time from Ministry

Sl. No	IAF/HAL	Report No./Year	Para No.	Title of the Report/Para	Money Value ₹ in crore	Date of laying in the Parliament
1.	**IAF**	10 of 2013	Stand Alone Report	Acquisition of helicopters for VVIPs	3726.96	13-08-13
2.	**IAF**	4 of 2014	2.1	Unfruitful expenditure on development of a system	156	18-07-14
3.	**IAF**	4 of 2014	3.9	Loss due to less recovery of interest	0.95	18-07-14
4.	**IAF**	34 of 2014	3.7	Directorate of stores, Air Headquarters	829.67	19-12-14
5.	**IAF**	34 of 2014	3.8	Audit on aerospace safety in Indian Air Force	N A	19-12-14
6.	**HAL**	8 of 2012-13	7.2	Excess payment of Performance Related Pay	43.18	04-09-12
7.	**HAL**	13 of 2013	7.10	Irregular payment of incentives	25.98	08-08-13
8.	**HAL**	13 of 2014	7.1	Irregular encashment of casual leave	12.43	01-08.14
9.	**HAL**	35 of 2014	9.1	Licence production of 'C' aircraft	NA	19-12-14

B. List of Paras/Reports on which revised ATNs are awaited from Ministry

Sl. No	IAF/HAL	Report No/Year	Para No	Title of the Para/Report	Money value ₹ in crore	Date on which vetted comments have been issued
1.	**IAF**	16 of 2010-11	2.8	Financial irregularities in organizing Military World Games 2007	50	12-12-13
2.	**IAF**	17 of 2012-13	2.1	Management of Defence Offset	3410.49	28.08.15
3.	**IAF**	17 of 2012-13	3.1	Extra expenditure due to delay in conclusion of a contract	87.52	19-02-15
4.	**IAF**	4 of 2014	2.2	Delay in up gradation of an aircraft	272	09-04-15
5.	**IAF**	4 of 2014	2.3	Avoidable expenditure in procurement of Aero-engines	227	28-04-15
6.	**IAF**	4 of 2014	3.1	Avoidable expenditure on procurement of Test Equipment	11	17-04-15

7.	**IAF**	4 of 2014	3.4	Induction of Precision Approach Radar in Indian Air Force	2.23	08-05-15
8.	**IAF**	34 of 2014	2.3	Procurement of Air Combat Maneuvering Instrumentation (ACMI) system	167	21.05.15
9.	**IAF**	34 of 2014	3.1	Avoidable expenditure on repair of turbine blades	10.14	18-05-15
10.	**IAF**	34 of 2014	3.4	Unjustified procurement of a system	3.49	03-09-15
11.	**IAF**	34 of 2014	3.6	Avoidable loss due to injudicious decision on procurement of colour dyes	4.51	27-08-15
12.	**IAF**	34 of 2014	3.11	Avoidable expenditure on Maintenance of Simulators	0.92	08-05-15
13.	**HAL**	24 of 2009-10	6.3.1	Fraudulent payments on unauthorized incentive scheme	52.24	09-07-09
14.	**HAL**	9 of 2009-10	7.3.2	Avoidable loss due to non provision of full maintenance expenditure- HAL	5.26	05-08-10
15.	**HAL**	9 of 2009-10	7.3.3	Failure to enter into a formal contract with AHQ for MiG upgrade- HAL	3.81	05-08-10
16.	**HAL**	10 of 2010-11	Chapter III (Performance Audit)	Production and supply of Advanced Light Helicopter- HAL	NA	05-08-10
17.	**HAL**	3 of 2011-12	7.4	IT audit of implementation of Industrial Financial System with specific thrust of Material Management module	NA	25-08-11
18.	**HAL**	13 of 2013	7.7	1. Execution of Shakti Engine for ALH 2. Delay in development and production of Shakti engine for Advanced Light Helicopter	NA	08-08-13
19.	**HAL**	13 of 2013	7.8	Execution of Intermediate Jet Trainer Project	NA	08-08-13
20.	**HAL**	13 of 2013	7.9	Loss in sale of Advanced Light Helicopters	58.80	08-08-13

Annexure-IA

(As referred in Para 2.2.5, 2.2.9.3)

Operational works sanctioned prior to year 2010-11 but not completed (as of March 2014*)

Sl. No.	Name of unit	Nomenclature of work services	Year of Sanction	Cost of work (₹ in Lakh)	PDC (Original)	Physical progress (March 2015)	Remarks
1	'W-10' Wing	Provision of security wall 3.2 KM length at 'Y' SU, AF	2002-03	665.00	30.11.07	85%	Initial delay in approval of design and slow progress of work by the contractor
2	'W-6' Wing	Provision of Airfield drainage system at 'W-6' Wing, AF	2006-07	393.29	16.04.08	47%	Work held up since 2010 due to flash floods and case initiated for fore closure
3	'W-1' Wing	Provision of Watch tower and Guard rest room at 'U' SU, AF	2006-07	61.60	30.09.07	71%	Slow progress by the contractor
4	'R' FBSU	Provision of security fencing around the base	2006-07	251.95	15.08.09	99%	Non-availability of 600 mm dia concertina coil on DGS&D and hindrances by nearby villagers
5	'W-6' Wing	Provision of cement slabs bay, oxygen and battery charging room, dust proof hydraulic as ultrasonic bay and parking shed of ground equipment and fuel browers at 'X' HU	2008-09	60.88	21.02.10	93%	Slow progress by the contractor
6	'W-1' Wing	Provision of Pre-fab structure for proper master quadrant and RH quadrant at Thoise Maidan Range at 'W-1' Wing	2009-10	106.05	7.01.11	Nil	Tender action was held up due to land dispute and the work has now been cancelled.
7	'Q' FBSU	Provision of Main Guard room and foot over bridge connecting main station to Nishat enclave at 'Q' FBSU	2009-10	186.00	31.03.12	57%	Slow progress by the contractor
8	'W-7' Wing	Provision of work services for improvement of water supply system at 'X' TRU	2009-10	50.45	30.11.11	75%	Work stopped due to land dispute
9	'W-7' Wing	Provision of temporary OTM accommodation at 'X' TRU	2009-10	468.38 516.18 (Revised)	31.12.12	5%	Work stopped due to pending transfer of ownership of land

***** These works remained incomplete as of March 2015 also.

Annexure-II

(As referred in Para 2.2.7.2)

Details in respect of operational works sanctioned during 2010-11 and 2013-14 for permanent nature of works

Sl. No.	Name of Unit	OP Task No.	Name of Work	Cost (₹ in Lakh)
(A) Cases in which Engineer Appreciations were prepared for permanent nature of works				
1	'W-6' Wing	WAC/Op Wks/3/'W-6' WG/2011-12	Construction of shed for housing of SATCOM Eqpt and DG Sets at Base Camp at 'W-6' Wg AF	47.75
2	'W-7' Wing	WAC/Op Wks/5/'W-7' WG/2011-12	Provn of re-carpeting of existing cemented road from main gate to helipad guards post No. 22 to Op location mess and other existing cemented road at Op location of 'X' TRU C/O 'W-7' Wg AF	14.71
3	'W-7' Wing	WAC/Op Wks/10/'W-7' WG/2011-12	Strenghtening of existing approach road by construction of retaining wall at 'Y' TRU C/O 'W-7' Wg AF	263.42
4	'W-7' Wing	WAC/Op Wks/11/'W-7' WG/2011-12	Provn of Parking shed, hard standing and servicing garages at Op location of 'Y' TRU C/O 'W-7' Wg AF	279.29
5	'W-7' Wing	WAC/Op Wks/12/'W-7' WG/2011-12	Strenghtening of Radar Ramp at Op location of 'Y' TRU C/O 'W-7' Wg AF	172.22
6	'W-7' Wing	WAC/Op Wks/7/'W-7' Wg/2012-13	Provn of porta cabin for communication equipment at Op location of 'X' TRU C/O 'W-7' Wg AF	16.4
7	'W-6' Wing	WAC/Op Wks/15/'W-6' Wg/2012-13	Provn of over head water tank filling facility at new safety bay at 'W-6'Wg AF	20.4
8	'W-7' Wing	WAC/Op Wks/18/'W-7' Wg/2012-13	Construction of cook house and misc B&R works at Op location at 'W' SU C/O 'W-7' Wg AF	27.54
9	'W-6' Wing	WAC/Op Wks/4/'W-6' Wg/2013-14	Provn of 4 garages for C-17 aircraft dett ground vehicles and equipment near IL dispersal at 'W-6' Wg AF	86.44
10	'W-7' Wing	WAC/Op Wks/6/'W-7' Wg/2013-14	Provn of retention wall with parapet at Op location of 'X' TRU C/O 'W-7' Wg AF	57.04

11	'W-10' Wing	WAC/Op Wks/7/'W-10' Wg/2013-14	Provn of Sheds for Compressed Gas Cylinders in 'Y' HU at 'W-10' Wg AF	13.09
12	'W-6' Wing	WAC/Op Wks/8/'W-6' Wg/2013-14	Provn of Pre fab four room accommodation with corridor and five garages for new refueling section at 'W-6' Wg AF	179.77
13	'W-10' Wing	WAC/Op Wks/9/ 'W-10' Wg/2013-14	Provision of sheds for 'FF' hard standing (Qty-6) at 'Y' SU AF	14.9
14	'W-7' Wing	WAC/Op Wks/10/'W-7' Wg/2013-14	Work services for Provn of hard standing for radar vehicle and room for AFNET at Op location of 'X' TRU AF at 'W-7' Wg AF	32.77
15	'Q' FBSU, AF	WAC/Op Wks/4/ 'Q' FBSU / 2011-12	Provision of Pre-Fabricated Ops Shelter for Visiting Squadron	52.99
16	'W-1' Wing, AF	WAC/Op Wks/2/ 'W-1' Wg / 2012-13	Provision of road and associated services at alpha & bravo sites of 'Sq-10' Squadron	57.55
17	'Q' FBSU, AF	WAC/Op Wks/14/'Q' FBSU/ 2013-14	Provision of Porta cabins at Rohini radar site of 'Sq-9' Squadron.	57.02
18	'Q' FBSU, AF	WAC/Op Wks/20/'Q' FBSU/ 2013-14	Provision of shelters for specialist vehicles and equipments at rohini Radar site of 'Sq-9' Squadron.	14.57
19	'W-1' Wing, AF	WAC/Op Wks/21/'W-1' Wg/ 2013-14	Addition/ alteration of plinth at old tech flight at 'Sq-10' Squadron	89.19
			Sub total	**1497.06**
(B) Other cases in which operational works were sanctioned for permanent nature of works				
20	'Z' SU	SWAC/77 SU/Op Wks/2/2010-11	Provision of Narmada water supply to AFS 'S-21'	114.1
21	'W-8' Wing	SWAC/27 Wg/Op Wks/2/2011-12	Renovation of certain Blast pens at AFS 'S-2'	450.39
22	'W-10' Wing	WAC/Op Wks/8/'W-10' WG/2010-11	Certain operational works services for induction of 'CC' system at Op location at 'Y' SU	863.77
23	'W-14' Wing	SWAC/33 Wg/Op Wks/1/2010-11	Augmentation of water supply at AFS 'S-18'	733.41
			Total	**3658.73**

Annexure-III

(As referred in Para 2.2.9.2)

Non-conclusion of contracts for Operational works sanctioned during 2010-11 and 2013-14 (as of March 2015)

Sr. No.	OP Task No.	Date of AA	Nomenclature of Work Services	Cost (₹ in Lakh)	PDC as per AA	Status
Year : 2011-12						
1	WAC/Op Wks/ 8 / 'W-7' Wg/2011-12	21-11-2011	Construction of four guard posts at Op location of 'X' TRU at 'W-7' Wing AF	31.41 revised to 94.91	30-11-2012	Under tender action at HQ CE Udhampur
Year : 2012-13						
1	WAC/Op Wks/ 15 /'W-6' Wg/2012-13	19-03-2013	Provision of over head water tank filling facility at new safety bay at 'W-6' Wg AF	20.4	31-03-2015	Due to change in scope of work RAA was pending for issue
Year : 2013-14						
1	WAC/Op Wks/ 10 / 'W-7' Wg/2013-14	28-01-2014	Work services for Provision of hard standing for radar vehicle and room for AFNET at Op location of 'X' TRU AF at 'W-7' Wg AF	32.77	31-01-2015	Under tender action at HQ CWE Rajouri
2	SWAC/'W-11' Wg/ Op Wks /1 / 2013-14	30-03-2014	Provision of tent plinths, toilets and ancillary buildings for camp at AF stn, 'S-10'	77.28	31-03-2016	Under tender action at HQ CE(AF) Gandhinagar

Annexure-IV

(As referred in Para 2.2.9.3)

Operational works sanctioned during 2010-11 and 2013-14 but not completed by MES (as of March 2015)

Sl. No.	OP Task No.	Name of Work	Cost (₹ in Lakh)	PDC as per AA	Executing Authority	Physical progress
Year : 2010-11						
1	WAC/Op Wks /4 /'W-10' Wg/2010-11	Provision of additional water storage tanks at stage-I at 'Y' SU	48.14	30.11.2012	CE (AF) Udhampur	90%
2	WAC/Op Wks/8 /'W-10' Wg/2010-11	Certain operational works services for induction of 'CC' at Op location at 'Y' SU	683.75 revised to 863.77	30.07.2013	CE (AF) Udhampur	21%
3	WAC/Op Wks/10 / 'W-7' Wg/2010-11	Construction of FRP shelter (Qty 2) at Op location of 'X' TRU AF	13.02	28..02.2012	CWE Rajouri	8%
4	WAC/Op Wks/12 /'W-1' Wg/2010-11	Provision of deficient qty-4 pre fab living in accn with bunk bed	182.1	30.03.2013	CE (AF) Udhampur	55%
5	WAC/Op Wks/13 / 'W-7' Wg/2010-11	Provision of parking shed, hard standing and servicing garages at 'X' TRU	6.93	30.04.2012	CWE Rajouri	95%
6	WAC/Op Wks/14 / 'W-7' Wg/2010-11	Provision of pre -fab shelter for power plant at Op location of 'X' TRU	2.74	30.04.2012	CWE Rajouri	95%
Year : 2011-12						
1	WAC/Op Wks/1 / 'W-10' Wg/2011-12	Construction of covered parking shed for MT vehicles at 'Y' SU	101.58	30.06.2013	CE (AF) Udhampur	40%
2	WAC/Op Wks/3 /'W-6' Wg/2011-12	Construction of shed for housing of SATCOM Eqpt and DG Sets at Base Camp	47.75	30.10.2013	CE (AF) Udhampur	40%
3	WAC/Op Wks/4 /'Q' FBSU/2011-12	Provision of pre-fabricated Op Shelters for visiting Sqn	52.99	31.10.2013	CE (AF) Udhampur	14%
4	WAC/Op Wks/7 /'W-6' Wg/2011-12	Provision of covered shelters for parking vehicles during extreme winter/snow fall at 'S-23' and Base Camp	168.18	30.11.2012	CE (AF) Udhampur	82%
5	WAC/Op Wks/8 / 'W-7' Wg/2011-12	Construction of four guard posts at Op location of 'X' TRU	31.41	30.11.2012	CE Udhampur	Under tender action at HQ CE Udhampur

6	WAC/Op Wks/11 / 'W-7' Wg/2011-12	Provision of Parking shed, hard standing and servicing garages at Op location of 'Y' TRU	249.55	30.06.2013	CE Udhampur	95%
7	WAC/Op Wks/12 / 'W-7' Wg/2011-12	Strenghtening of Radar Ramp at Op location of 'Y' TRU	143.58	31.07.2013	CE Udhampur	2%
8	WAC/Op Wks/14 /'R' FBSU/2011-12	Provision of four pre-fab with modular fabricated shelters	242.69	31.03.2013	CE (AF) Udhampur	30%
9	SWAC/ 'P' FBSU/ Op Wks/1/2011-12	Construction of tarmac for HESU at K' Link at AF Stn 'S-24'	200.08 revised to 371.46	28.02.2014	CE (AF) Gandhinagar	95%
Year : 2012-13						
1	WAC/Op Wks/2 /'W-1' Wg/2012-13	Provision of road and associated services at alpha & bravo sites of 'Sq-10' Sqn	57.55	08.01.2014	CE (AF) Udhampur	80%
2	WAC/Op Wks/3 /'W-1' Wg/2012-13	Provision of road at Op location of AD radar at 'W-1' Wing AF	68.79	08.01.2015	CE (AF) Udhampur	94%
3	WAC/Op Wks/8 /'W-6' Wg/2012-13	Construction of temporary concrete platform for three LLLW radars and sheds for nine generator sets with footpath from main road to radar	28.67	28.02.2014	CE (AF) Udhampur	50%
4	WAC/Op Wks/9 /'W-6' Wg/2012-13	Construction of four temporary pre fab shelters for newly raised DSC Platoon at 'S-23'&'W-6' Wg AF	141.63	28.02.2015	CE (AF) Udhampur	35%
5	WAC/Op Wks/10 /'W-6' Wg/2012-13	Construction of 4 additional pre fab accommodation for Office, SNCO and Airmen billets at 'Z' TRU	149.25	28.02.2015	CE (AF) Udhampur	59%
6	WAC/Op Wks/12 /'W-1' Wg/2012-13	Provision of Qty-1 shelter for MCC at 'W-1' Wg AF	24.1	28.02.2015	CE (AF) Udhampur	65%
7	WAC/Op Wks/13 / 'W-7' Wg/2012-13	Work services for power supply and allied works for operation of LLTR at Op location of 'Y' TRU	151	31.08.2014	CE Udhampur	95%
8	WAC/Op Wks/14 / 'W-7' Wg/2012-13	Work services for provision of radar ramp for 'K' TRS of 'V' SU	415	31.03.2015	CE (AF) Udhampur	35%

9	WAC/Op Wks/15 /'W-6' Wg/2012-13	Provision of over head water tank filling facility at new safety bay at 'W-6' Wg AF	20.4	31.03.2015	CE (AF) Udhampur	RAA pending for issue
10	WAC/Op Wks/16 / 'Q' FBSU/2012-13	Provision of Pre Fabricated shelters for storage of drop tanks at 'Q' FBSU	326.9	31.03.2015	CE (AF) Udhampur	16%
11	WAC/Op Wks/17 / 'W-1' Wg/2012-13	Provision of porta cabin at Op location of 'Sq-10' Sqn	67.52	31.03.2015	CE (AF) Udhampur	93%
12	WAC/Op Wks/18 / 'W-7' Wg/2012-13	Construction of cook house and misc B&R works at Op location at 'W' SU	27.54	30.09.2014	CWE Rajouri	95%
13	WAC/Op Wks/19 / 'Q' FBSU/2012-13	Provision of porta cabin at ground station of 'Sq-11' Sqn	26.58	31.03.2015	CE (AF) Udhampur	30%
Year : 2013-14						
1	WAC/Op Wks/3 / 'W-7' Wg/2013-14	Provision of 1000 litres solar water heater (Qty-4) at 'Y' TRU	10.47	31.12.2014	CWE Rajouri	0%
2	WAC/Op Wks/5 / 'W-7' Wg/2013-14	Provision of water filtration plant at Op location of 'X' TRU	20.73	31.01.2015	CWE Rajouri	0%
3	WAC/Op Wks/6 / 'W-7' Wg/2013-14	Provision of retention wall with parapet at Op location of 'X' TRU	57.04	31.01.2015	CE Udhampur	0%
4	WAC/Op Wks/7 / 'W-10' Wg/2013-14	Provision of Sheds for Compressed Gas Cylinders in 'Y' HU	13.09	31.01.2015	CE (AF) Udhampur	98%
5	WAC/Op Wks/8 / 'W-6' Wg/2013-14	Provision of Pre fab four room accommodation with corridor and five garages for new refueling section	179.77	31.01.2015	CE (AF) Udhampur	2%
6	WAC/Op Wks/10 / 'W-7' Wg/2013-14	Work services for provision of hard standing for radar vehicle and room for AFNET at Op location of 'X' TRU	32.77	31.01.2015	CWE Rajouri	Under tender action at HQ CWE Rajouri
7	WAC/Op Wks/11 /'W-1' Wg/2013-14	Provision of Qty-3 Semi underground launcher shelter at Alpha Flight of 'Sq-10' Sqn	33.82	20.02.2015	CWE (AF) Srinagar	45%
8	WAC/Op Wks/12 /'W-1' Wg/2013-14	Provision of Semi underground FOL Shed at 'A','B' and SMT at 'Sq-10' Sqn	36.3	20.02.2015	CWE (AF) Srinagar	35%
9	WAC/Op Wks/13 / 'W-7' Wg/2013-14	Provision of temporary shelter for use as billet at Op location of 'Y' TRU	54.39	20.02.2015	CE Udhampur	75%
10	WAC/Op Wks/14 / 'Q' FBSU/2013-14	Provision of Porta Cabins at Rohini Radar site of 'Sq-9' Sqn	57.02	31.03.2015	CE (AF) Udhampur	0%

11	WAC/Op Wks/16 /'W-1' Wg/2013-14	Provision of Qty-2 Pre-fab structures as OTM accommodation at Tech Flight of 'Sq-10' Sqn	110.32	31.03.2015	CE (AF) Udhampur	1%
12	WAC/Op Wks/17 / 'R' FBSU/2013-14	Provision of parking shed for APPA & specialist vehicle at tarmac at 'R' FBSU	214	31.03.2015	CE (AF) Udhampur	0%
13	WAC/Op Wks/18 / 'R' FBSU/2013-14	Construction of sheds in POL yards of MT Section and LGS Section at 'R' FBSU	103.8	31.03.2015	CE (AF) Udhampur	0%
14	WAC/Op Wks/20 / 'Q' FBSU/2013-14	Provision of shelters for specialist vehicles and equipments at Rohini Radar site of 'Sq-9' Sqn	14.57	31.03.2015	CWE (AF) Srinagar	10%
15	WAC/Op Wks/21 /'W-1' Wg/2013-14	Addn/Altn of Plinth at Old Tech Flight at 'Sq-10' Sqn	89.19	31.03.2015	CE (AF) Udhampur	0%
16	WAC/Op Wks/22 /'W-1' Wg/2013-14	Provision of sheds for Compressed Gas Cylinders at 'W-1' Wg	39.46	31.03.2015	CWE (AF) Srinagar	0%
17	SWAC/ 'P' FBSU/ Op Wks /1 /2013-14	Provision of fiber glass shelter for missile storage and fire fighting works for A&B combat fleets of 'Sq-12' squadron at AF Stn. 'S-24'	24.58	31.03.2015	CWE (AF) Jodhpur	0%

ANNEXURE-V

(As referred in Para 2.3.1)

Acquisition of 'C' aircraft along with relevant comments in earlier Audit Reports

Name of the supplier	Year of Contract conclusion	Qty	Value	Delivery during the year	Commented in Audit Report No	PAC's Concern /ATN
Russia (OEM)	1996	8 'C' aircraft 10-Phase-I 12-Phase-II 10-Phase III Total: 40 air craft	$1462 Million (₹5122 crore) +₹1188 crore = ₹6310 crore	1997-2004 (40 aircraft)	Paragraph No.2 of the Report of the C&AG of India, Union Government, Defence Services (Air Force & Navy) for the year ended March 1999 (Report No.8 of 2000)	In reply to a PAC question (2003-2004) Ministry stated (December 2003) that " 'C'aircraft Project Development and Monitoring Cell" had been formed at Air HQ to monitor, coordinate and execute the project and function as a single point agency to maintain an interface with all the vendors and also to ensure timely setting up of repair and overhaul facilities to sustain the operations of fleet
Russia (OEM)	1998	10 'C' aircraft	$277.01 Million ₹1187 crore	1999 (10 aircraft)		
HAL	March 2006	140 'C' aircraft	$4809.3 Million ₹22,122. 78 crore	2004-2015 (99 aircraft)	Chapter I of Report of the C&AG of India for the year ended march 2005, Union Government (Defence Services) Air Force & Navy (Report No.4 of 2006)	Ministry in their Action Taken Note (ATN) had accepted (May 2011) the Audit conclusion while giving a detailed justification of the events leading to audit observations. However, Ministry submitted the ATN without any assurance / remedial action taken with reference to lesson learnt / system improvement.
	March 2007	40 'C'	₹9036.84 crore	2008-2012 (40 aircraft)	Paragraph 2.7 of Report of C&AG of India for the year ended March 2008, Union Government (Defence Services) Air Force & Navy (Report No.CA 18 of 2008-09)	Ministry in their ATN (June 2011) had agreed with the facts and figures included in the Paragraph.
	December 2012	42 'C'	₹16,147. 28 crore	2012-2015 (15 aircraft)	Paragraph 9.1.2.5 of Report of the C&AG of India for the year ended March 2013, Union Government (Defence Services) Army, Ordnance Factories and Defence Public Sector Undertakings (Report No.35 of 2014)	
Total		**272 aircraft**		**204 aircraft**		

Annexure –VI
(As referred in Para-3.1.3)

Details of 27 MM projects undertaken by nine laboratories for IAF

Closed Projects								
					(₹ in lakh)			
Sl. No.	**Name of the Lab**	**Name of the Project**	**Month of Sanction**	**User**	**Sanctioned cost**		**Original PDC**	**Actual month of Completion**
					Original	**Revised (if any)**		
1	CAIR	MEGHADOOT	Dec- 2007	Air Force	976	1109	Jul-2012	Dec-2013
2	DEBEL	HAWK AJT	Nov-2005	Air Force	49	49	Nov-2008	Nov-2008
3	DEBEL	ARM	May-2008	Inter - Services	50	50	May-2010	May-2010
4	DEBEL	Individual Protective Equipment	Aug-2008	Armed Forces	135	135	Feb-2011	Jul-2013
5	DEBEL	Portable Hand held vital Parameter Monitor	Jan-2009	Armed Forces	48.5	48.5	Jul-2010	Jul-2010
6	DEBEL	Common Helmet and Mask	July-2009	Air Force	47.5	134	Sep-2013	Jul-2013
7	LRDE	ROHINI	Nov-2003	Air Force	3405	3405	Nov-2006	Aug-2007
8	LRDE	PPA REVATHI & ROHINI (PPA)	Dec-2007	Navy & Air Force	800	800	Mar-2009	Dec-2010
9	LRDE	Low Level Light Weight Radar	Dec-2004	Air Force	2244	2244	Jun-2007	Jan-2011
10	DARE	EW Suite for Fighter Aircraft (MiG – 27)	Sep-2005	Air Force	16842	17557	Mar-2011	Mar-2012

Ongoing projects

Sl. No.	**Name of the Lab**	**Name of the Project**	**Month of Sanction**	**User**	**Sanctioned Cost**	**Revised Cost if any**	**Original PDC**	**Revised PDC**
1	ADE	RUSTOM-2	Feb-2011	Tri Services	143744	143744	Aug-2016	-
2	CABS	AEW&C	Oct-2004	Air Force	180000	215700	Apr-2011	Dec-2015

3	DARE	Program for Development of EW Suite for Fighter Aircraft (TEJAS)	Sep-2005	Air Force	14329	15474	Mar-2011	Dec-2014
4	DARE	Development of Dual Colour Missile Approach Warning System for Fighter Aircraft (Su-30 MK I) (DCMAWS)	Nov-2008	Air Force	19100	26880	Jun-2013	Jun-15
5	DARE	Structural Modification of MiG-29 Aircraft for Internal EW Suite (D-29)	Mar-2009	Air Force	7410	9229.74	Nov-2010	May-2014
6	DARE	Development of D-29 System (Internal EW System for MiG-29 Up gradation Aircraft)	Mar-2010	Air Force	16885	16885	Dec-2012	May-2014
7	DARE	Development of ESM for AEW&C System	May-2005	Air Force	7500	7500	Apr-2011	Dec-2015
8	DARE	Development of SPS for AEW&C System	May-2005	Air Force	1800	1800	Apr-2011	Dec-2015
9	DARE	Development of D-JAG System Internal RWJ System for Jaguar DARIN-III Up gradation Aircraft	Aug-2012	Air Force	26827	26827	Jun-2015	-

10	DEBEL	Life Support System for Services	Mar-2009	Tri Services	2500	2500	Feb-2014	NA
11	DEBEL	Development of Enhanced Thermal Insulation Material for Extreme Cold Weather Clothing (DETIMAT)	Jun-2012	Army & Air Force	403	403	Dec-2015	NA
12	DEBEL	Indigenisat-ion of Jaguar Personal Equipment Connector (Man Portion)	Apr-2013	Air Force	35	35	Apr-2015	NA
13	DFRL	Development of Specific processed Food Technologies for Armed Forces in Combat Environment	Jun-2009	Inter Service	1400	1400	Jun-2014	-
14	GTRE	Design & Development of Kaveri Engine for LCA	Mar-1989	Air Force	38281	283900	Dec-1996	CCS note is under process
15	LRDE	Development of Primary Radar for AEW&C System	Dec-2004	Air Force	55000	9700	Apr-2011	Dec-2015
16	LRDE	Project ARUDHRA-Development of Medium Power Radar (MPR)	Nov-2008	Air Force	13414	13414	May-2013	May-2014
17	LRDE	Low Level Transportable Radar (LLTR)-ASHWINI	Jun-2009	Air Force	7395	7395	Dec-2012	Jun-2014

Annexure –VII (A)

(As referred in Para 3.1.3)

List of 14 MM projects selected for Audit

Sl No	Name of the project , Sanction Date and Name Laboratory	Date of initial projection of IAF	In principle approval for development	Project Status Closed or ongoing	Date of completion	Time taken from initial requirement to close of project/ March 2015	Status of ongoing projects in brief
1	2	3	4	5	7	8	6
1.	Development of Low Level Light Weight Radar (ASLESHA) + PPA 22/12/2004- LRDE	August 2004 (36 No)	September 2004	Closed	January 2011	85months	-
2.	Development of NBC individual Protective Equipment for crew of Transport Aircraft and Helicopter (NITA) - 26/8/2008- DEBEL	July 2007	NA	Closed	25.2.12	55 months	-
3.	Design and Development of Common Aircrew Helmet-Mask for IAF - 30/7/2009- DEBEL	March 2009	NA	Closed	29.7.13	52 months	-
4.	Development of 3D-Surveillance Radar 'ROHINI' for AF 4/11/2003- LRDE	August 2003	NA	Closed	31.8.07	112 months	-
5.	Post developmental activities of Radars 'ROHINI'&'REVATHY' (PPA-2007/LRD-268) 10/12/2007 –LRDE	-	NA	Closed	31.12.12		-
6.	Project on 'Secure Communication of video, Voice and Fax between Airborne platform and Ground Station –project MEGHDOOT-27/12/2007 – CAIR	October 2006	NA	Closed	31.12.13	86 months	PDC expired (31-12-13) and CAIR consider the project closed after development of the security solution. Hence no extension has been sought by CAIR. However, the user trials are under progress and IAF is yet to accept the security solution developed by CAIR

7.	Development of Medium Power Radar (MPR) – Project 'ARUDHRA' – 4/11/2008 - LRDE	November 2004	April 2006	Ongoing		128 months	The user-evaluation of the MPR developed is yet to commence
8.	Development of Low Level Transportable Radar (LLTR)-Project 'ASHWINI'- 17/6/2009 - LRDE	February 2006	October 2005	Ongoing	-	113 months	The user-evaluation of the LLTR developed is yet to commence
9.	Parallel development of Primary Radar for AEW&C system under Mission Mode and TD- 6/10/2004 –LRDE	December 2004	NA	Ongoing	-	127 months	The flight trials of the PR jointly developed by LRDE & CABS is under progress and the PDC is December 2015
10.	Development of Dual Colour Missile Approach Warning System (DC MAWS) - 5/11/2008-DARE	November 2006	September 2004	Ongoing	-	104 months	DARE has claimed that the DC MAWS has been developed successfully within the extended PDC of June 2015 and has proposed to carryout integration of the IR sensors on the modified Su-30MKI under separate project
11.	Development of EW suite (D-29 system) for MiG-29 aircraft- 25/3/2010-DARE	August 2006		Ongoing	-	107 months	Ground acceptance test of D-29 system developed has been completed whereas its flight trials have not commenced in the absence of upgraded aircraft which is undergoing for evaluation of the systems installed during upgrade

12.	Structural modification of MiG-29 aircraft 27-3-2009 DARE	August 2006		Ongoing	-	107 months	Out of six upgraded aircraft that underwent structural modification at Russian, additional modification on three upgrade aircraft is yet to be commence
13.	Development of SPS for AEW&C system-12/5/2005 - DARE	May 2005		Ongoing	-	122 months	The ground trials of the SPS developed is under progress (PDC December 2015)
14.	Development of ESM for AEW&C system-12/5/2005 - DARE	May 2005		Ongoing	-	122 months	The ground trials of the ESM developed has been completed and flight trials is under progress (PDC December 2015)

Annexure –VII (B)

(As referred in Para 3.1.8.4)

Time and Cost overrun in respect of 14 MM projects selected for Audit

Sl. No.	Project Name, Sanction date and the lab executing the project	Time				Cost ₹ (in crore)				
		PDC in months		Time overrun (month)	Time over run (in *per centage*)					
		Original	Total including Latest Extension			Original	Revised	Actual expend-iture as of March 2015	Savings with reference to original cost *(per centage)*	Cost Over run with reference to original cost *(Per-centage)*
1	2	3	4	5	6 (5/3x 100)	7	8	9	10 (9-7)	11 (9-7/7 x 100)
	Closed Projects									
1	Development of Low Level Light Weight Radar (ASLESHA) + PPA 22/12/2004- LRDE	30	42	12	40	22.44 (21.94 +.50)	-	20.77	1.67 (7.44)	-
2	Development of NBC individual Protective Equipment for crew of Transport Aircraft and Helicopter (NITA) - 26/8/2008- DEBEL	30	42	12	40	1.35	-	1.00	0.35 (25.07)	-
3	Design and Development of Common Aircrew Helmet-Mask for IAF -30/7/2009- DEBEL	36	48	12	33	0.475	1.34 (47.5+ 44.5+42)	1.23	-	158.94
4	Development of 3D-Surveillance Radar 'ROHINI' for AF 4/11/2003- LRDE	36	45	9	25	34.05	-	28.02	6.03 (17.70)	-
5	Post developmental activities of Radars 'ROHINI'&'REVATHY' (PPA-2007/LRD-268) 10/12/2007 –LRDE	15	36	21	140	8.00	-	7.27	0.73 (9.12)	-
6	Project on 'Secure Communication of video, Voice and Fax between Airborne platform and Ground Station –project MEGHDOOT-27/12/2007 – CAIR	24	72	48	200	9.76	11.09 (9.76+1.33)	10.07	-	3.17

	Ongoing Projects									
						Original	**Revised**	**Actual expend-iture as of March 2015**	**Savings with reference to original cost** *(per centage)*	**Cost Over run with referen ce to original cost** *(Per-centage)*
7	Development of Medium Power Radar (MPR) – Project 'ARUDHRA' – 4/11/2008 - LRDE	54	74	20	37	134.14	-	130.06*	-	-
8	Development of Low Level Transportable Radar (LLTR)-Project 'ASHWINI'- 17/6/2009 - LRDE	42	70	28	66.66	73.95	-	63.72	-	-
9	Parallel development of Primary Radar for AEW&C system under Mission Mode and TD-6/10/2004 –LRDE	78	134	56	71.79	550.00	97.00	66.90	-	-
10	Development of Dual Colour Missile Approach Warning Sensor (DC MAWS) - 5/11/2008-DARE	55	79	24	43.63	193.00	273.8	194.16	-	0.60
11	Development of EW suite (D-29 system) for MiG-29 aircraft- 25/3/2010-DARE	33	62	29	87.87	168.85	-	137.83	-	-
12	Structural modification of MiG-29 aircraft 27-3-2009 DARE	20	62	42	210	74.10	92.30	61.99	-	-
13	Development of SPS for AEW&C system-12/5/2005 - DARE	78	134	56	71.79	18.00	99.00	18.46	-	2.55
14	Development of ESM for AEW&C system-12/5/2005 - DARE	78	134	56	71.79	75.00		75.43	-	0.57
						Total	**1017.31**			

***** **Committed expenditure up to March 2015**

Annexure-VIII

(As referred in para 3.1.8.10)

Development partners of MPR (Project Aurdhra)

Sl. No	Nomenclature	Name of Firm	Original PDC	Revised PDC	Date of Delivery & Date of Acceptance
1	Development and realisation of Antenna Cabin	M/s L&T, Mumbai	10-3-12	30-10-12 30-4-14	24.01.2014 30.04.2014
2	Development & Realisation of Active Array Electronics	M/s Astra Microwave Products Ltd., Hyderabad	30-3-12	30-3-12 12-7-12	30.03.2012 12.07.2012
3	Development & Realisation of Array Group Receiver (AGR)	M/s Astra Microwave Products Ltd., Hyderabad (for prototype radar)	8-6-11	15-3-12	31.01.2012 08.06.2012
		M/s Data Patterns India Pvt. Ltd., Chennai (for final radar)	29-8-12	30-8-13 2/ 2014	02.2012 30.08.2013
4	Development & Realisation of Digital Beam Former	M/s Core EL Technologies, Bengaluru	2-6-11	8-2-11 10-2-12	08.12.2011 10.02.2012
5	Development & Realisation of liquid cooled DC-DC Power Supply	M/s Jai Sales Corporation, Bengaluru	29-7-12	30-11-13	28.11.2013 20.02.2014
6	Development & Realisation of Pedestal	M/s L&T., Mumbai	13-12-11	30-6-12 28-2-13 30-4-13	03.06.2013 16.04.2014
7	Supply of Rotary Joint Assembly	M/s Schliefring, Germany	21-10-11	18-10-12	21.10.2011 09.04.2012
8	Development & Realisation of Operation Shelter	M/s BEL, Ghaziabad.	8-3-13	31-1-14 15-12-14	21.01.2014 15.12.2014
9	Development & Realisation of Radar Shelter	M/s BEL, Ghaziabad.	8-3-13	31-1-14 15-12-14	21.01.2014 15.12.2014
10	Development & Realisation of Liquid Cooled Signal, Data, Timing, Calibration, ECCM Processor	M/s Mistral Solutions, Bengaluru	14-1-12	30-3-13	30.03.2013 30.11.2013
11	Supply of IFF Interrogator	M/s Thales, France	20-1-13	11- 2014	--
12	Development & Realisation of IFF Pedestal	M/s System Controls, Bengaluru	23-4-13	28-4-14	28.04.2014 17.10.2014
13	Development & Realisation of IFF Control unit	M/s Mistral Solutions, Bengaluru	15-4-13	31-12-13	31.12.2013 15.01.2014
14	Development & Realisation of Power System	M/s Mak Controls Pvt. Ltd., Coimbatore	28-4-12	30-11-13 21-2-14	23.11.2013 21.02.2014
15	Development & Realisation of Antenna Cooling System	M/s Pair Engineers, Pune	5-1-12	30-6-12 31-3-13	31.03.2013 04.2013
16	Development & Realisation of Antenna Pressurisation System	M/s Entek, Bengaluru.	31-10-12	30-4-13 30-6-14	30.06.2014 07.2014

Annexure-IX

(As referred in para 3.1.8.11)

Development Partners of LLTR (Project 'Ashwini')

Sl. No	Nomenclature	Name of Firm	Original PDC	Revised PDC	Date of Delivery & Acceptance
1	Development & Realisation of Digital Beam Former	M/s CoreEL Technologies, Bengaluru	7-8-12	Nil	30.03.2012 20.09.2012
2	Development & Realisation of High Mobility Vehicle (One TATRA Vehicle for Radar Sensor Vehicle)	M/s BEML Limited, Bengaluru	4-6-12	Nil	22.02.2012 10.05.2012
3	Development & Realisation of High Mobility Vehicle (Three TATA Vehicles)	M/s TATA Motors, Bengaluru	10-4-12	30-11-12	30.11.2012 23.01.2013
4#	Development & Realisation of Operation Shelter	M/s BEL, Bengaluru	30-6-12	27-11-13	27.09.2013 27.11.2013
5#	Development & Realisation of Mobile Platform & Antenna Engineering	M/s L&T, Mumbai	30-6-12	30-11-13 15-05-13	04.07.2014@ 10.12.2014
6	Development & Realisation of Rotary Joint Assembly	M/s Schliefring, Germany	23-11-11	30-4-12	30.04.2012 04.01.2013
7#	Development & Realisation of Active Array Antenna	M/s Data Patterns India Pvt. Ltd, Chennai	8-2-12	31-5-12 31-7-12 30-9-12 7-12-12 29-03-13	12.03.2013@ 30.07.2014
8	Development & Realisation of Signal & Data Processor	M/s Mistral, Bengaluru	4-5-12	Nil	16.03.2012 07.06.2013
9	Development & Realisation of Array Group Receiver (AGR)	M/s Data Patterns India Pvt. Ltd, Chennai	10-1-12	31-3-12	15.06.2012 18.06.2012
10#	Development & Realisation of Power Supply System	M/s Mak Controls Pvt. Ltd., Coimbatore	30-8-12	28-2-13 21-3-13	04.03.2013 21.03.2013
11	Development & Realisation of Antenna Cooling System	M/s Entec Engineering, Bengaluru	7-11-11	30-12-11 30-4-12 31-7-12	31-7-2012
12	Development & Realisation of Radar display	M/s Alligator designs, Bengaluru	7-12-12	14-6-13	02.07.2014@ 24.07.2014
13	Development & Realisation of low bed trailer for air loading	M/s Tratec. Gurgaon.	17-9-13	15-4-14	07.03.2014 10.04.2014

@ Regularization of delay in delivery of items beyond revised PDC as per actual receipt is under progress.

Delays in respect of four supply orders are as under -

Sl No.4:

Stores supplied by BEL in October 2013 as against the original PDC of June 2012, reportedly due to stringent EMI/EMC[1] specifications for meeting user requirements

Sl No.5:

Due to delay in manufacture of hydraulic cylinders, rotary plate and shield assembly, firm delayed supply of the Mobile Platform. Also there was a delay by LRDE in despatching IFF[2] antenna to the supplier for integration with 'Ashwini' antenna array. After obtaining two[3] PDC extensions, the mobile platform was delivered (July 2014) by the firm with overall delay of 24 months and same was accepted by LRDE in December 2014.

Sl No.7:

Due to complexities in antenna array system and consequent delay in supply, PDC was extended five times[4] at the request of supplier and firm finally supplied antenna array in March 2013 which was tested and accepted (June 2014) by LRDE after a lapse of 16 months. However, inconsistent performance of the antenna electronics resulted in repeated re-work by the vendors of T/R modules.

Sl No.10:

It was delivered only in March 2013 by firm after obtaining two PDC extensions, reportedly due to delay in finalisation of critical design parameters by LRDE and delay in import of critical sub-systems.

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1 Electro Magnetic Interference / Compatibility.

2 Identification of friend and foe (IFF) is secondary radar. Antenna was realised by M/s AMPL Hyderabad and I/D from M/s Thales, France.

3 30-11-12 and 15-5-13.

4 PDC extended upto 31-5-12, 31-07-12, 30-9-12, 7-12-12 and upto 29-3-13.

Annexure-X

(As referred in para 3.1.8.15)

Details of Supply Orders placed for ESM & SPS

Sl. No	Nomenclature	Name of Firm	PO NO & DT	Value	Original PDC	Revised PDC	Date of Delivery & Acceptance
1	Multiple Channel RF Digital Signal Processor (MRDSP)	M/s. ELTA Israel	DARE/CONT/AEW&C/CONT/01/2005-06 DT: 29-03-06	USD 4935000	31-10-08	31-10-10 31-8-11 31-12-12 30-3-14	30-3-14
2*	18-40 GHz Spiral Antenna with Radome	M/s IMC MW Industries L td., Israel	DARE/FPD/AEW&C/PO-01/2006-07 Dt.22-5-06	USD 26400	10-12-10	31-3-11	14-7-11
3	Counter Measure Dispensing Systems (CMDS)	M/s Bharat Dynamics Ltd, Hyderabad	PO:3481/DARE/LPD/AEW &C (SPS) -03/2005-06	₹ 2.83 crore	31-3-07	31-3-09 31-12-10	17-12-10
4	RF Cables	M/s Radiall, France	DARE/FPD/AEW&C/PO-02/2006-07 Dt.22-8-06	EURO-22339.20	4-12-06	-	19-12-06
5	Interferometer Antenna Array System (IAAS)	M/s. EDO Corporation NY,USA	DARE/FPD/AEW&C(ESM)/-01/2007-08 Dt.6-7- 07	USD 1500256	28-2-09	-	15-1-09
6*	Front End Amplifier-Front End Receiver (FEA-FER)	M/s AKON INC, USA	DARE/FPD/AEW&C(ESM)/-03/2007-08 Dt.17-10-07	USD 893200	16-10-08	16-10-08	12-9-14 16-3-15 21-1-15
7	0.5 – 18 GHz Broad band Equalizer with ESS-P/N A90-MX002	M/s AKON INC, USA	DARE/FPD/AEW&C(ESM)/-04/2007-08 Dt.26-10-07	USD 26000	30-4-08	30-6-08 9-12-08	12-8-08 29-12-08
8	Supply of PFMG application software for ESM system	M/s EWAS Technologies Pvt Ltd Bengaluru	4328/DARE/LPD/AEW&C (ESM)-09/2009-10 dt. 3-8-2009	₹85,00,000	2-8-10	12-8-11	8-1-10
9	Avionics Grade Display and Control Unit (AGDCU)	M/s BEL, Bengaluru	4439/DARE/LPD/AEW&C (ESM) 26/2009-10 dt.29-4-2010	₹2.31 crore	29-10-10	25-1-11	25-1-11
10	Front End Amplifier-Front End Receiver (FEA-FER) QT	M/s AKON INC, USA	DARE/FPD/AEW&C(ESM)/-02/2010-11 Dt.30-4- 10	USD 104000	31-8-10	15-11-11 31-3-13	10-3-13
11	Qualification Testing (QT) on 0.5-18 GHz and 18-40GHz Spiral Antennas	M/s IMC MW Industries Ltd., Israel	DARE/FPD/AEW&C(ESM)/-06/2010-11 Dt.8-9- 10	USD 45936.52	31-8-10	11-5-11 11-7-11	11-5-11 11-7-11
12	Switch Matrix Module Model No. A35-MX 141	M/s AKON INC, USA	DARE/FPD/AEW&C(ESM)/-01/2011-12 Dt.23-3- 11	USD 255000	30-11-11	31-3-12 31-5-12	28-9-12
13*	Front End Amplifier-Front End Receiver (FEA-FER) Model No: A25-MH 229	M/s AKON INC, USA	DARE/FPD/AEW&C(ESM)/-03/2011-12 dt June 2011	USD 1402038	31-1-12	30-4-13 26-3-14	26-3-14
14	Rugged Ethernet LAN Switch adpl P/N AcomEth 12-211-12-AG	M/s Alligator Design Pvt Ltd. Bengaluru	4663/DARE/LPD/AEW&C (E)-09/2010-11 dt.15-12-2010	₹179000	6-7-11	29-12-11	29-12-11
15	MILDS Sensor-AN/AAR 60 IN1,Part No. 1000005803 (50.2817.918.00)	M/s Alpha Design Technologies Pvt ltd, Bengaluru	4777/DARE/LPD/AEW&C (S)-15/2010-11 dt. 31-3-11	₹46800000	1-6-11	-	12-5-11

***** Reasons for delay in respect of three supply orders are indicated below -

Sl No. 6 and 13

There was abnormal delay in receipt / acceptance of two major items: (i) Front End Amplifier (FEA) – Front End Receiver (FER) received (October 2008) was actually accepted by LRDE in January 2015 due to time taken by the vendor for qualification testing (ii) M/s ELTA, Israel took more than five years to complete delivery (March 2014 as against October 2008) of all items of MRDSP due to delay in finalising the system configuration, ICD finalisation, System development, etc., by DARE which affected ESM-SPS schedule.

Sl No.2

DARE procured (July 2011) DTOA[5] antennas with radomes for ESM from M/s IMC Israel. However, radomes had developed cracks during ground testing and flight trials made in 2011. As a result, CABS could not conduct envisaged flight sorties (20 sorties) of ESM. DARE received modified radomes only in January 2015 and functional testing of these antennas with modified radomes were completed in February 2015 and supplied (March 2015) to CABS.

[5] Differential Time of Arrival

Annexure - XI

(As referred in Para 4.1.1 and 4.1.2.3)

Status of Land Acquired by the Company as on 31 March 2014

Complex/ divisions	Total land held	Land and building Acquired by the Company but deed not executed	Land transferred to other agencies pending execution of deeds	Land leased to other agencies	Land under litigation and encroach ment
	(in acres)				
Bengaluru Complex	2,184.86	0	137.22	149.081	11.96
Nashik	4,620.13	265.70	0	890.92	1.34
Koraput	3,121.15	0	100.00	4.944	50.21
MDM office	0.06	0	0	0	0
Hyderabad	314.00	0	0	2.29	0
Lucknow	293.00	41.89	0	0.23	0
Korwa	282.40	0	38.68	0	0
Kanpur	429.03	429.03	0	34.75	0
Barrackpore	29.63	0	0	0	0
Corporate Office	1.08	0	0	0	0
Total	**11,275.34**	**736.62**	**275.9**	**1,082.215**	**63.51**

Annexure - XII

(As referred in Para 4.1.2.1)

Market Value of 220 Survey Numbers

(₹ in lakh)

Sl. No.	Village	Total Survey numbers	Acre	Guntas	Market rate per acre	Market rate per gunta	Value of Land
1.	Vibuthipura	48	89	831	487	12.175	53460.43
2.	Doddanekundi	17	16	366	406	10.15	10210.9
3.	K.G. Srinivasapura	8	11	93	65	1.625	866.125
4.	Benninganahalli	1	3	11	731.25	18.28125	2394.844
5.	Byappanahalli	6	0	96	195	4.875	468
6.	Belur	19	52	335	49	1.225	2958.375
7.	Kempapura	5	37	96	162	4.05	6382.8
8.	Konenaagrahara	34	45	647	325	8.125	19881.88
9.	Yemlur	19	46	348	162	4.05	8861.4
10.	Kodihalli	15	33	279	487	12.175	19467.83
11.	Marathehalli	3	4	61	406	10.15	2243.15
12.	K.G. Thippasandra	14	32	183	366	9.15	13386.45
13.	K.G. Byrasandra	10	18	181	171	4.275	3851.775
14.	B.M. Kaval	4	6	87	211	5.275	1724.925
15.	Challaghata	17	10	222	244	6.1	3794.2
	TOTAL	**220**	**402**	**3836**			**149953.1**

Annexure - XIII

(As referred in Para 4.1.2.1)

Land not in name of HAL but included in Compendium

(₹ in lakh)

SI. No.	Village		Survey Numbers	Extent of land as per Compendium/ Disinvestment data		Total Land not in Name of HAL		Market rate per acre	Market rate per gunta	Market Value of Land not in name of HAL
	SI. No.	Name		Acres	Guntas	Acres	Guntas			
1	A	Challaghatta	33/1	0	13	0	13	244	6.1	79.3
2			33/5	0	6	0	6	244	6.1	36.6
3			38/1	2	18	2	0	244	6.1	488
4	B	Yemlur	22/6	0	10	0	10	162	4.05	40.5
5			22/07	0	18	0	18	162	4.05	72.9
6			24/11	0	6	0	6	162	4.05	24.3
7	C	K G Byrasandra	53	5	31	5	31	171	4.275	987.525
8			66	0	4	0	4	171	4.275	17.1
9			78/1	0	3	0	3	171	4.275	12.825
10			90/2	1	17	1	17	171	4.275	243.675
11			91	0	29	0	29	171	4.275	123.975
12			92/4	0	38	0	38	171	4.275	162.45
13	D	Kodihalli	47/1	2	2	2	2	487	12.175	998.35
14		B M Kaval	6/7	3	35	3	35	211	5.275	817.625
15			6/8	3	10	3	10	211	5.275	685.75
16	F	Doddanekkundi	96/5	0	23	0	23	406	10.15	233.45
17			97/1	2	8	2	8	406	10.15	893.2
18			97/2	1	21	1	21	406	10.15	619.15
19			113/1	1	34	1	34	406	10.15	751.1
20			157	1	10	1	10	406	10.15	507.5
21	G	Konenagrahara	50/3	4	10	2	0	325	8.125	650
22			43	0	22	0	22	325	8.125	178.75
23			37	0	11	0	11	325	8.125	89.375
24			38	4	16	4	16	325	8.125	1430
25			48	3	0	3	0	325	8.125	975
26	H	K G Thippasandra	59/1	1	0	1	0	366	9.15	366
27			60	1	1	1	1	366	9.15	375.15
28			61	0	19	0	19	366	9.15	173.85
29			62	7	1	7	1	366	9.15	2571.15
30			64	1	0	1	0	366	9.15	366
31			66	2	28	2	28	366	9.15	988.2

SI. No.	Village		Survey Numbers	Extent of land as per Compendium/ Disinvestment data		Total Land not in Name of HAL		Market rate per acre	Market rate per gunta	Market Value of Land not in name of HAL
	SI. No.	Name		Acres	Guntas	Acres	Guntas			
32			67	1	0	1	0	366	9.15	366
33			69	7	27	7	27	366	9.15	2809.05
34			70/2	2	19	2	19	366	9.15	905.85
35			72/1	2	8	2	8	366	9.15	805.2
36			72/2	2	10	2	10	366	9.15	823.5
				58	508	56	480			21668.35

Annexure - XIV

(As referred in Para 4.1.2.3)

Sale of Land for which Sale Deed is not executed/ not available

Sl. No.	Parties to whom land sold by HAL	Reasons for sale of land	Details of Board approval	Location of land	Survey No. of land	Extent of land in acres	Date / year of sale	Amount of Sale Price / Compensation received etc, if any (In rupees)	Whether Sale agreement executed
1.	GTRE	Requirement for GTRE	105 – 20.09.1976	K G Srinivasapura	21,22,23,24	2.33	1976	53,475.00	Sale deed not available. Air force did not come forward for execution
2.	26 ED	Requirement for 26 ED	141- 30.9.1982	Vibhuthipura	81,82,83,84 ,85	15.26 0.76 (Bldg).	1982	19,67,000.00	Sale deed not available.
3.	Institute of Aviation Medicine (IAM)	Requirement for Airforce	105- 20.09.1976	Konena Agrahara	1,3,4,5,6,7, 80	7.3 4.9 (Bldg).	1976	2,90,973.00	Sale deed not available.
4.	Railways	Requirement for Railways	191 - 16.11.1990	Benniganahalli	12	0.32	1990	32,529.00	Sale deed not available
5.	Army (POL Bulk Depot)	Army	68 - 19.02.1972	Kodihalli	39,40,58	5.1	1972	7,650.00	Sale deed not available
6.	BDA	For Road	113- 26.1.1978	Doddanekkundi	96/1,96/2,96/3,96/6,97/1,97/2	2.45	1996	15,31,416.00	Sale deed not available
7.			28.1.1978	Kodihalli	58	0.61		12,413.00	Sale deed not available
8.	ASTE	Requirement for Sister Organisations	144 – 29.01.1983	K G Srinivasapura	10,15,16,17 ,18,20	15.99	1983	4,23,735.00	Sale deed not available. Air force did not come forward for execution
			144 – 29.01.1983	Marathahalli	36,37,38,39	18.46	1983	4,52,270.00	
			178 – 22.09.1988	Marathahalli	24,37,39	5.04	1988	2,48,744.00	
			144 – 29.01.1983	Belur	30,31,44,48 ,49,50,52	22.4	1983	4,51,360.00	
			178 – 22.09.1988	Belur		0.91	1983		
			178 – 22.09.1988	Belur		0.55	1988	22,110.00	
			144 – 29.01.1983	Belur		2.35	1983	53,818.56	
			144 – 29.01.1983	Belur		1.478	1983	33,848.44	
			144 – 29.01.1983	Belur		3.05	1983	69,849.62	
			192 – 30.01.1991	Belur		1	1991	69,770.00	
			144 - 29.01.1983	Belur		0.25	1983	5,725.38	
			178 –	Kempapura		8	1988	5,59,176.00	

Sl. No.	Parties to whom land sold by HAL	Reasons for sale of land	Details of Board approval	Location of land	Survey No. of land	Extent of land in acres	Date / year of sale	Amount of Sale Price / Compensation received etc, if any (In rupees)	Whether Sale agreement executed
			22.09.1988						
9.	Army Land Project	Exchange of land	264-18.08.2003	Doddanekkundi	146,147,156	5.0	26.04.2005 (Brrackpore) and 02.03.2011 (Bengaluru)		Handing over taking over report
10.	Muslim Welfare Trust.	Requirement for Muslim welfare trust	210-4.3.1994	0.4	29.10.1998	1,91,620.00			Sale deed not executed
11.	DGCA (NAA)	Requirement for DGCA	105-20.9.1976	Konena Agrahara	1,3,4,5,6,7 &80	13.179	1976	9,99,391.00	Sale deed not available.
12.	BEML	Requirement for BEML	150-13.2.1984	Thippasandra & K G Byrasandra	62,65,68,69,70,72,68,69,70,71,72,73,75,76,77,78,79,80,81,82,84,85,93,63	81.262	1965	99.00	Sale deed not executed
13.	SBI	Requirement for SBI	210-4.3.1994	Konena Agrahara	77	0.225	25.06.1997	14,73,900	Rectification Sale deed not executed

Annexure-XV

(As referred in Para 4.2.1)

JVCs formed by HAL

(₹ in crore)

Sl. No.	Name of the joint venture company & Date of incorporation	Name of the partners and composition of share capital	Paid up capital as on 31.3.2014	HAL share of invest-ment as on 31.3.2014	Objective of formation
1	BAe-HAL Software Limited **(BAe-HAL)** 9 February 1993	HAL -49% BAe Systems plc, UK - 40% BAeHAL Employees welfare Trust - 11%	6.00	2.94	(i) To develop, design, improve, market, sell, lease, loan and support software, firmware and computer programs. (ii) To provide and perform technical, commercial, research, consultancy and other services in the fields of computer technology/ computer software/ systems. (iii) To operate and manage computer systems. (iv) To undertake and execute turnkey projects in the forgoing fields. For the above purposes, it was allowed the JVC to qualify as a 100% Export Oriented Unit (EOU).
2	Indo Russian Aviation Limited **(IRAL)** 12 September 1994	**Indian Partners:** HAL - 48% ICICI - 5% **Russian Partners**: RAC MiG - 31% Ryazan -10% Aviazapchast - 6%	1.95	0.94	To carry out the following activities in India and third countries except in Republics of the former USSR: (i) Overhaul and repair of the Aircrafts, engines, aggregates and systems. (ii) Product support for maintenance and operation of the aircraft. (iii) Modernization and re-equipping of aircraft, engines and aggregates. (iv) Life extension of the aircraft engines and aggregates. (v) Supply of the aircraft, engines, aggregates and spares. (vi) Supply of ground and role support equipment, etc.

					(vii) Rendering engineering consultancies, TOT, Know-how and technical assistance. (viii) Setting up repair and overhaul facilities in third countries on turnkey basis, etc.
3	Snecma HAL Aerospace Private Limited 24 October 2005	HAL - 50% Snecma, France-50%	22.80	11.40	To establish a center of excellence for production manufacture, buy, sell, market, distribute, export, import, deal in on wholesale basis, assemble, fit, reload, repair, convert, alter, maintain and improve all types of of Precision Aero Engine components and assemblies as an Export Oriented Unit (EOU).
4	SAMTEL HAL Display Systems Limited 25 January 2007	HAL -40 % Samtel Display System Ltd, New Delhi -60 %	4.00	1.60	To design and develop new generation display systems for airborne and ground applications for Indian aircrafts as well as international market. Later on diversify into civil & industrial sector in India and abroad.
5	HAL Edgewood Technologies Private Limited 27 April 2007	HAL -50 % Edgewood Ventures LLC, USA - 26% Edgewood Technology Private Ltd., Bangalor - 24%	6.00	3.00	(i) To set up design center for design and development of chip for data encryption and digital design center. (ii) Application for Radar data simulation and performance evaluation of various algorithm in different conditions. (iii) To develop CNS for Defence and Civil applications as well as TOT for microwave sub-systems and gyros.
6	HALBIT Avionics Private Limited 1 May 2007	HAL -50% Elbit Systems Ltd, Israel -26% Merlinhawk Associates Private Ltd, Bengaluru - 24%	7.65	3.83	Design, development & marketing of airbone avionics products and systems; mission computers, display computers and displays for Indian & International Markets.
7	INFOTECH HAL Limited 23 August 2007	HAL -50% Infotech Enterprise Limited -50%	4.00	2.00	Engineering services in the field of aero engines, technical publications and execution of work under offset programme.

8	HATSOFF Helicopter Training Private Limited 16 January 2008	HAL -50% CAE, Canada - 50%	76.81	38.40	To provide and market military and civil helicopter pilot training services through the operation of a flight training center at Bengaluru by setting up and operating Rolls-On/ Rolls-Off Full Mission Simulators (FMS) and various flight training devices (Training equipment) to be operated by the JVC.
9	TATA HAL Technologies Limited (Formerly INCAT HAL Aero Structure Limited) 28 May 2008	HAL-50% TATA Technologies Limited - 50%	10.14	5.07	(i) To take advantage of the global aerospace demand by leveraging the strengths of the parties i.e. Aerospace domain knowledge of HAL and the marketing network and programme management experience of INCAT. (ii) To be a market leader for providing engineering and design solutions and services in the area of aero structures and activities under offset programmes. (iii) To establish marketing network, customer base, best business practices, proven global delivery model. (iv) To leverage the competitive advantages for accelerated market penetration.
10	International Aerospace Manufacturing Private Limited (IAMPL) 16 July 2010	HAL - 50% Rolls Royce -50%	85.00	42.50	Manufacture of shrouds for Rolls Royce in the civil aerospace sector as an 100% Export Oriented Unit (EOU).
11	Multirole Transport Aircraft Limited (MTAL) 1 December 2010	HAL - 50% Russians -50% (UAC-TA & Rosoborone Export)	226.93	113.46	Design, development, manufacture, marketing and product support of Multirole Transport Aircraft.
			Total	**225.14**	

Annexure - XVI

(As referred in Para 4.2.2)

Performance of JVCs

(₹ in crore)

Sl. No.	Name of the JVC	Paid Up Capital	HAL Share	Accumulated Profit(+) / Loss(-)	Amount Provided for Diminution
	JVCs with Accumulated Loss				
1	SAMTEL HAL Display Systems Limited	4.00	2.00	-0.69	
2	HALBIT Avionics Private Limited	7.65	3.83	-4.43	3.21
3	INFOTECH HAL Limited	4.00	2.00	-3.33	1.66
4	HATSOFF Helicopter Training Private Limited	76.81	38.40	-102.16	38.40
5	TATA HAL Technologies Limited	10.14	5.07	-7.25	3.63
6	HAL Edgewood Technologies Private Limited	6.00	3.00	-9.79	3.00
7	International Aerospace Manufacturing Private Limited	85.00	42.50	-21.12	
	JVCs earning Profits				
8	BAe-HAL Software Limited	6.00	3.00	12.08	
9	Indo Russian Aviation Limited	1.95	0.94	60.44	
10	Snecma HAL Aerospace Private Limited	22.80	11.40	11.41	
	JVCs yet to commence Production				
11	Multirole Transport Aircraft Limited	226.93	113.46	1.18	
		451.28	**225.60**		**49.90**